IMPLICIT INTERACTIONS WITH A PECULIAR RADIO: DESIGNING AN INTERACTIVE ARTEFACT FOR FOSTERING MEANINGFUL MUSIC-LISTENING EXPERIENCES

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## ABSTRACT

### IMPLICIT INTERACTIONS WITH A PECULIAR RADIO: DESIGNING AN INTERACTIVE ARTEFACT FOR FOSTERING MEANINGFUL MUSIC-LISTENING EXPERIENCES

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Interacting with internet-enabled artefacts has become an indispensable norm of an everyday person's life as it can reduce otherwise demanding tasks down to a flick of a finger. Whereas consumption and utilisation of vast amount of information have also became a norm for navigating through the world's digital commodities – rendering almost every single action an informed decision. On the other hand, music-listening is an ephemeral experience per se, yet it became a certainty to interact with extrinsic attributes thereof as prominent music-listening platforms became saturated with information, which isn't a bad thing in itself; although, *having to* experience something knowledgably can also mean forgoing certain qualities of that experience. Even though it still is possible to listen to music through less information-intensive artefacts such as a radio, the advent of technology shows promise for affording a more (subjectively) meaningful experience. The same principle pertaining to how information influences user's future actions presented itself as a theoretical notion of user experience that is applicable to interactions with all kinds of artefacts: Explicitness of Interactions.

In this study, the goal is to design a music-listening artefact that doesn't afford utilisation of extrinsic attributes of music to users (as opposed to modern music-listening paradigms); and through that process, to empirically discover how the qualities of information relayed by an artefact may influence the user's subsequent actions. This is done through a three-part Research through Design process consisting of a Contextmapping research with sensitisation and idea generation phases to which 12 design specialists partook; tied into a consequential well-documented solo design phase.

The outcome involves an extensive literature review with discussions, a methodology for conceptualisation of implicit/explicit artefacts, an empirically derived implicit music-listening artefact, and discussions on Explicitness of interactions concept.

Keywords: Design for Interaction, Contextmapping, User Experience, Music Listening, Research through Design

**ÖZ**

**OLAĞANDIŞI BIR RADYO ILE İMALI ETKİLEŞİMLER: ANLAMLI MÜZIK DİNLEME DENEYİMLERİ SAĞLAYAN BİR ÜRÜN TASARLAMAK**

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İnternetin etkin olduğu eserlerle etkileşim kurmak, aksi takdirde zorlu görevleri bir parmak hareketine indirgeyebildiğinden, günlük yaşamın vazgeçilmez bir normu haline geldi. Büyük miktarda bilginin tüketilmesi ve kullanılması is dijital dünyada gezinirken bir norm haline geldi ve neredeyse her eylemi detaycı ölçüde bilinçli bir karar haline getirdi. Öte yandan, müzik dinleme başlı başına anlık yaşanan bir deneyimdir, ancak önde gelen müzik dinleme platformlarının bilgi ile dolmasıyla birlikte, müziğin kendi içsel niteliklerinden ziyade dışsal niteliklerle etkileşime girmek kesin hale geldi; bununla birlikte, bir şeyi, bütün detaylarının farkındalığıyla deneyimlemek zorunda olmak, o deneyimin belirli özelliklerinden vazgeçmek anlamına da gelebilir. Radyo gibi daha az dışsal bilgi yoğunluğuna sahip eserler aracılığıyla müzik dinlemek hala mümkün olsa da, teknolojinin gelişimi sayesinde zamana uyumlu ve değer yaratan deneyimler için tasarım yapma fırsatı yakalanmıştır. Bu süreç aracılığıyla edinilen bilginin kullanıcının gelecekteki eylemlerini nasıl etkilediğiyle ilgili bir kavram olarak Etkileşimlerin Açıklığı'nın tartışılması ve özelliklerinin belirlenmesi hedeflenmektedir.

Bu çalışmada amaç, faydayı müziğin dışsal özelliklerinden kaynaklı (modern müzik dinleme paradigmalarının aksine) olmayan bir müzik dinleme deneyimi sağlayan bir ürün tasarlamaktır. Bu, 12 tasarım uzmanının katıldığı, duyarlılaştırma ve fikir üretme aşamaları içeren bir Bağlam-Haritalandırma araştırmasının üç bölümden oluşan Tasarım Yoluyla Araştırma süreci aracılığıyla yapılacak; sonuç olarak da detaylıca dökümante edilmiş bir solo tasarım aşamasıyla sonlandırılacaktır.

Sonuç olarak bu araştırma; tartışmalarla birlikte kapsamlı bir literatür taraması, örtük/açık eserlerin kavramsallaştırılması için bir metodoloji, ampirik olarak türetilmiş bir örtük müzik dinleme ürünü ve etkileşimlerin açıklığı kavram ve ilgili tartışmaları içerir.

Anahtar Kelimeler: Etkileşim için Tasarım, Bağlam-Haritalama, Kullanıcı Deneyimi, Müzik Dinleme, Tasarım Üzerinden Araştırma

*“aaaaaaaaaaaaaaaAAAAAAA—aAAAH!"*

Led Zeppelin – Immigrant Song

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I also would like to recognise significant amount of consideration, time, and effort given by the 12 research participants for their quintessential contributions for the contextmapping phase of this study.

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## GLOSSARY

**Agency:** Degree to which individuals possess self-determination.

**Artefact/Device/System:** Interactable hardware and/or software entities with a functional utility for the users. In this study, they denote artefacts that afford playback of pre-recorded music pieces if not stated otherwise.

**Attribute (Extrinsic) Information:** Information conveyed through the extrinsic attributes (Rao & Monroe, 1988) of products. It denotes the extrinsic attributes of music pieces: these include *name of a music piece, artist name, album name, year, rating, album art, popularity ratings* etc.

**Chapter/Section:** Refers to in-document cross-links unless they're embedded into a citation.

**Explicit:** An outcome that is directly specified or expressed.

**Extrinsic Motivation:** Motivation and attitudes that are affected and driven by external factors.

**Format:** Medium that stores and plays the pieces of media: like hard drive, vinyl, cassette, radio waves, and data streamed from a server.

**Implicit:** A space of possibilities indicating an indeterminate outcome.

**Impression:** The appraisal of, and the emotional value given to, a music piece through the subjective judgement of its functional attributes (adapted from (Rao & Monroe, 1988).

**Information:** Facts about entities that can be perceived by human beings and associated to other entities.

**Intrinsic Information:** Information pertaining to only the core or self-contained function/outcome of a process, event, interaction, experience, artefact, and so on.

**Intrinsic Motivation:** Motivation and attitudes that are influenced by a person's inner drive unaffected by extrinsic factors.

**Mental Model:** A representation of individuals' thought processes about how something functions.

**Music-player:** Denotes the same concept as artefact/device/system; however, it explicitly indicates a music-playing artefact.

**Piece/Track:** A playable music media. For example: an album song or an instrumental recording.

**Music-Listening Preference:** Long-term subjective affective evaluations relating to music listening. Liking a certain category of music is an example of this.

## LIST OF ABBREVIATIONS

ABBREVIATIONS

**BPM:** Beats per Minute

**EoIX:** Explicitness of Interaction

**HCD:** Human-Centred Design

**HCI:** Human-Computer Interaction

**ID:** Industrial Design

**IX:** Interaction (user-product)

**IXD, DfI, D4I:** Interaction Design, Design for Interaction

**LED:** Light-Emitting Diode

**ML:** Machine-Learning

**PD:** Participatory Design

**RtD:** Research through Design

**SDT:** Self-Determination Theory

**TLDR:** Too Long; Didn't Read

**UI:** User Interface

**UX:** User Experience

# CHAPTER 1

# INTRODUCTION

*Judy was moving her gaze on sparsely scattered rays shining through clouds that encircled the Sun whilst riding the evening tram and listening to an upbeat song with her headphones, which seldomly let muffled sounds pass through. She diverted her attention from the Sun and realised that she was listening to the last few tunes for the first time. Silently tapping the toes of her shoes along with the rhythms, she started moving her gaze around: there weren't many people in the tram given the time of the day contrary to what she would have expected. An elderly man was reading a newspaper, and a sleepy student was wobbling back and forth, sitting next to the elderly man just across where she sat. She gazed around, closed her eyes, and relished that moment without thinking about other things for once; after all, she just was feeling at peace. There was nothing to worry about except the current point in time. The sound of the playing music seemed like the perfect companion of that moment. She thought to herself: how come I didn't listen to it any earlier? She didn't particularly choose the music she was listening to; and at that moment, became aware that she was enjoyably experiencing the moment. She was listening to music right at that place and time without much regard to past and future, or anything else — fusing everything about that moment and making it a somewhat common yet dear experience. The sense of bliss she experienced happened due to her detachment from external thoughts; despite masquerading as an arbitrary experience, it was a much-needed moment for her to wind down, which wouldn't have happened if her mind was preoccupied with matters concerning the past or the future.*

Upon rewinding from this experience to her usual music-listening behaviour, we observe that Judy either makes specific music choices when she has strong preferences or chooses music subsequent to a browsing session for finding a music piece that satisfies what she has in mind. For the latter, she normally employs extrinsic information of the music to tip the scales in favour of a certain piece of music among the options to affirm that it'll be enjoyable for her. Like most people, she continually consumes and exchanges a tremendous amount of information with digital sources frequently in everyday settings to make choices: while working in her workplace, in search of where to dine next, to determine what she'll watch, or to choose the clothing she is going to wear. These behaviours and the habits attributable thereof greatly reduce her possibility of being dissatisfied by her choices, which is a safe option indeed; however, one should ask: at what cost – could there be a trade-off of that behaviour?

Let us imagine multiple timelines: if Judy hadn't drifted off during that particular commute, she might have chosen a piece of music well within her comfort zone without any chance of being disappointed — trading off the possibility to enjoy a piece of music that she could appraise as itself and to experience it as a part of that moment. Of course, we know that not having to take information about an album, artist, and genre into account for choosing and appraising the music yielded a favourable outcome for her *in this timeline*. In contrast to this experience, in an alternative timeline, something she wouldn't have liked might have started to play – preventing a peaceful moment right at that moment by annoying or frustrating her, which is one of the scenarios people usually try to avoid by making informed choices and exerting high level of control over their devices. Pure chance can be a double-edged sword, as the outcomes may yield unexpected positive experiences or rather negative ones; however, a high-level of control could mean relinquishment of some of the experiential qualities that can enhance the music-listening experience.

## 1.1 Background of the Study

Rephrasing of the preceding occurrence as an inquiry leads to a wicked question: "How might we mindfully experience and appraise music in itself without having to utilise any extrinsic attribute information, yet maintain a satisfactory level of control?", which is wicked because there is currently neither a rational direction nor a precedent for answering it. There stands a significant challenge in answering this question: it is currently implausible to navigate between pieces of music effectively without utilising *any* extrinsic attribute information of a musical piece (such as genre, name, artist, etc., to a satisfying level of control?)[1]. Even though there are conceptual music-players that are in the right direction of overcoming this challenge in a small capacity, user agency while interacting with those artefacts is still limited without utilising a single extrinsic attribute information in terms of open-endedness, which is a critical impediment to self-determination[2].

I should note that the current music-listening artefacts in the market fulfil their functions as per their offerings completely well as intended; although, the issue I am bringing up is about the industrial unidirectionality of the music-listening technologies that unanimously emphasise instant access to music, maximal number of parallel offerings, and high density of attributes fettered to the pieces of music[3]. On the other hand, in spite of the availability of modern technological infrastructure, there is an apparent lack of enthusiasm[4] in the market[5] about the

[1] This applies to all artefacts in the market: music streaming services utilise maximum number of attributes, while a radio relies on heuristic utilisation of genres or categories.
[2] As per Self-Determination Theory, which dictates that constraints limiting a person's agency is detrimental to their wellbeing after a certain point (Peters et al., 2018).
[3] Most apparent in recent technologies such as music streaming services, online video platforms, online radios, digital music libraries (Chapter 2.1).
[4] However, there are experimental projects directed towards that direction: most fleshed-out example is Spotify Stations, a standalone app (Chapter 2.1.3).
[5] Some academics attribute the way the media products are designed to business goals and financial ends of the companies/industry behind those products (Burnett, 1996; Herman & Chomsky, 2006).

empowerment of music-listeners for them to appraise the music through the impression of music by itself.

> "I am of the opinion that all this digitization now is becoming more and more a part of our life. I think it diminishes our ability to experience things." says Rams. "There are pictures that disappear, one after the other, without leaving traces up here (points to his head). This goes insanely fast. And maybe that's why we can, or we want to, consume so much. The world that can be perceived through the senses exudes an aura that I believe cannot be digitized. We have to be careful now, that we rule over the digital world, and are not ruled by it." (Hustwit, 2018)

Those words were uttered by Dieter Rams, a designer who influenced several generations of designers to come with his design philosophy: what he connotes through those words especially carries weight due to the fact that our norms about the way of experiencing things are being framed in and constrained by the way those artefacts are designed.

Owing to those interactive artefacts, we now have a potent ability to make informed choices at one's will with a relatively low effort, yet we need to be critical about this relationship as it might affect our human experience and wellbeing – for the better, or the worse. In relation to this, Industrial and interaction designers have an increasing responsibility to design products by prioritising the betterment of human wellbeing. Everyday life is flowing in an exponentially increasing speed as a result of the increasing throughput of information exchange, which is dazzling for an everyday person to keep the track of the events that surround them. Even the most rudimentary activities woven into an ever-expanding web of information, decisions related to them can easily be influencing by all kinds of information competing for one's attention (Janlert & Stolterman, 2018).

It is argued in the literature that attending to too much information can actually be detrimental to the wellbeing of users – overloading them and causing problems such as stress and anxiety. In addition to that, we often see information and choices conjointly, affording an exuberant number of interactive decision points with several attributes to account for, which is claimed to enhance the overload (Ch. 2.3.3). Whether these consequences are foreseen or not, this is the point where designers need to take the responsibility into their own hands to enable healthier relationships between users and information technologies to benefit human wellbeing. Most people (in the everyday, including designers) often take their products for granted, accept them in accordance of prevalent norms, and rarely question their designs and uses. Asking such questions can lead to divergent design possibilities for enabling ways of enhancing experiences and wellbeing of the people. Whereas in this thesis, the approach will be to ask such questions of music-playing artefacts.

### 1.1.1 Problem Statement

Some would argue that advancing technologies for enhancing personal wellbeing isn't a worthwhile pursuit, which may be an authentic claim from a certain perspective focal in remedying negative issues ailing the humankind; although, it is limited to the boundaries of its perspective. In contrast, improving the conditions for human flourishing can produce a genuine impact on subjective wellbeing according to the viewpoint of positive psychology; as an extension of that, positive design aims to cultivate these conditions through the design of the artefacts (Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013; Seligman & Csikszentmihalyi, 2000). This viewpoint is especially relevant in the context of aesthetic experiences – music being such an experience as it directly influences people's emotional state (Weinberg & Joseph, 2017). Alas, designs of music-playing artefacts per se may foster such an effect to a degree; more importantly, also serve as enablers of musical experiences. In the end, the qualities of those enablers define the silhouettes and possibilities of those experiences. In this case, there are a few notions that may be of concern for the design of a music-playing artefact:

- Consumption of large bulks of information is becoming increasingly pervasive and habitual in people's lives: resulting in a complicated decision-making process due to information-seeking behaviour.
- Evolution of music-listening devices happened in the direction of ease of access, through a paradigm that doesn't necessarily focus on the cultivation of a better experience in terms of wellbeing.
- Music can be appraised without its extrinsic attributes: designing music-player artefacts for fostering mindfulness and personal wellbeing has a potential to enhance people's experiences.

## 1.2 Aim, Objectives & Scope of the Study

### 1.2.1 Research Aim

The aim of this research is to discover design strategies to design music-player artefacts for navigation between, and experience with, the pieces of music independent of their extrinsic attributes, for the purpose of fostering an open-ended experience focusing on the appraisal of the music played at the present moment.

### 1.2.2 Goal Statement

The goal is to explore strategies for designing music artefacts with affordances that do not utilise attribute information – enabling a way to experience media solely through the user's impression of it. I will be focusing on recorded music-listening experience in this study, which will be carried out through an empirical design research process that generates strategies and designs resulting from the sensitisation and involvement of experienced designer-participants in the act of design throughout a longitudinal period. I will then analyse and refine the outcomes in order to arrive at a finalised conceptual design of a recorded music player artefact; by doing so, I will be investigating the relationship and effect of information on user experience in the context of (recorded music) media.

Outcomes of this research will primarily benefit researchers in HCI, UX, UI, D4I, and ID areas through theoretical knowledge on user-product interaction, a methodological approach for investigating concepts through design, and a case of research through design. Secondly, it will provide a guideline and a case for researchers for designing media players that are not reliant on extrinsic attributes of the media.

### 1.2.3 Research Question

How might a music-listening artefact that fosters mindfully meaningful listening experiences for the enhancement of user's wellbeing be designed whilst maintaining a satisfactory level of self-determination for user agency solely through the utilisation of implicit means of interaction?

### 1.2.4 Research Objectives

I planned to achieve four main objectives within this research, which I will elaborate on at the discussion part of this thesis. These are:

- Establishment of a theoretical background by reviewing normative and conceptual music-listening artefacts, relevant facets of music-listening experience, and pertinent design for wellbeing literature.
- Elicitation of design strategies for conceptualising music-players that afford interactions excluding extrinsic attributes and the conceptual outputs thereof through a participatory design activity.
- Execution of a solo design process for conceptualising a music-playing artefact as per the considerations from the literature review, the participatory design outcomes, and design heuristics.

- Definition and exploration of the explicitness facet of interactions: discussing and evaluating what pertains to their properties. Doing so throughout a process of designing a music-listening artefact that may only be interacted through implicit interactions for intrinsic motivations.

### 1.2.5 Scope of the Research

Boundaries of the scope of the research were set through the elimination of certain portions of the music-listening domain. The criteria is as follows:

- The concern is the listening experience of pre-recorded music: it shouldn't be livestreamed nor generated in real time.
- Subject matter of this research is the user-end of the artefacts: technical details and back-end features are relevant only to the extent that they affect the realisability of design concepts.
- Providing explanations about the technical properties of musical phenomena is not an objective of this study.
- This research is focused on personal music-listening experience: social facets of the experience are deemed peripheral in this study.

## 1.3 Research Plan

This thesis consists of consequently ordered chapters of progression consisting of introduction, literature review, a prelude to methodology, research through design procedure (RtD) and methodology thereof (consisting of three phases), a theoretical discussion on Explicitness of Interactions, and the conclusions (Figure 1.1). Within the RtD phase are self-contained parts including methodological background, preparation, thematic coding, procedure, analysis, and discussion.

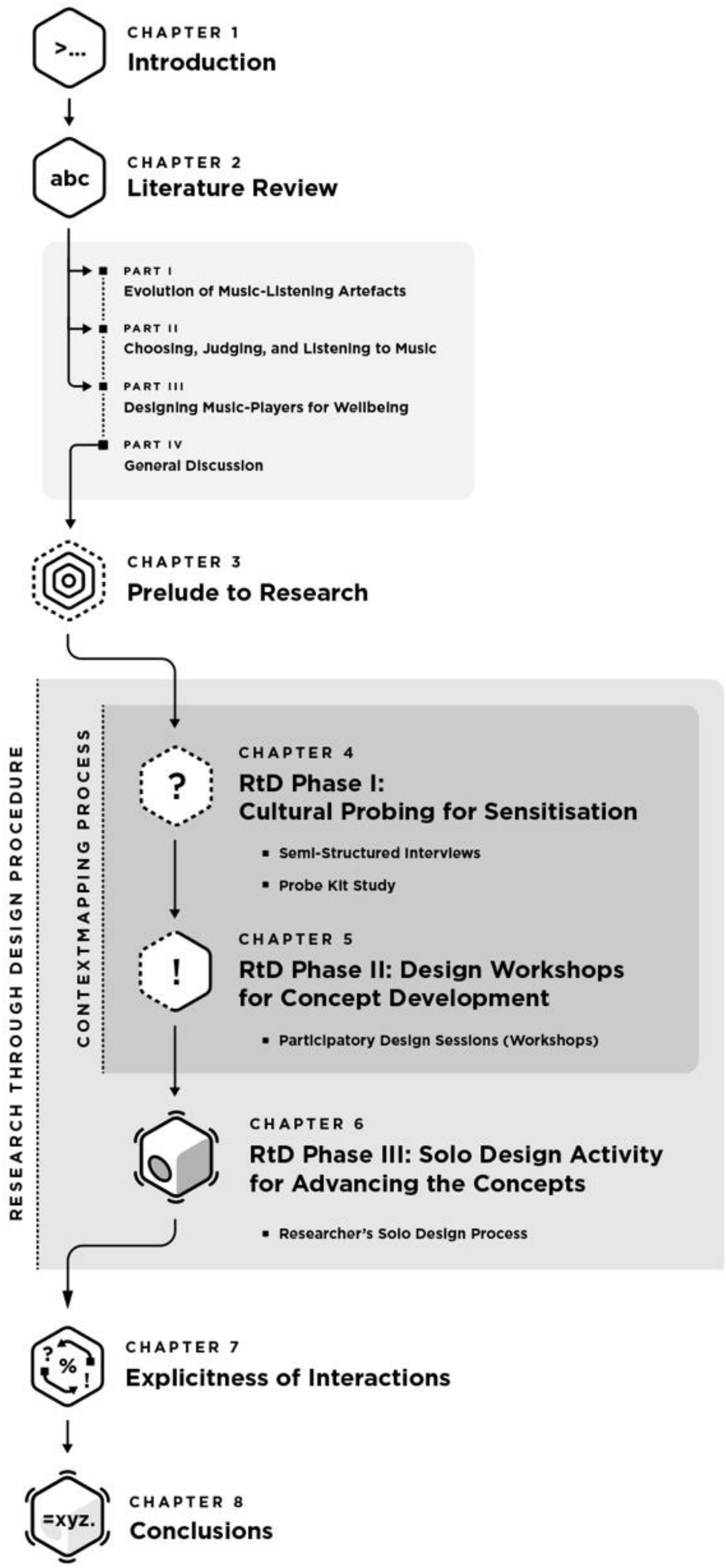


Figure 1.1 - Detailed visual breakdown of the research process.

# CHAPTER 2

# LITERATURE REVIEW

In this part of the research, I will be reviewing and discussing the relevant literature as per our research goal and objectives.

Firstly, I'll go over the how the users' relationship with music-listening artefacts evolved as a result of the technological progress and then discuss this historical trend with respect to users' emergent mental models for using them (Chapter 2.1).

Secondly, I'm going to explore the how people listen to music and form preferences of it, the process and aspects of the how they actively choose, judge and experience music, recognise the relevant factors that influence that process, and discuss what those might mean for a listener's intrinsic motivation for listening to music (Chapter 2.2).

Lastly, I'll talk about design for interaction and user-centred design and the how they relate to design for wellbeing, how wellbeing concepts are relevant to - and why they matter for - designing an artefact for music-listening, and the key considerations to pay attention to while designing an artefact for wellbeing (Chapter 2.3).

In the end, I will be discussing how these concepts relate to the goals and objectives of this research and the consequent research through design phases (Chapter 2.4).

## 2.1 Part I: Users' Evolving Relationship with the Artefacts that Play Recorded Music: Past, Present, and Future

Marc Hassenzahl (2010) illustrates a scenario in his book, in which a woman is woken up by receiving a text message from her boyfriend saying, "I love you.", following with a remark saying that she couldn't have experienced that particular meaningful moment if not for her phone, then adding that she doesn't actually need a phone to feel what her boyfriend means to her. However, that moment wouldn't be stimulated by surprise if it was a different artefact such as a ring or flowers, which would convey the meaning, nonetheless (p. 2). Likewise, each type of music-player stimulates a distinct user experience – affecting music-listening experience through their characteristic features. A user might listen to a music album either through a cassette or a music-streaming platform: it is exactly the same album after all, yet unique features of each music-player creates nuances that refashion the user experience (Cross, Hallam, & Thaut, 2016; Krause, North, & Hewitt, 2015; J. H. Lee & Price, 2016). For these reasons, acknowledgement and understanding what defines and distinguishes the music-listening artefact typologies will be informative for the future phases.

In this part of the literature, I will be initially exploring the technologies of the past, present, and future to get an idea about the how and why they have evolved, and what it means for the capabilities of these artefacts; and consequently, I'll identify the emergent regularities and patterns of them.

### 2.1.1 Analog Music-Players through the Ages

Analog music-players differ from their digital counterparts due to their limited capabilities when compared to computerised skills of digital devices. Analog media doesn't have absolute and strict values like the digital ones do, which makes each analogue recording or transmission unique or 'flawed' in varying degrees. Interestingly, some of them are still cherished by many despite –or because of–

those so-called shortcomings (Brykman, 2019; Millard, 2005). I'll be talking about the historical, innovation-related, cultural, and experiential qualities of eight types of analogue sonic media technologies chronologically with respect to their order of invention and succession.

**Music Box.** Earliest music-player dates back to the 9th Century, in form of a water-powered music box that produced sounds as the protrusions on its rotating cylinder hit corresponding pins that chimed at different notes (Fowler, 1967). Several iterations and likenesses of this machine have appeared and been utilised by people throughout history. Even though these machines produced encoded sounds, they merely played the melodies that were manually encoded onto them by artisans. Sounds produced by those artefacts aren't the vestiges of the actual sounds that occurred naturally, which was something that wouldn't happen up until 19th Century (Crandall, 1925). Many iterations of music boxes appeared throughout the history, even there were technological improvements on each of them, they were still the similar properties as far as this research is concerned. *Note that* what I mean by natural sounds isn't something limited to sounds produced in the natural environment such as waterfalls and forest animals, but also including the sounds produced by humans, like speech, singing, and sounds of musical instruments.

This format is limited to physical copies with manually embedded tunes played by a specialised device. Hypothetically, there should be a very direct mapping between its physical properties and the music it emitted.

**Phonautograph.** It was invented by Édouard-Léon Scott de Martinville in 1857 (Crandall, 1925). It proved to be an essential technology for experiencing the vestiges of the natural sounds. Despite only being able to record natural sounds at low fidelity that didn't allow playback due to its low fidelity recording technique, the phonautograph was able to transform sound waves in its vicinity into physical markings – replicating the natural sounds. It only recently became possible to transform those recordings into actual sounds thanks to the development of new technologies (Rosen, 2008).

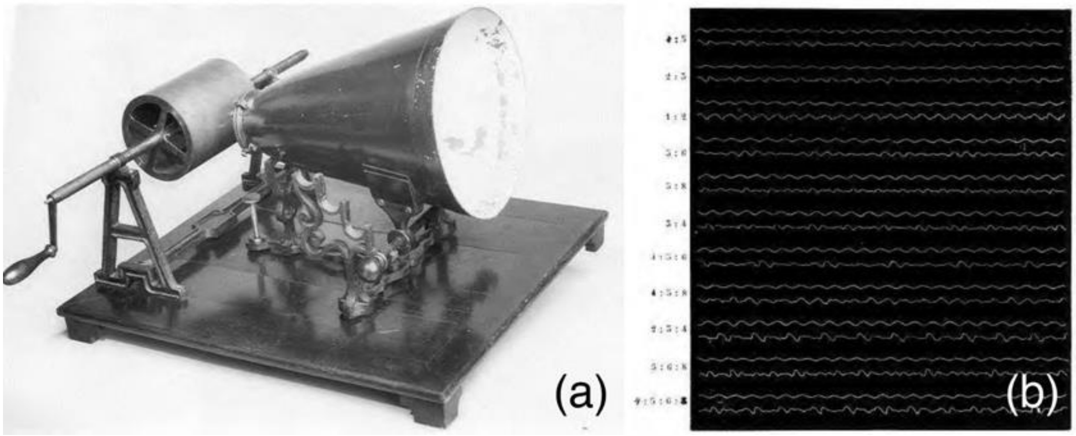


Figure 2.1 - Karl Rudolph Koenig's reconstruction of Scott de Martinville's Phonautograph as photographed; whose form has semblance to gramophone – only that it is working to capture sound rather than emit it (a). Depictions of the recordings of phonautograph, demonstrating the same principles used in vinyl records (b). [Images taken from *Smithsonian's Albert H. Small Documents Gallery* at americanhistory.si.edu]

This format couldn't playback any sound; thus, it could not foster any sonic experience when it was a relevant technology, but rather was about the appreciation of the visual markings of sounds that were recorded on pieces of paper (Crandall, 1925).

**Phonograph.** Inspired by its similarly named ancestor, Thomas Edison invented the phonograph, a device that could record *and* play the recorded sounds (Edison, 1878). It became a ground-breaking invention that altered the contextuality and temporality of experiencing sounds; and more importantly, music. Gaining the ability to sound recording marked the birth of both archival and curational ways of experiencing music. However, it is worth noting that a French inventor named Charles Cros independently conceptualised a method for sound reproduction a few weeks before; although, Edison is popularly known as the inventor of sound reproduction as Cros did not attempt to prove the concept. This invention quickly gained traction and fuelled a cultural transformation (Kenney, 1999): people could enjoy music from the leisure of their homes any time they wanted, given that they owned the device. In addition to that, it is the technology that enabled music libraries. People then could store music and experience it unbound from place and time of the original musical performances.

Figure 2.2 - Braun’s PS 2 Stereo Turntable manufactured on 1963, designed by Dieter Rams. [Image from online catalogue of The Museum of Modern Art (MoMA) at moma.org]

**Turntable.** Also known as vinyl and LP (long player), it is most commonly known as the ‘record player’ today. The ‘record’ format has a growing cult following despite its seemingly impractical facets, carried along since 2007 as the ‘vinyl revival’ (Nielsen, 2019), which is happening while the other physical formats decline in sales, which connotates significant aspects about users’ music-listening preferences beyond the practical reasons. The record player’s semantic qualities such as its usage rituals, physical connection, its physical embodiment of sound, and its nostalgic appeal sets it apart from the other formats (Brykman, 2019). Even the imperfections within its sound stemming from the dirt, dust, and production flaws on the physical records are considered positively by its users due to contributing to its authenticity and listening experience – the whole occurrence between the user and playing records on a turntable is a holistic experience. All those properties are cherished by its users for fostering a deep emotional and multisensorial experience of music.

**Telephone & Electrophone.** Listening to music through a landline telephone might be regarded as an impractical practice through the perspective of someone from year 2020; however, it made perfect sense back in the 1880s. It was perfectly practical to listen to an opera that took place hundreds of miles away in exchange of a subscription fee if one could afford it. The services offered through telephone included news and weather reports, sermons, narrated stories, and pay-per-play phonograph recordings ('The 19th Century iPhone', 2010; White, n.d.). This practice didn't survive long after the rise of radio broadcasting due to access, practicality, and the costs associated with it.

Even though it is a distinct way of experiencing music by today's standards, it has notable similarities to the access to music through on-demand services on the internet.

**Radio Broadcasting.** Radio emerged in the early 1900's, allowing people listen to the sounds beyond vast distances through encoding and decoding them – from the source to the recipient. This development enabled real-time dissemination of curated music playlists, giving birth to a culture of its own (Skretvedt & Sterling, 2018). This might be the most unique type of artefact with respect to the models of access which can be found further down in this chapter. The invention of radio is a fairly convoluted topic; because of that, we'll be talking about milestones for the conception of this technology, as well as its cultural and experiential impact for the sake of relevancy. The inventor of the radio is widely regarded as Guglielmo Marconi; however, there were several cooperating *and* competing parties that played significant roles over a span of time during the radio's journey towards its conception and adoption (*Understanding Media and Culture: An Introduction to Mass Communication*, 2016).


Figure 2.3 - Top view of Braun's T580 transistor radio as designed by Dieter Rams in 1961. Note that its controls are focused on tuning-in to stations and adjusting the volume. [Image from online catalogue of The Museum of Modern Art (MoMA) at moma.org]

Radio broadcasting gained cultural significance as a movement started by radio enthusiasts known as 'ham radio operators', who began to broadcast music and commentary in their areas, laying the foundations of radio culture we're familiar with. It amplified the cultural impact and dissemination of music due to its immediacy and availability as well as transformed the music-listening experience in many ways. It became a somewhat common practice for people to broadcast their favourite song through their ham radios to their neighbours (Skretvedt & Sterling, 2018). The first commercial radio broadcast was made in 1920 yet there is still something drawing in the audience to the radio medium to this day. One might expect that radio listenership would dwindle, only that isn't the case. Radio wasn't annihilated by the digital revolution; nonetheless, it went through a transformation to be just as strong as it was before the digital revolution (Ferrigan, 2020). There are now various formats spun off from the radio as well as the traditional radio in its original form. Its direct descendants are DAB, satellite radio, and HD radio (*Understanding Media and Culture: An Introduction to Mass Communication*, 2016), which present essentially the same user experience besides being able to show more music attributes to the users. I’ll be talking about the radio’s spin-offs in the later sections.

In terms of interaction, radio doesn’t provide its users much control aside of changing the stations and adjusting the volume. The listeners are usually pleased with listening to music curated by the DJs of their preferred radios; if not, they change the stations until they find something that fits their tastes. It may not be an on-demand way of accessing music, yet people continue listening to it with devotion, nonetheless.

**Television.** Most interestingly, the emergence of television dates back to a time not very long after the popularisation of the radio, it slowly creeped into becoming a household item from the 1930s. The television is a technology that followed in the footsteps of the radio (Frith, 2002). It afforded the first multisensorial experience (aside from the tactual effect of sounds) of *media by itself* when separated from its physical artefact.

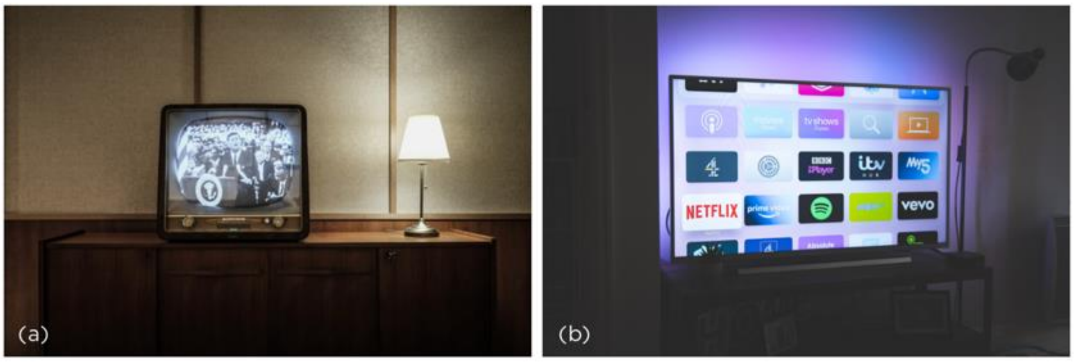


Figure 2.4 - Television in 2020s is a screen (b) that mainly acts as a hub (like smartphones) for projecting media from various sources in comparison to its predecessor (a) with strictly channel-based ephemeral watching qualities. [Photo by Nicolas J Leclercq on Unsplash]

Television and music are said to have an uneasy relationship with each other culturally; however, in terms of people’s listening experience of music, it became a more intimate platform. After all, artists could be seen in the TV in flesh. It also became an important tool for people to discover music through the appearances of those artists on channels. Then, music clips started to appear because of the television's popularity. There are two main reasons for creating the video extensions of the music: artistic intentions and promotional appeal. In terms of artistic expression, TV afforded an entirely new way for artists to communicate the music to listeners by complementing it with visual media: music videos. This was also a controversial topic. It made critics question the legitimacy of the artists who were popularised by the means of the TV, which might be attributed to the fact this format gave an edge to the artists with resources and connections who could appear on it, rather than the musical quality alone (Shuker, 2010). It also became a tool for the record labels to exert their influences over people's music-listening preferences and for steering the popular culture (Frith, 2002; *Understanding Media and Culture: An Introduction to Mass Communication*, 2016).

Interaction-wise, the TV functions in essentially the same way as the radio. Users select a 'channel' and watch it, all much the same as tuning-in to a station. Different than the radio, the modern TV format (known as 'cable TV') allow the users to watch past content, rewind and record it while being able to see the schedules of TV channels.


Figure 2.5 - Sony's TPS-L2, also known as the original Walkman. [From *Sony History / Just Try It!* page on sony.com]

**Cassette Tape Player.** Physical record formats may satisfy most of the music-listening needs of their users, yet they have an inherent usability issue in certain contexts: they are nothing but compact (except for more compact sizes), hence it is quite impractical to listen to an LP on the go. Additionally, it is relatively costly to manufacture a vinyl record. Cassette proved to be a solution for these two issues: it was more compact and relatively cheap to produce (Millard, 2005).

At long last, it became possible for people to listen to music from their own libraries during automobile trips and morning jogs, when the cassette players became mainstream. Of course, the revolution of portable music listening didn't happen overnight: not until Sony released its famous Walkman. It is a product line that outlasted its own lifespan through something its design afforded: a sense of freedom. This goes without saying one can only carry a finite amount of cassette tapes to play on the go – a hurdle which people overcame by compiling mixtapes of their favourite music into a single tape, which was a task ordinary people could handle without too much difficulty (Burnett, 1996; Millard, 2005). At this point, personalisation of the music-listening experience became a common practice for the first time in human history; because of that, mixtapes became icons of their times as artefacts of self-expression and communication (*Understanding Media and Culture: An Introduction to Mass Communication*, 2016).

Cassette, on this day, doesn't have the cult following of vinyl; still, it's still being recognised and appreciated by people despite its gradual fall to disuse. This fall can be attributed to the cassette's durability along with the other factors, the format is quite fragile when compared to the vinyl – it might be the reason why there wasn't a prominent cassette revival.

### 2.1.2 Digital Music-Players through the Recent History

Digital technologies enabled music to be experienced by music-listeners in a never-before-seen way. Its main hallmarks include access, speed, visibility, and computerised features such as logic and recommendations. In contrast to analogue media, digital artefacts operate on absolute values, which means that two given copies of the same recording are identical and same in principle, unless there is a corruption in the media's physical carrier. This makes it possible for digital artefacts to run tasks in an accurate and efficient style, which opens up almost infinite possibilities when compared to analogue sonic media player technologies.

In terms of relevancy of digital music-listening technologies, there is generally a considerable gap between when a technology was available for the first time, and the time they became popular. Because of that, I'll be ordering those technologies in chronological order of when they were popularised.

**Compact Disc Player** is the closest descendant of the cassette, with a single twist: it wasn't analogue like the cassette. Most commonly known as the CD player, it was developed through the joint efforts of Philips and Sony in 1982, and toppled vinyl sales in 1988 (Straw, 2009).

The first playable digital record released to the public was encoded into a compact disc. In spite of availability of various CD players, it wasn't radically different in entirety of its user experience when compared to the cassette. However, it carried a significant difference in its form factor: it was round like the vinyl; yet unlike it, it had a much smaller form factor that didn't trade-off the quality. This mattered most to the collectors and those without much space. The most iconic and popular CD player, much like its predecessor, cassette, was Sony Walkman. Sony knew what their products were doing, and that they did it well. It applied the same formula for the new format, and it continued its reign as Walkman users adopted its new iteration, the Discman (Millard, 2005).

CD players had a few tricks in their pockets: they could skip the songs almost immediately and required no rewinding or physical readjustment like its precursors. They were *mostly* fail-safe from the physical defects stemming from wear and tear, excluding the fact that they could scratch. The users simply put or changed the CDs, and it was ready to go without hassle. However, the CD's main selling point became the reasons of its downfall: the efficiency of its form factor and ease of its dissemination (Straw, 2009). Sometime after, online media sharing through computers and portable media players took over its throne in the beginning of 2000s.

**Music-Listening through Computers.** This concept needs to be disambiguated as the first thing due to there being countless instances of novelties when it comes to computers (after all, it's a wide term), including music. The first digital piece of music was played through a computer in the 1950s, yet its significance was about a technological achievement and novelty effect, rather than serving as a way for people to experience music (Millard, 2005). That wouldn't happen until music-listening practice through computers was popularised in the late 1990s, after the CD's rise to popularity.

**Mp3 and Piracy of Music.** A technology that allowed audio files to be compressed down to a size that made them to be stored efficiently within then-limited digital storages without sacrificing significant listening quality was essential for transforming the music industry and how we listened to music. That technology is known as the 'mp3'; those who lived through the early 2000s are very well-acquainted with it (Millard, 2005).

The mp3 format's release to the public marks the beginning and popularisation of music-listening on computers – only that it wasn't so simple. It took decades of research and knowledge accumulation, and development to release the mp3 (short version of 'MPEG-1 Audio Layer 3'), which would have ended up in the mp3 becoming an obsolete format if not for a paradoxical event that happened in 1995, saving it from the dominance of the superior AAC format (by the same developers). Pirates acquired the mp3 technology through a stolen credit card and released it to the public along with a note saying, "Thank you Fraunhofer!", addressing and mocking the Fraunhofer Institute, the owner of the format. Reverse engineering of the mp3 format allowed everyday computer owners to utilise it for the distribution and piracy of digital music; thus, lifting it to its decades-long status of being *the* digital music format (Orlowski, 2017; Sterne, 2012, p. 202). Transferring old recordings to mp3 format, and sharing and distributing the results, wasn't an uncommon practice. Those who did so viewed themselves as 'internet heroes', radically changing the distribution of music pieces, which were popularly downloaded and archived by the public (Giesler, 2008). This is how everyone's access to digital music was transformed on day zero, which was something the music industry could not foresee and had difficulty in catching up with until the rise of streaming services that became popular many years later (Marshall, 2015).

**Music-Listening Software.** Computer software offered affordances and ease of access that brought ubiquity to music-listening. On-screen graphical user interfaces (GUIs) for playing music were a completely novel way of interacting with music libraries for everyday people, especially if they didn't own a computer before. The interfaces could shift between two-dimensional specialised shapes on the screen; in addition, they could adapt to different scenarios, removed from the constraints of a physical form factor (Bertelsen & Pold, 2004; Shneiderman & Plaisant, 1998).

One of the most memorable examples of music-player software is Winamp, in which users could adjust sonic properties of their music through equalisers, keep an archive of their music, personalise the GUI of the player by applying it different skins, and much more. At that point, everyone with Winamp could curate and manage their own music archives (Millard, 2005). The development and support of Winamp was halted in 2013, which saddened a devoted community, which is interesting because a software for playing music proved to be much more than a tool in a similar fashion to its physical counterparts – proving that software music players could foster emotional attachment and sentimental value towards itself. For sure, Winamp was full of character from the moment it ran its demo track that made a goat voice followed by a whipping sound when it was installed and run for the first time by a user (Farivar, 2017).

**Online Music Sharing Platforms.** In relation to hacktivism activities as per the mp3 format, millions of people shared music as mp3 easily and commonly through online file-sharing systems like Napster and Kazaa and then played them with their respective music-player software (Herman & Chomsky, 2006). Of course, 'pirate' sharing activities started to be surrounded by controversies as legislative and corporate stakeholders saw them as a looming threat and slowly started to divert their attention to those activities – ensuing a years-long conflict that would define every single music-listening artefact thereafter (Giesler, 2008; Herman & Chomsky, 2006). These activities kickstarted a series of events that would lead to the eventual creation and popularisation of portable media players, internet radio, and music streaming services.

**Online Music Stores.** In contrast to the controversy surrounding Napster, iTunes Store by Apple set the prime example of obtaining music through legal channels from the Internet. It evolved with distinct features that brought it to a different direction by providing the framework for Apple to establish a music market and to enable seamless music transfer to its new music player: the iPod, finding success despite being a late entrant to that market. Apple demonstrated that seamlessness is a critical feature of the user experience, through its offering of a perfectly complementary hardware and software platform for obtaining and listening to music (Moggridge, 2006).


Figure 2.6 - iTunes functioned as a media store for, and media management bridge between, a number of devices over the years, enabling a coherent and seamless UX. [Image from *Working with iTunes* page on apple.com]

**Portable Media Player.** It is a type of physical device that plays digital audio and/or video media, eventually succeeding CD players as the most popular music-listening artefacts. They were most commonly known by the public and marketed by the companies under the name of ‘mp3 player’. Despite their popular naming, it is safe to say that most of those products could play media including, but not limited to mp3 file format. Albeit, the naming was not a coincidence as mp3 format allowed the media players to be shrunk down to a portable form factor (Millard, 2005; Sterne, 2012).

The most popular *portable media player* in the history is, without a doubt, Apple iPod – none of its alternatives created its success according to Bill Moggridge

(2006). A number of factors can be attributed to its success, most of which boil down to the appeal of its design. Aesthetical features that enable hedonic experiences are meaningful to the users, making them more likely to be preferred. Famous names were involved in its design and development: Steve Jobs and Jonathan Ive. The idea behind it was simple – to create an aesthetically pleasing and experientially seamless portable media player in a market saturated with unmemorable products (Bull, 2005; Shelley, 2015). According to Bill Moggridge (2006): “When the first iPod was launched, the beautiful design was captivating, but the integration with iTunes really made the interactivity irresistible.” (p. 305), who then quotes Paul Mercer:

> There were MP3 players before Apple shipped the first iPod, and there were music stores before the iTunes music store, but Apple was the first to make it mass-market capable. They applied the ineffable “Apple magic” to make that possible, whatever that is. (Moggridge, 2006, p. 314)

In terms of utility, access, and control, the iPod was similar to any other product on the market, and again, its features attributable to aesthetics and experience made it a more desirable product despite arriving to the party late.

Figure 2.7 - $2^{nd}$ Generation iPod model sitting on human palm, whose controls were centred on a tactual dial for continual browsing through the archives. [Photo by Cartoons Plural on Unsplash]

**Shuffle.** This is not a music player as such, but rather a revolutionary feature that unbounded pieces of music from the straightforwardness of sequential playing order – adding the element of surprise to playback. Shuffle is quite a significant feature that altered the experience dramatically. On the top of that, even simple in theory, shuffle needed a human touch to its ‘randomness’ to feel actually random (TW Leong, Vetere, & Howard, 2005; Sener & Pedgley, 2012).

Figure 2.8 - iPod Shuffle is an artefact with a small form factor, which relies on music sequence and shuffling (hence the name) to navigate through a music archive without utilising visual mode. [Photo by Glen Carrie on Unsplash]

This technology can be found built into almost all of the significantly successful music-players since it was popularised by the music players in computers and Apple iPod, or even earlier as the ‘random’ feature on CD players. Shuffle is one of the very few significant features that drastically altered music-listening experience without being related to access, speed, and ubiquity: giving music-listeners more control over how they listen to their music by letting go of control (TW Leong et al., 2005).

**Mobile Phones & Smartphones.** These are milestone technologies that gradually transformed the relationship of everyday people with information technologies, which eventually became ubiquitous. On this matter, these devices represent a critical importance due to their necessity for almost everyone to perform their daily engagements properly (either in most of the countries or developed urban locations). Nonetheless, those devices were quite transformative of the music-listening experience due to enabling people to “choose to hear music” – equipping large populations with accessible music-listening technologies (music player, radio & streaming) as a feature (Cross et al., 2016, Chapter 43).


Figure 2.9 - Home screen of a smartphone; specifically, iPhone XS, an artefact acting as a hub for applications, which largely overtook the functions of physical music-listening artefacts in day-to-day life.

**Online Video.** It was mainly popularised with the emergence of YouTube, which dominates the online video format, including music videos, whereas none of its competitors achieved its ubiquity (with the exception of live-streaming and specialised video sharing platforms, both of which are outside our scope).

YouTube swept a significant real estate in the time people spend online, making it the default platform for people to consume audio-visual music content as this platform can host music clips, lyric videos, concerts etc. It is also being used as a music listening and discovery tool by music-listeners; in return, a prominent marketplace for the production and publishing companies to push the music labels they work with (Herman & Chomsky, 2006; Krause et al., 2015).

**Internet Radio.** It is same in its spirit in comparison to traditional radio; however, due to the ubiquity and its dependence on a (relatively) costless infrastructure, it is more economical for broadcasters – especially amateurs and enthusiasts – to maintain. Although, it is not as accessible as the traditional radio due to having no space within the radio frequencies: making it incompatible for use in an analogue radio receiver (Millard, 2005; Morris & Powers, 2015).

**Music Streaming Services.** This is the most ubiquitous music-listening technology in 2021, yet it has been around for quite a long time before it was popularised. It is the most pervasive music-listening technology ever created. Access to music and information thereof is instantaneous, flexible, and effortless for users. Users can either access to music media by browsing or searching the entire music archive of those services, by selecting curated playlists, or by listening to the music recommendations provided by those services, based on their past music-listening choices.

The most popular of these services are mostly dominated by 'tech giants', technology companies with immense wealth, yet the most popular and earliest is an independent service: Spotify (occupying 36% of the market by the number of subscribers, according to research made in 2019). The rest, in descending order of subscriber numbers, are Apple Music, Amazon, Tencent, Google, Deezer, Pandora, Fizy, and others, by the same criteria (MIDiA Research, 2019).


Figure 2.10 - Digital artefacts such as music-streaming services like Spotify (as photographed) don't have a dedicated physical artefact, they rather occupy the real estate of other devices and utilise their hardware capabilities – providing a uniform experience through their interfaces.

The market leader, Spotify, has been around since 2008. The company announced that it had about a million paying subscribers out of 6.5 million total users in 2011, which dramatically rose to 124 million subscribers out of total of 271 million users of the service by the end of 2019, which is only a portion of the total of 1.07 billion music streaming users (MIDiA Research, 2019; Spotify, 2020; Statista, 2020), meaning that roughly 1 out of every 7 people stream music worldwide. These numbers indicate that streaming music is the mainstream way of listening to music, shaping the industry, as well as influencing people's present and future music-listening experiences.

**Implications for the Future.** People's access to music is at a point where it is the farthest it can go. Almost anyone can listen to (almost) any piece of music they want to listen to, at a moment's ease, anywhere there is Internet access. On the surface, there seems to be no technology further beyond the current technologies to advance one's access to music. In spite of this, there are attempts and experimentations for fostering more unconventional ways to experience the recorded music, which I'll be reviewing in the next part.

### 2.1.3 Experimental and Conceptual Artefacts

I am going to descend into a more microscopic level in this part: I'll now be reviewing particular artefacts rather than the technologies due to the sparsity of the number of examples. I will be reviewing select both physical and digital music-player designs within a wide-span of resources that include academic researches, conceptual projects, and proofs of concepts that incorporate novel and innovative methods for interacting with recorded music to access and experience it in ways which users are largely unaccustomed to. This will be done in a descending order of product lifecycle – meaning that the actualised ones will come earlier, whereas ones at the earliest stages of conceptualisation will come later.

**Spotify Stations.** It is an experimental service available only in the United States. Its visual aesthetics are similar to Spotify as they adhere to the same design language; however, it is built upon a few distinct fundamental features, differing it from its older sibling. It seems to mimic the characteristic music-listening experience of the radio with a twist: there are playlists called 'Stations' brought by the algorithms to the users based on their preferences; however, songs within those stations can't be specifically selected and the controls are quite limited when compared to the other streaming services ('Stations', n.d.).

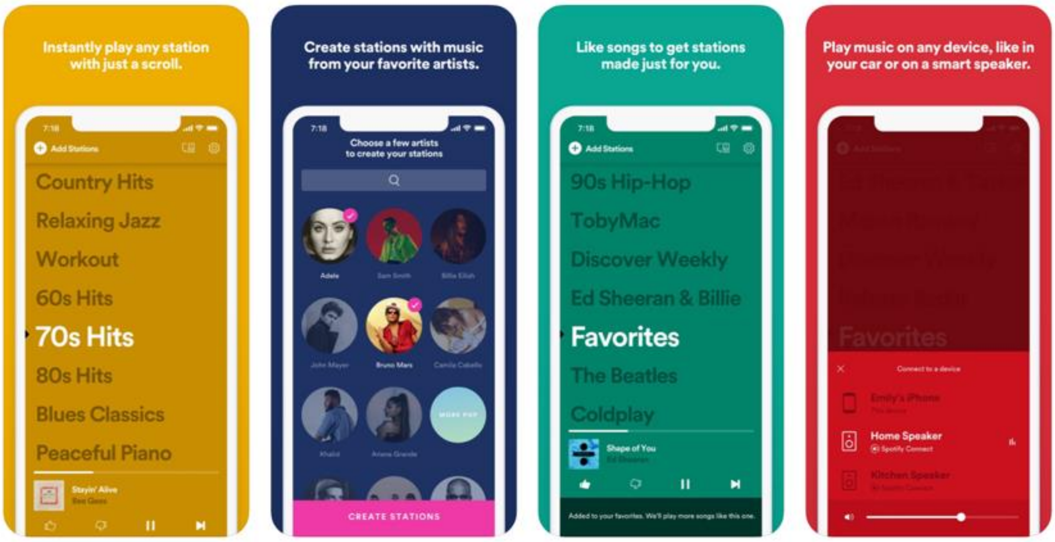


Figure 2.11 - A few screens of Spotify Stations, whose primary means of control is vertical movement through themed music playlists (stations). [Image taken from Apple App Store page of *Spotify Stations* on 10 May 2021]

Its working principle is based on feeding the system with binary positive & negative feedback by user about the current music played by it, so that it may create a taste profile of the user; consequently, bringing songs fitting better to that profile into the stations. Much like the radio, there is no option to wind it back to the previous piece of music. It fosters a serendipitous music-listening experience by limiting the options and choice available to the user; thus, also limiting the effect of the information available to them.

In hindsight, its semantic properties are quite alike the radio, the purpose might be to create a modern iteration of the radio experience. The music community seemed to embrace it and gave positive feedback about it; although, that community is currently limited to the US – a place where the radio culture is quite strong and deeply rooted into the fabric of society, which may be a factor of bias. Its users acclaimed its non-pervasiveness and loose constraints on user agency ('Spotify launches a "Lean-Back Listening App" called "Stations" in the US', 2018). Stations is unique in a way that it's the only actualised music-listening artefact that lets users access music solely through recommendations serendipitously.

**Mighty Audio.** This physical device is a portable media player that works through Spotify integration to play Spotify playlists on the go. It isn't radically different from iPod Shuffle as both of them share the same size factor and don't have a screen, yet Mighty attempts to overcome the lack of a deliberate interface through audio feedback for extended control features. It is the only screen-free portable media player integrated with a music streaming service. It was mildly received by the users and doesn't provide a radically different music listening experience when compared to portable media devices; however, it shows an effort on fostering a music-listening experience without relying too much on attribute information of the music.

Figure 2.12 - Variously-coloured Mighty units resting on palms. Similar in terms of form and scale to iPod Shuffle. [Image taken from *Press Center* page of bemighty.com]

**OLO Radio.** A conceptual physical radio designed as a part of a research through design by Will Odom and Tijs Duel in 2018. It incorporates a novel idea in a simple and effective way: experiencing temporality of past music experience through the interaction with the music-playing artefact. They argue that even though the conventional artefacts enable discovery and experiencing the music in the present moment, they don’t enable reflection for experiencing the music through the temporal materiality of the music-playing artefact.

Figure 2.13 - In resemblance to a retro music set, OLO has no screen for enabling interaction unlike the modern music-playing artefacts; instead, it carries a slider and two dials for navigation through time and control of the music's volume, which is the purpose thereof (Odom & Duel, 2018).

For this, their design constituted a knob to navigate their history of reminiscing what they listened to in the past, functioning as an experiential time machine directed towards the past. The only attribute relevant to it is the time when a piece of music was listened to, this was achieved through programming Python scripts and implementing them on a Raspberry Pi 3, which collected past music-listening data of the user. There is no feedback mechanism except for the music that starts to play when the knob and slider is moved to a time in the past.

Regarding the future work, the authors note that this design serves as an inspiration and suggestion for design researchers to explore meaningful ways to interact with the data (Odom & Duel, 2018).

**Olly.** It relies on the same temporality principle as OLO Radio (as some of their researchers/designers are mutual) and functions similarly to it with a single twist: slow design is even more heavily incorporated into it – emphasising the materiality of the music and past experiences through interaction (Odom et al., 2019).

Its form communicates a minimalistic aesthetic that emphasises a single feature: a wide circle, which also is the exclusive control element of Olly. Conversely, OLO Radio exhibits radio-like features such as a pair of dials and a slider, hence the name.

Unlike its sibling, Olly went through user testing to gather insights about the users' experiences with it. Despite the users' initial reluctance, it succeeded in its purpose as the users began contemplations while winding the artefact back in time for open-ended duration of winding effort (by rotating its circle-shaped control feature).


Figure 2.14 - Physical form, interactivity, and material qualities of Olly, respectfully in order. Navigation between the tracks is done through the rotation of its hand-sized dial (Odom et al., 2019).

Both OLO Radio and Olly succeed in the cultivation of subjective reflections, also fulfilling their purpose. Those cases give a valuable insight about designing successful unorthodoxly designed artefacts: keeping it simple and establishing mappings that utilise relatable metaphors prove themselves to be successful design strategies. Those mappings and metaphors feed-forward the user's interactions with the artefact, letting the media (in this case, the music) serve as a feedback.

**Spotify Box.** This artefact was the MA finishing project of Jordi Parra from Umea University Institute of Design in 2011. It is, as one might guess, a digital music-player, which works through Spotify integration. The main idea behind it was giving materiality to playlists played through music streaming services. It works through associating physical RFID tags with the address of a respective playlist on Spotify, making it a music storage medium comparable to vinyl and cassette. Putting the tag onto the designated space on the device gives the input for playing the playlist to the player device, which streams music from the service (Parra, 2011).

Figure 2.15 - Parra's Spotify Box and whose RFID-enabled playlists resting next to it, which works through placing the tags onto the device just like any other analogue method of listening. [Image taken from the designer’s site, zenona.com]

It is an interesting exploration for altering the digital music-listening experience by the limitation of digital user interfaces (Pierce & Paulos, 2014) through the employment of physical artefacts, a technique used for allowing critical contemplation. The user only has the information pertaining to the playlist on the faces of the tags – a retrospection in terms of user experience of interactions with the music-playing artefact.

**MuRedder.** An artefact designed for researching ways of representing the ephemerality of experiences like music-listening; after all, the features that translate that ephemerality to the physical space have become invisible or replaced by intangible artefacts that push the music to periphery of users according to the authors (Kim, Jang, Kim, Kwon, & Park, 2019).


Figure 2.16 - muRedder's use scenario: user selects a song from their catalogue (a), inserts it (b) to the device, the music sheet gets shredded (c) as the music is played, its container (d) visualises the music listened in the past with a pile of shreds (Kim et al., 2019).

The device runs after shredding the RFID tags that play the music. The irreversibility of the action aims to make its users contemplate about the qualities of music, uniqueness of every moment, and the ephemerality of experiences. We believe that this statement is especially strong in a time when access hinders the value of experiences like music-listening by making them available on-demand. This might also mean undercutting the face value of the moments occupied with the music that accompanied them; consequently, making it feel as if those moments that a person feels at that moment can be replaced and controlled just like those music pieces.

**Orbit.** Orbit is an award-winning design concept for a tangible music-player. The designer of the concept, Senna Graulus, expresses the reason behind it as enabling a way of listening to previously streamed music playlists through a tangible interface by distancing the user from the ‘extreme digitalisation’ of music-listening experience.

Figure 2.17 - Graulus's Orbit allows interaction through user’s actions on changing the relationship parameters like distance and placement of its base and dial components, which becomes a filled cylinder when laid concentrically to its default state. [Taken from the public portfolio of the designer, on behance.com]

Its way of achieving its purpose is through cleverly mapped metaphoric interactions. It is constituted of two parts, the separation of which switches it on by ‘picking the music from where it was left off’. Moving the separated part around the base allows the user to switch between the pre-determined playlists, whereas moving it away in the direction of playlist makes the device play similar songs to the playlist. Rotating the separated part around itself adjusts the volume. These interactions allow to interact with the music physically (Hoare, 2018).

This concept and its mappings are well-aligned with the direction of this study, which were designed with similar intentions – showing promising ideas for the progress in that direction.

### 2.1.4 Three Models for Accessing Music through Music-Players

I came across several patterns and regularities when reviewing the existing and conceptual recorded music-listening technologies: all of them carry qualities of certain use patterns of users for interacting with the music through recorded music-playing artefacts.

Access models employed for interacting with the music-playing artefacts are subject to differ between each individual; however, I identified three regularities between the interaction flows of the artefacts I inspected. Even though new technologies brought technological advancements that enhanced how we interact with these devices, interaction flows of all artefacts seemed to coalesce down to three models. I'll be elaborating and giving examples of each, those are: archival, curational, and recommendation models of interacting with recorded music-players.

**Archival Music-Listening.** This model involves choosing recorded music that is within the library of the user, who has the means to play any piece of music within that library on-demand. The effort spent by the user may vary depending on the format of the music player technology that plays the music from that library. Examples include LPs, cassettes, digital personal music libraries etc. (Millard, 2005).

**Curational Music-Listening.** It is a model for listening to sets of recorded music that are essentially compiled, maintained, and published or broadcasted as playlists by someone other than the listeners. These listeners might either have means to tune-in to an on-air playlist (like radio or music TV) or selecting tracks to listen from an on-demand playlist. Examples include radio, digital music playlists, music compilations and so on (Millard, 2005).

**Music-Listening by Recommendations.** It is what we could regard as the most recent model, thanks to the increasing aptness of novel programs that accompany the music-player technologies. Algorithms and intelligent technologies allow the programs to associate music-listening tastes of users, giving them recommendations or queuing up what to play next for the user automatically. An example would be the ‘Discover Weekly’ playlist feature that recommends tracks based on the taste profile of the users; another example is Spotify’s continuation to play music pieces similar to the ones in a playlist upon the exhaustion of that playlist.

**Intersections and Composite Models.** These models are not mutually exclusive and may intersect with each other in varying degrees depending on the offerings of individual artefacts. For example: music streaming services let users subscribe to a music library containing millions of music pieces on-demand and add them to their own playlists (archival), listen to pre-made playlists made by people (curational), and automatically recommend related songs with respect to a user’s current listening sessions or their general music tastes (recommendation).

### 2.1.5 Discussion on the Existing and Conceptual Artefacts

We explored the fundamental recorded music-listening artefacts and the key technologies that significantly affected users’ relationship with those artefacts and recorded music-listening experience in general. Music-listening experience as we know it today evolved through the advent of the technologies that afforded them; however, the succession between the artefacts occurred as a result of pragmatic reasons. For example: electrophone was replaced by radios, which owes its emergence to homebrew radio enthusiasts, yet the succession took place due to factors such as practicality and its cost factor (See 2.1.1). Another example is the transition from CDs to digital music formats due to the public’s access to mp3 encoding (resulting from technology espionage), which made the storage and distribution of music much more practical than how it is in CD format: eventually leading to the birth of portable music players, due to increased access, personalisation, decreased costs, and size factor (See 2.1.2).

Empirical findings indicate that each format is utilised for music-listening for their distinct uses and gratifications[7] (Brown & Krause, 2020; Krause et al., 2015; Lonsdale & North, 2011). The models of access I previously defined and discussed in the last section have enabled us to distinguish the qualities of the artefacts in Table 2.1 (ordered from oldest to most recent), where we observed that there are significant differences between each type of artefact as per their artefact properties, models of access, and availability of extrinsic attribute information.

Upon reviewing types of music-players, as supported by empirical uses and gratifications analyses in the literature (Brown & Krause, 2020), I identified that many older formats are still actively used by significant music-listener populations despite the practical advantages of newer formats. This can be attributable to several factors like physicality and intimacy for vinyl and cassette, discovery and lazy listening and "human touch" for radio, aesthetics and meaning of the experience for iPod (portable music player) and vinyl et cetera.

On the other hand, as backed per the literature (Brown & Krause, 2020): formats like music streaming services, online video platforms, and digital radios achieved a strong foothold and became the go-to choices of many music-listeners for pragmatic reasons such as on-demand access, high level of control, and feature richness, which also constitutes the current trajectory of newer music-listening technologies. In addition to that, financial reasons determine whether the listeners choose free or paid services. As a part of this direction, increased availability and variety of extrinsic attributes subjoined to music pieces became quite prominent and essential as a feature of the newer music-listening artefacts, which signals a direction converging into a uniform trajectory focused on the maximisation of offerings (See Table 2.1).

[7] Uses and Gratifications Theory refers to each media use having an underlying reason, whereas its studies explain why people use a specific media (Brown & Krause, 2020).

When I look at the situation today, in my opinion, it doesn't seem like any significant shift is going to happen due to "maximisation" of pragmatic concerns thanks to the advent of Internet-connected technologies (See Table 2.1). While this kind of an artefact is beneficial for users (as consumers), music-listening experiences would be defined by the norms of uniform music-listening artefacts, in which the maximised offerings would be, paradoxically, ineffectual in enabling unembellished experiences.

On the other hand, upon looking at Table 2.1, I see that currently there isn't any conventional means for enabling neither recommendation-only model for accessing the music, nor attempts at mitigating the information availability for exploiting those qualities for enabling unconventional ways of experiencing the music. However, the experimental and conceptual artefacts that were reviewed in Chapter 2.1.3 seem to achieve those qualities to a degree in different ways and be applauded for doing so. These artefacts point us to a direction for the further phases of the research and serve as examples for tackling the design issues.

Table 2.1 - Properties of the Types of Music-Listening Artefacts

| | Models of Music Access | | | Availability of Extrinsic Attribute Information | | | | | | | | | | User Concerns | Artefact Properties | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Artefact Name | Archival | Curated | Recom-menda-tion | Music Name | Album Name | Artist Name | Album Art | Station / Playlist Name | Genre | Popu-larity Info | Content Length | Related Content | Content Trivia | Uses and Gratifications | Control Scheme | Internet Connect ivity | Porta bility | Incorpor-ation | Content Availability |
| Music Box | x | | | 1* | | 1* | | | | | | | | N/A | Limited | No | No | Physical | Physical Posession |
| Phonograph | x | | | 1 | 1 | 1 | | | 1 | | | | | N/A | Limited | No | No | Physical | Physical Posession |
| Turntable | x | | | 1 | 1 | 1 | 1 | | 1 | | 1 | | 1 | Physicality, Intimacy | Limited | No | No | Physical | Physical Posession |
| Analogue Radio | | x | | 3 | 3 | 3 | | 1 | 2 | 3 | | | 3 | Discovery, Serendipity | Limited | No | Yes* | Physical*** | Coincidential |
| Television | | x | | 2 | 2 | 2 | 3 | 1 | 2 | 3 | | | 3 | Discovery, Serendipity | Limited | No | Yes* | Physical*** | Coincidential |
| Cassette Player | x | | | 1 | 1 | 1 | 1 | | 1 | | 1 | | 1 | Physicality, Nostalgia | Basic | No | Yes | Physical | Physical Posession |
| CD Player | x | | | 1 | 1 | 1 | 1 | | 1 | | 1 | | 1 | Ownership, Nostalgia | Basic | No | Yes | Physical | Physical Posession |
| Portable Music Player | x | | | 1* | 1* | 1* | 1* | 1* | 1* | | 1* | | 1* | Nostalgia, Phys., Practicality | Adv. | Yes* | Yes | Physical | Digital Ownership |
| Digital Music Library | x | | | 1 | 1 | 1 | 1 | | 1 | | 1 | | 1* | Reliability, Trust, Ownership | Adv. | Yes* | Yes** | Virtual | Digital Ownership |
| Online Music Service | x | | x | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 3 | Access, Ownership | Adv. | Yes | Yes** | Virtual | Digital Ownership |
| Online Radio | | x | | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 1* | 1* | 3 | Access, Availability | Adv. | Yes | Yes** | Virtual | Coincidential |
| Online Video Platform | x | x | x | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Pragmatic | Adv. | Yes | Yes** | Virtual | On-demand |
| Music Streaming Services | x | x | x | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Access, Control, Cost (for free) | Adv. | Yes | Yes** | Virtual | On-demand |

1 - Instantly available / 2 - Coincidentally available with the currently playing music / 3 - Occasionally available along with a vocal narrative / (*) - Varies between artefact models
(**) - Depends on the device they're installed to / (***) - In normal cases, can be nested into devices virtually

## 2.2 Part II: Choosing, Judging, and Listening to Music through Music-Listening Artefacts

The task of choosing music may be considered as the most critical process when interacting with a *modern music-playing artefact*[8] in terms of user agency. A (seemingly) split-second interaction for choosing a piece of music might seem insubstantial; however, the events that surround that action influence users' choices more than it seems; in fact, this process relies on complex and multifaceted factors (See 2.2.1 – 2.2.3). More importantly, it is a crucial part of the user's music-listening *experience* (Hassenzahl, 2010) that is intertwined with how the chosen music piece is appraised: *it is the user's experience of exerting agency on the music selection*.

Making sense of the relevant underlying mechanisms of why and how people listen to, choose, and judge music is critical for understanding what matters in relation to interactions of music-listeners with the music-playing artefacts.

For the reasons above, in this part of the literature review, I'll be exploring why people listen to music, how they perceive and categorise music in their minds, how their preferences develop, the mechanisms behind the decision-making process, and the factors affecting how individuals choose music for listening to through music-playing artefacts.

### 2.2.1 Listening to Music

Giving an answer to someone who asks, "why do we like music?" could seem like a redundant task; after all, most human beings can experience music as a natural trait. A straightforward answer would probably be, "Because it's *pleasurable*.";

[8] Any given internet-connected virtual artefacts that allow ubiquitous access to music.

however, such a statement would correspond to a motivation for listening to music. So, why do we listen to music and what it means for the design of music-playing artefacts?

You most probably heard the famous phrase, “Music is the universal language.”, connotating that human beings can communicate through music. The interesting thing is that it is mostly true *within the human realm*: musicality is considered an innate trait of human beings, music being the product and language of it. Scientific findings indicate that musicality is a complex feature resulting from the evolution of human brain – thought to be originated as a survival mechanism for recognising the aural patterns, to which humans can also attribute meanings (Juslin, 2013). Perception and comprehension of music as a part of this complex mechanism needs to be facilitated by several centres in the brain to occur (Honing, ten Cate, Peretz, & Trehub, 2015; Pearce & Rohrmeier, 2012). In spite of its underlying multifaceted complexity, music can be experienced by human beings naturally mostly without the need of conscious effort; of course, the experience is known to differ vis-a-vis the cultural schemas an individual recognises (W. W. Gaver & Mandler, 1987; Juslin, 2013).

To put things into perspective regarding this, it can be mentioned that a recurrent international public opinion survey since 2013 with more than 600.000 respondents, where (the median of) 86% of respondents claimed they couldn’t be happy without listening to music (Generation What, 2017). Many studies in academia back-up these findings (Cross et al., 2016, Chapters 13 & 45).

#### 2.2.1.1 Categorisation of Music Pieces & Emergence of Schemata

People accumulate pieces of information they gather from their surroundings from the point they are born. These pieces of information get encapsulated and ordered into categories as per the entities they correspond to (Holyoak & Morrison, 2005, Chapters 2–3). For example, the semantic category of ‘cat’ in someone’s mind is the amalgamation of all the cats that person perceived in the past, which doesn't represent any particular cat, but cat as a concept – a mental representation. Samples accumulated in the mind over time amalgamate similar entities by forming mental representations that doesn't exist in the real world, in a way similar to silhouettes (Halpern, 1988; Holyoak & Morrison, 2005; Shepard, 1978). The mind categorises things to make sense of them effectively in relation to what those things are (Holyoak & Morrison, 2005; D. Norman, 2013).

Let's move away from the example of cats, and closer to the concept of music. Of course, unlike cats, music doesn't have any physical form: it is a temporal chain of ephemeral sonic events, which means that it's not possible to visually observe it (albeit it's possible to visually interpret it); regardless of that, music pieces have distinctive characteristics: unlike the physical qualities like texture, dimensions, and shapes; pieces of music are perceived through the combinations of aural qualities such as melodies, their harmonies, lyrical overlay (if it's a song), timbres, rhythms etc. (Maes, Leman, Palmer, & Wanderley, 2014). Categories are *constructed* with respect to these qualities for practically distinguishing pieces of music from each other. There are many ways of categorising music: from the ear it was conceived to the emotions it conveys; nevertheless, it's safe to say that most widely known type of categorisation deployed for music tracks is the 'musical genre'. Each genre leaves a relatively distinguishable impression on the listeners; albeit, not in a strict sense: *personal schemata*[9] of Blues, Rock, Classical, Rap, or any other genre are quite limited as per the total sum of a person's encounters with them – making them have subjectively constructed categorical boundaries; for this reason, attempts of drawing hard boundaries between them would only be ill-defined at best (Gjerdingen & Perrott, 2008), this is due to the fact that there are more than often *areas of ambiguity* blurring the lines between pieces of music in

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[9] Schemas are mental associations of meanings given to concepts or categories (Cross et al., 2016, p. 561).

terms of categorisation. This is especially so, considering that there are countless pieces of music that fit into several genres simultaneously (Gjerdingen & Perrott, 2008; Rentfrow & Gosling, 2007).

Regardless of the ambiguities and objectively accepted definitions of the categories, each person forms schemata and subjective norms about the categories based on the sample size and the qualities of the music pieces that make up those categories (Cross et al., 2016). It goes without saying that individuals can associate values to pieces of music and their respective categories based on their past experiences and dispositions; as a result of that, people develop preferences of music based on antecedents.

#### 2.2.1.2 Liking Music & Formation of Music Preferences

In spite of music's universality among humans, not everyone likes the same kind of music, which may indicate that not every piece of music is universal. So, why can't everyone enjoy the music as something universal? This is the point where the preferences and individual differences come in.

Gaver and Mandler (1987) assert that "Music exists as an interaction between structured sound and a comprehending mind." (p. 261) [10]; in this sense, liking music depends on the congruence of schemas between the qualities of the aural events that constitute musical structure and the ones the listener can recognise. On the other hand, as per the recent account of Juslin (2013), aesthetic judgement of music is an equation of lower level perceptual input, high-level cognitive input, and emotional input (in which he elaborates much greater detail) on the condition of recognition of music as art. These inputs are evaluated through individualised

[10] I'll be refrainining from elaborating the technicalities of music as per the scope of the study. Gaver and Mandler (1987) discuss it in a greater detail with regards to congruence of schemas, whereas Juslin meticulously elaborates emotional and aesthetic judgement processes of music (2013).

aesthetic criteria; therefore, a judgement emerges with respect to the weights of each criterion (subjective for each person). As a result, either positive or negative aesthetic judgement is always made; however, the author expresses that emotional response emerge a percentage of the instances as per the surpassing of an aesthetic threshold (Figure 2.18). Even though these researches are focal to aesthetics and emotional response and largely disregard the effects of extrinsic and contextual factors, the author mentions that factors outside this process can affect the judgement on the music pieces in the form of different functions, input, and criterion (Juslin, 2013).

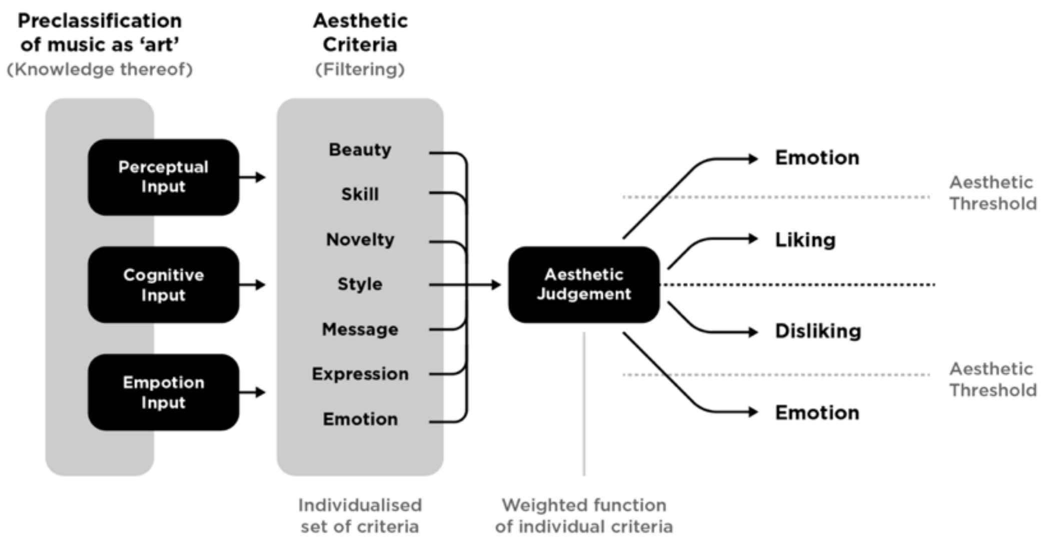


Figure 2.18 - Juslin's (2013) schematic description of the aesthetic judgment process in music listening (Reproduced).

People perceive all pieces of music as music indeed, yet each individual develops their own music preferences as they experience music (Hargreaves, 1982; Rentfrow & Gosling, 2003). Preferences emerge as a result of individualised congruence of schemas of music pieces and their categories per se with respect to the individuals' past and present experiences (W. W. Gaver & Mandler, 1987; Kahneman, Slovic, & Tversky, 1982). As the resulting subjectivity of those experiences, a piece of music can evoke a positive response from one person, while it may become a negative response for someone else. We may refer to LeBlanc's model of variation in musical taste for a broader overview of how musical preferences and taste emerges (Figure 2.19).

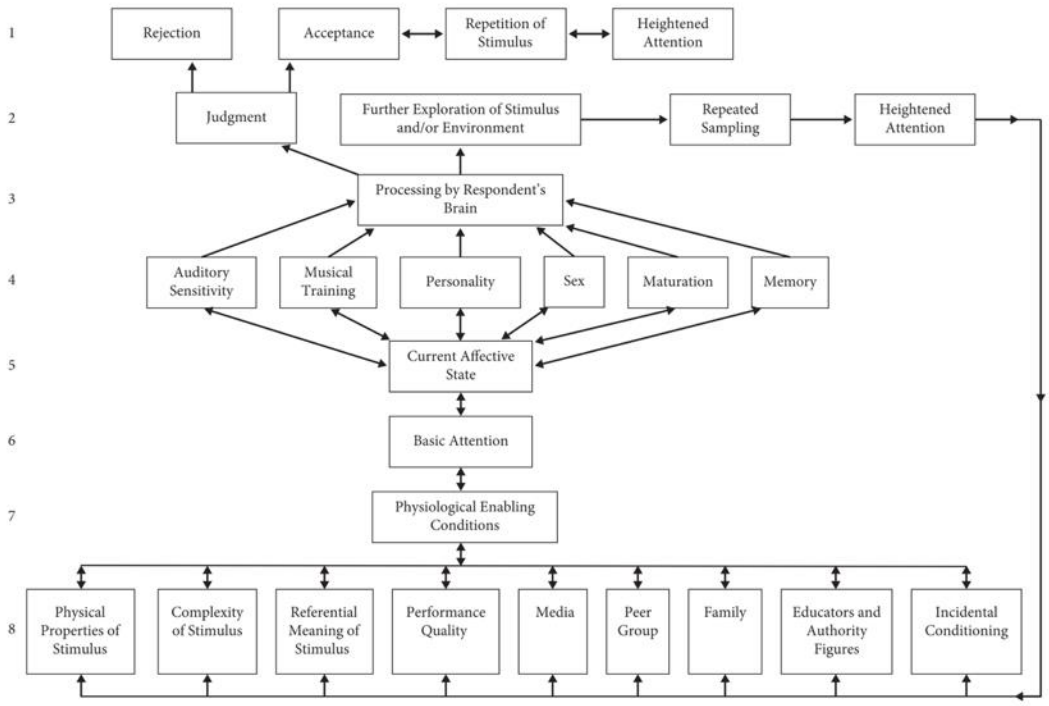


Figure 2.19 - LeBlanc's model of sources of variation in musical taste (Cross et al., 2016). (Taken from The Oxford Handbook of Music Psychology)

For example, let's think about a person who used to listen to pieces of music that were aesthetically pleasing for them along with their group of friends while growing up, with whom they accumulated memories and assigned meanings due to the positive qualities of the whole experience such as social connectedness, positive aesthetics, and fond memories. For this reason, this person would be more likely to enjoy a category of music compatible to the ones they listened to with their friends. Of course, the effect of the peer group is only a single variable among many other variables such as personality traits, culture, self-image etc. It's worth noting that the values and weights of factors affecting people's music-listening experiences and music preferences, and not just the presence (or not) of those factors, may change from person to person in a fuzzy manner due to the subjectivity of experiences (Desmet & Hekkert, 2007; Kahneman et al., 1982; Krause & North, 2017).

### 2.2.2 Cognitive Processes Affecting Choice and Judgement in Music-Listening Experience

In the preceding topics, I explained why people listen to music, how they categorise it, and what makes individuals like music and form preferences in a general sense, from the beginning of section 2.2 up until this point. Now I'll be reviewing the mental processes that play significant roles in music decision processes, these are: the temporal difference in experiencing past and present events, dual process theory, and decision heuristics and biases. Each of these phenomena will help us understand parts of the processes that guide the decisions made by users and affect the outcomes thereof.

#### 2.2.2.1 Present and Recalled Experiences in Decision-Making

Kahneman distinguished between the experience in the present moment and the reminiscence of past experiences as different processes; therefore, indicating a discrepancy between what people experience in the proximity of the actual moment and what they experience when they recall that experience sometime later. This distinction implies that the appraisal of each would create different emotional responses, vis-a-vis the temporal dissonance between both (Kahneman, 2011).

#### 2.2.2.2 Dual Process Theory in Decision-Making

Design literature is familiar to a few accounts compatible with Dual Process Theory (DPT): most famously is Norman's "Three Levels of Processing", in which a decision-making process happens in subconscious visceral and behavioural, and conscious reflective level. In essence, according to this concept, the human mind runs a *visceral and behavioural level* of processes swiftly and subconsciously (*intuition*), and a *reflective level* of processes slowly and consciously (*reasoning*) (Kahneman, 2011; D. Norman, 2004). This duality between the groupings of those processes is comparable to DPT, which was also acknowledged by Norman (2013, p. 310).

Before continuing, I'll need to acknowledge that there are multiple readings of DPT. These concepts are *representative constructions* of the phenomena of the mind for establishing a functional understanding; nonetheless, the processes utilised for making decisions are as follows:

**Intuition.** This type of processing is commonly characterised as fast and subconscious, which is thought to be effortless, uncontrollable and automatic (Kahneman, 2011). Actions such as driving a car or scrolling through a screen would be representative examples of this process (D. Norman, 2013).

**Reasoning.** This processing type can be generalised as slow and subconscious, while it is thought to be relatively demanding in terms of effort, controllable, and reflective (Kahneman, 2011). Trying to solve a mathematical problem that is relatively difficult to solve and learning to use a new electronic device would represent this process.

I believe it is worth noting that both of these processes may function in parallel; because of that, assuming mutual exclusivity would convey a poor model of their functions. In addition, even though it's appealing to attribute absolute values to either of the processes, it would lead to erroneous assumptions: either of the processes are thought to be permeable to the attributes characterised with the other (to some degree) (Kahneman, 2011).

#### 2.2.2.3 Bounded Rationality Concept, Decision Heuristics and Biases

The human mind has limits to its cognitive resources and limited extrinsic resources such as information to make decisions (Kahneman et al., 1982, p. 191), which has to act within those limitations to make decisions and act upon the world. In attribution to that, the mind sacrifices some portion of the decision quality to make an economical decision that is satisfactory enough to attain the goal. As per the account of Herbert Simon (1997, Chapter IV.3), this concept is called 'bounded rationality' in which individuals make their choices.

> ...people rely on a limited number of heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations. In general, these heuristics are quite useful, but sometimes they lead to severe and systematic errors. (Kahneman et al., 1982, p. 3)

It would be naive to believe that decision heuristics and biases aren't in effect when choosing a piece of music to listen. Even though an everyday person is unaware of these factors affecting their decisions, they are pretty much at play regardless of the chooser's awareness as per their bounded rationality. It would otherwise be too difficult and time-consuming to make decisions in face of uncertainty in the absence of decision heuristics (and biases) – for the better or worse.

**Decision heuristics.** Heuristics are elementary strategies to come up with judgements in the face of a situation that demands a good-enough decision, which are commonly utilised by people in from everyday situations to complex ones (Kahneman et al., 1982, pt. 1).

**Decision biases.** Biases represent orderly deviation from the normative behaviour patterns with the effect of their subjective tendencies, which affect the individuals' decisions unbeknownst to them (Kahneman et al., 1982, pt. 1).

There are a number of heuristics and biases in effect in decision-making, whereas some biases can be associated with certain heuristics. I'll now go over the following processes as illustrative examples to portray an image of how they may affect the process:

*Availability heuristic and bias.* Individuals tend to make judgements based on the availability of the information that is most salient and more accessible to them, in which case the individuals rely on the most immediate examples they perceive or recall. Availability and salience biases come hand in hand with their heuristic thereof as one might guess: they refer to one's disposition to pay attention to things that stand out the most in the present, while also indicating inclinations towards remembering the relatively extreme instances of an event during memory recall (Kahneman et al., 1982, p. 191).

*Recognition heuristic (and bias).* As per this heuristic, individuals are more likely to choose the items that they recognise better – this happens due to people's tendency to assign higher value to more familiar items, which is feasibly a bias in itself (Cross et al., 2016, p. 797).

*Satisficing heuristic.* Within the bounded rationality, individuals tend to "satisfice" rather than "maximise" the end results, which means that people would trade-off the extra effort (time and mental resources are applicable in this case) in order to attain an economical outcome that would satisfy (Simon, 1997, Chapter IV.4).

As conveyed above, decision heuristics and biases can take effect as per the design of the music-playing artefact: through the manner it exchanges information with the user and what it affords in terms of its interaction capabilities.

### 2.2.3 Factors Affecting the Users' Choice & Judgement of Music through the Use of Recorded Music-Listening Artefacts

According to Şener and Pedgley (2019), interactions with artefacts – which would include interactions with music-playing artefacts – are not isolated, but rather affected by contextual factors. On top of it, music-listening experience is influenced by numerous factors surrounding those who listen to music (Denora, 1999; Krause & North, 2017; Krause et al., 2015).

I will be attempting to recognise factors affecting users' experience of interacting with recorded music-playing artefacts. As far as I am concerned in this study, I'll be framing and grouping the affecting factors through the facets of user experience due to this research's focus on design for interaction.

Music-listening experience, music choice, and judgement of music in music-players are influenced by numerous factors, which I'll be attributing under three facets of user experience (UX) as per the distinction made by Roto, Law, Vermeeren, & Hoonhout (2010), which are: **user**, **context**, and **system**: respectively referring to *personal factors affecting the user*, *immediate environment surrounding the user,* and *the system that is being used.*

In order to discuss the factors affecting users' music choice and judgement, we need to attain a better understanding on the aspects of UX in which we have limited control over. For this purpose, I'll be associating and reviewing the factors affecting music choices through emphasising the *user* (personal) facet of user experience within the scope of recorded music-listening artefacts, whereas I'll be providing a limited working review of *context* and *system* facets due to the difference in relevance and the level of complexity between the former and the latter in the context of this research.

#### 2.2.3.1 Personal (User-Centric) Factors Affecting the Listening Experience, Choice, and Judgement of Music

Each individual evolves throughout their life as per their interactions with the world around them; in relation to that, everyone accumulates a personal history and unique personality. According to Kahneman and Tversky (1981, p. 453), people take decisions within a decision-frame, which involves one's conception of acts, contingencies, and end results of the actions – controlled partially by the *functions* and partially by the *norms, habits, and personal characteristics* of the person.

An individual may listen to a certain kind of music for hedonic fulfilment, as a time-filler, for social utility, for emotional regulation etc. (Lonsdale & North, 2011): these are the *functions* (as in goals). In addition to them, there's also the personal dispositions such as *concerns; norms, habits, functions, and personal characteristics* thereof (Desmet & Hekkert, 2007, p. 6; Tversky & Kahneman, 1981) – constituting aspects of a person's decision frame (Tversky & Kahneman, 1981). The factors in the decision frame include identity, self-image, personality, culture, social connections, media effect, preconceptions, familiarity, expectations, mood (Denora, 1999; W. W. Gaver & Mandler, 1987; Krause & North, 2017; Krause et al., 2015; Lonsdale & North, 2011).

Even though relationships between those factors within the decision frame cannot be mapped to a granular detail, it can be safely assumed that those factors interact with each other within the decision frame of the users and drive the their interactions with the music-player in a non-random and non-hierarchical manner with respect to deterministic chaos mechanisms during decision-making process (Ayers, 1997): the subjective salience of which may exert disproportionate influences on the decisions (Kahneman et al., 1982, p. 192). I identified the following factors that are applicable factors of a user's decision frame for *choosing music through music-playing artefacts*.

**Identity.** Individual identity is a predominant and multifaceted concept that plays a significant role in users' choices and preferences. Denora (1999) professes that self-identity is an evolving project in which personal music consumption plays a significant role to flourish it. A report by UK Government Office for Science (*Future Identities: Changing identities in the UK - the next 10 years*, 2013) indicates that individuals' subjective identities are evolving rapidly due to the elevated rate of connectivity and the distinction between the private and public identities of individuals blurring. Individuals bring themselves closer to their projected identities over the years: closing the gap between actual identity and their projected self-images (Markus & Nurius, 1986), which may as well be reflected to their music choice behaviour.

**Self-Image.** There are several factors that affect users' music listening choices in relation to their images, which is tightly related to their identities. Self-Congruity represents the similarity between individuals' self-images, and meanings and associations attributed to brands (Branaghan & Hildebrand, 2011); in relation to that, it is safe to say that music artists and such can be considered as brands in today's world – through the consumption of which the individuals associate what those brands represent to their selves. As claimed by Markus and Nurius (1986), individuals strive to close the discrepancy between their present selves and desired possible selves through making decisions such as buying a 'luxury' car compatible with the desired self due to its symbolic value (Yardim Sener, Sen, Pedgley, Sener, & Murray, 2016); in relation to that, it may also indicate the choice of the music in alignment with that image.

**Personality.** Distinct from identity and self-image, there are certain correlations between individuals' personalities and their music-listening preferences. Empirical findings show that there are affective correlations between individuals' personality traits and music preferences (Rentfrow & Gosling, 2003; Vella & Mills, 2017). These traits are Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, which are evidently correlated with the music-listening functions of individuals; in addition to that, studies indicate that the music-listening behaviour can be predicted in relation to these traits.

**Culture and Norms.** Culture has a deep effect on individuals' choice on music: it's a part of their personal and social identity. On the top of that, the cultural patterns of the music pieces need to be recognised in order to appraise the music.

> Two different listeners may understand the same piece of music in very different ways. They may have varying degrees of appreciation for the internal structure of the piece, the way the work fits into its cultural or

> historical context, or indeed that the sounds they hear are music at all. (W. W. Gaver & Mandler, 1987, p. 264)

In relation to this quote, the authors assert that only some of the structures in the music adhere to what is considered meaningful in context of culture. Juslin (2013) attributes this to learned schemata of different types of music with specific values particular to distinct cultures.

**Social connections.** Social connections play a critical role in people's music choices, which became more apparent in the connected world, it is a way for them to reflect their identities and establish connections (Rentfrow & Gosling, 2003). People, especially adolescents, listen to or identify with music they don't normally prefer in order to project a personal image to their social connections as per the cases given by Buckingham (2007, p. 107). This might be especially relevant in the era of music streaming. For example, people can see the playlists of, and music listened by whom they follow in Spotify, which may affect people's music listening behaviour due to their social concerns.

**Media Effect.** Forces exerted by media channels are known to influence the choices of the music-listeners for favouring the music promoted by the media. A critical take on the media effect by Chomsky and Herman (Herman & Chomsky, 2006, p. 257) asserts that there are mass media filters exerting a biasing force on what the audience consumes, the first two of which are attributable to music consumption: ownership and advertising. In this sense, dissemination of popular music through mass media channels that are funded by major labels put forward artists with the goal of revenue generation. Burnett (1996) claims that "The standardization of commercial music aims at the standardization of audience reaction, of consumption, because it maximizes economic dividends." (p.31) – indicating that the media steers the behaviour and the character of the audience to reach business goals, which connotes the creation of an artificial and standardised image exerted upon the masses. With respect to individuals' desire to close possible self-concept, the effect of such a force becomes especially prominent (Burnett, 1996; Markus & Nurius, 1986).

**Preconceptions.** Empirical findings suggest that people (in general) form strong established conceptions about certain categories of music; as a consequence, people attribute stereotypes to categories of music and to the listeners thereof (Rentfrow & Gosling, 2007). For example, people associate higher quality to Classical Music whist not particularly liking it themselves (Hargreaves, 1982). We are assuming that this may have twofold effect on the attitudes of people towards the music. As previously mentioned in the social connections part, users may take up aversive or inclined behaviour towards certain categories of music due to their social concerns (Buckingham, 2007); in addition, music-listeners might choose either inclination or aversion to listen to the music concerned, to embody their projected self-image and with a lesser regard to the aesthetic experience they gain from listening to the music (Markus & Nurius, 1986).

**Familiarity and Exposure.** Music listeners are affected by familiarity more than they would like to admit: studies show that in contrast to people's claims for their preference in novelty in music-listening, empirical evidence asserts that listeners subconsciously gravitate towards familiarity even though they strive for novelty in their listening behaviours (Ward, Goodman, & Irwin, 2014). Gaver and Mandler (1987) profess that familiarity is a critical part of appraising (and thus choosing) music. David Hargreaves proposed in a study that music-listeners' attitudes towards music changes in accordance to an inverted-u model with respect to the listeners' familiarity to it, meaning that the they show dislike towards a piece of music if they are completely unfamiliar to it, their liking begins to increase as they get more familiar to it, which starts to decrease as it goes out of fashion (W. W. Gaver & Mandler, 1987; Hargreaves, 1982; Sluckin, Hargreaves, & Colman, 1982). In addition, too much exposure to a piece of music makes a piece of music predictable and unsurprising for a given listener (W. W. Gaver & Mandler, 1987).

**Anticipation and Expectations.** Expectations play a critical role while choosing and appraising music. People form expectations prior to and while playing a piece of music: those antecedent to playing sets a baseline for the evaluation of the music, whereas the way the expectations interact with a playing music piece affects the how those pieces are judged (W. W. Gaver & Mandler, 1987; Huron, 2006). In addition to that, emotional responses like surprise stem from the way the expectations are met. The expectations aren't necessarily conscious, for example: heuristic listening produces anticipation resulting from the musical patterns about what will come next in the musical piece (Huron, 2006, Chapters 2-6–8).

**Mood.** Pieter Desmet (2015) asserts that mood is a long-lasting affective phenomenon that has an internal locus and gradual onset. Mood affects users' tendency to engage with events and entities: positive mood increases likelihood of engagement while the negative ones decrease it as supported by the dedicated literature (Randall & Rickard, 2017). The literature also indicates that mood can affect the weight distribution of functions. Users' product interaction behaviour is significantly affected by their moods during the time of interaction; consequentially, *users' interactions with music-listening artefacts* are presumed to be affected by their moods at the time of listening.

**Functions**[11]**.** Functions connote the main reason for taking an action. Why people listen to music is proven to be dependent on changing contexts and temporalities. In relation to this, there is a great variety of functions for listening to music as per the findings of Lonsdale and North (2011); according to them, the most prominent clusters of music-listening functions are as follows, in descending order of prominence: positive mood regulation (to set the right mood), passing the time (diversion), managing interpersonal relations, negative mood regulation (to feel

[11] Function is a substitution of the term 'motivation' to avoid confusing it with regulatory states of motivation (R. M. Ryan & Deci, 2000).

better), managing personal identity, and learning about others' thoughts (surveillance).

#### 2.2.3.2 Effect of the System on Music-Listening Experience, Choice, and Judgement of Music

System is equivalent to the music-playing artefacts I am referring to in this study. The system functions as the enabler of the music-listening experience, which means that the capabilities of the system defines the utmost capabilities of its user for interacting with music pieces[12]. This is the only facet of user experience that designers may influence directly, whereas the other two (user and context) may only be indirectly influenced.

On a broader sense, Gibson's Theory of Affordances conveys the same concept through an ecological viewpoint: affordances are what one's environment affords to oneself, defining anything a person is capable of for interacting with any given thing around them (Gibson, 1986, pt. 2.8). In the case of this research, the system gives sensorial (usually mostly visual) affordances, and thus clues about how it might be interacted with based on one's perceptual and motor capabilities, alongside the communication of non-instrumental information.

Norman later adapted Gibson's Theory of Affordances to the field of design, and introduced[13] the concept of signifiers, constraints, feedback, and mappings (D. Norman, 2013). Those five concepts incorporate the system facet of the music-listening experience through music-players: a signifier is the elaboration of an affordance on an artefact, a constraint is a limitation on certain affordances to limit errors and emphasise intended use, a feedback is a verification on the state of the

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[12] Not the aural qualities of music, but rather music as a discrete media item that can be called up, navigated, changed, etc.
[13] Integrated them into a conceptual framework in the first edition of his book thereof.

system upon an action, and mappings indicate causal relationships between events taking place between the user and the system (D. Norman, 2013).

#### 2.2.3.3 Contextual Factors Affecting the Listening Experience, Choice, and Judgement of Music

Contextual factors are situational elements that affect the music-listening experience throughout the time of listening. These factors can't be controlled by the design of the artefact; on the other hand, the artefact needs to be designed with contextuality in mind. Although, I can argue that context of use may be indirectly governed by the design of the artefact: an example would be a radio design that requires connection to a power outlet, which limits the use of that radio to indoors. There are four contextual factors as per the classifications made by Roto et al. (2010), namely: physical context, social context, task context, and technical context.

Physical context is the literal environment of the user during the time of use: its examples include home, commute, workplace, school, outdoors, sports venue et cetera. Social context denotes the presence of other people and their correspondence to the user, and also social norms; for example, listening to music in a work environment and in a social meeting may require different equipment and controls. Task context is the detail the user is preoccupied with while using an artefact: an example is listening to music while working, which is quite distinct from music-listening as a leisure activity. Lastly, technical context refers to the infrastructure that the use of the artefact relies on; for example, it would not be possible to *stream* music when there is no Internet or Intranet service (Krause & North, 2017; Krause et al., 2015; Roto et al., 2010).

The function of listening to music (see 2.2.3.1) is known to be partially correlated with the context of use (Krause et al., 2015; Lonsdale & North, 2011), which is due to the fact that context sets the premise for listening to music, affording and restricting usage scenarios of music-playing artefacts.

### 2.2.4 Discussion I: A Model for Music Choosing Process through Music-Listening Artefacts

The user's decision-making process for choosing music isn't so simple considering that there are countless choices and various factors affecting those choices. Current models in the literature give robust explanations of the decision-making process for music-listening; however, they fail to integrate the role of the artefacts that facilitate the process and most of them don't attempt to convey causality in this process. On the other hand, this study is focal on the artefacts – causing compatibility issues with many of the models that might be related to music choice and judgement. Therefore, I needed to derive a model that integrates the artefact into the equation; although, there is a recent empirically derived model that suggests links where the artefacts may be within the process, whose author also criticises the earlier models due to the lack of causality within the selection process of music (Greb, 2018). Of course, especially Internet-enabled artefacts have greater dimensionality when it comes to offering choice; because of that, I coalesced the consumer decision process model into Greb's model per basis of causality (Teo & Yeong, 2003). This new model (Figure 2.20) stays true to the basis of proven models, and functions well with the facets of user experience.

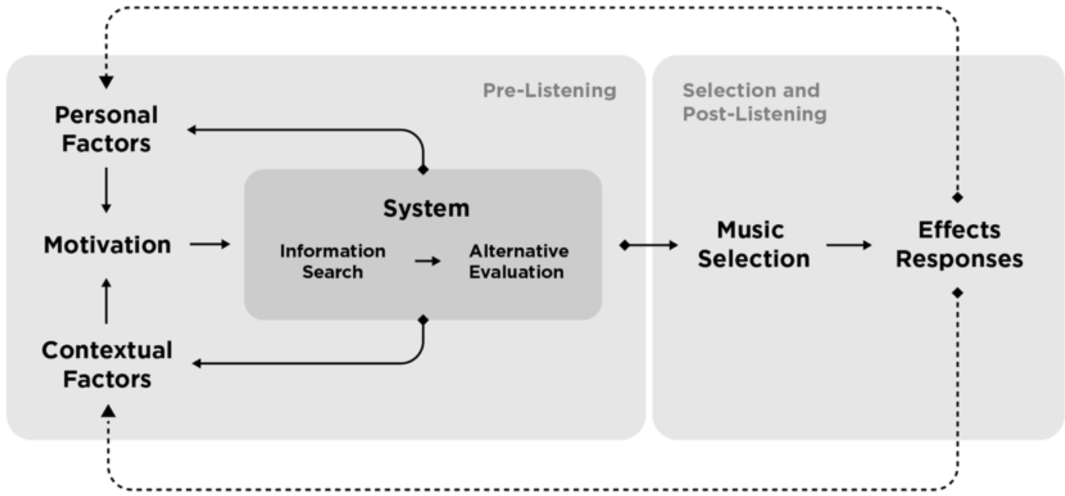


Figure 2.20 - Model of Choice and Judgement of Music (Adapted from Greb's empirically derived model of music selection).

In this newly devised model, the user forms motivations per their personal factors with respect to their subjective norms on the categories of music and the contextual factors for music listening. The user then acts upon their motivation to choose music to listen in a given system: seeking information and evaluating alternatives to choose a music piece to listen to. Music is judged with respect to the presentation of extrinsic information and availability of alternatives per their compatibility with personal and contextual factors; therefore, attuning the motivation and feeding into the interaction with the system. This process continues until the user selects a piece of music from a set of alternatives once a piece becomes more dominant as per their motivation, who then responds to the music after (or while) listening to it: judging the music it per the factors. The process takes place through a combination of intuition and reasoning processes: the degree of utilisation of either of which may be subject to the user's function for listening to music. The outcomes, quality, and duration of this decision process can be influenced by what may be characterised as decision heuristics and biases.

### 2.2.5 Discussion II: The Issue of Free Will and Role of Motivations in Music Choice and Judgement

I previously went over the factors affecting the how users choose music and outlined the extent of external influences that may impact their decisions (See 2.2.3). The influence of those factors on users' music choice at the moment of interaction begs the question: "Are we really choosing what we *truly* want to listen to?"

Upon looking at the inquiry above, one wonders about whether people choose the music as per their free will, for which we may refer to the sentiment of Martin Heisenberg (2009) regarding the matter of free will[14] as expressed by him as follows:

> Some define freedom as the ability to consciously decide how to act. I maintain that we need not be conscious of our decision-making to be free. What matters is that our actions are *self-generated*. Conscious awareness may help improve our behaviour, but it does not necessarily do so and is not essential. Why should an action become free from one moment to the next simply because we reflect upon it? (p.165)

One could argue that conscious reasoning would be a way to take action free from the external influences thereof; however, the rationale above guides that action driven by free will needs to be self-generated in limited regard to whether the motivation of the action is intuitive or reasoned. After all, as we previously discussed (See 2.2.2.3 & 2.2.3), reasoning-driven thoughts are considered just as susceptible to biases and influences.

[14] Free will is a matter of multidisciplinary discussion with multiple viewpoints, in which Prof. Heisenberg's viewpoint appeals to the reading most relevant to this research.

An important issue arises when we look at the factors affecting the action (of choice): whether they are self-generated and hence intrinsically motivated or extrinsically motivated. In congruence to the discussion above, Deci and Ryan (2000) illustrate that there are several regulatory states of motivation represented taxonomically on a continuum between intrinsic motivation (autonomous), extrinsic motivation (controlled), and amotivation (Figure 2.21).

Needless to say, the philosophical thesis of what has intrinsic value goes back to the time of Plato and Aristotle, for which the most conclusive answer is “for its own sake”, opposing to “for the sake of something else” (M. Zimmerman & Bradley, 2019): intrinsic motivations stemming from the former, while extrinsic motivations are controlled by the latter (R. M. Ryan & Deci, 2000; M. Zimmerman & Bradley, 2019). According to this dichotomy, appraisal of a piece of music would be the total sum of its aural qualities and its extrinsic attributes[15]; for this, I can argue that the “purest” appraisal of a piece of music *for its own sake* would solely stem from its aural qualities. Whereas according to the taxonomy of motivations (Figure 2.21), intrinsically motivated actions contribute to one’s wellbeing in a significant and meaningful manner (Peters, Calvo, & Ryan, 2018; R. M. Ryan & Deci, 2000).

[15] As per their relationship to personal, contextual, and system factors.

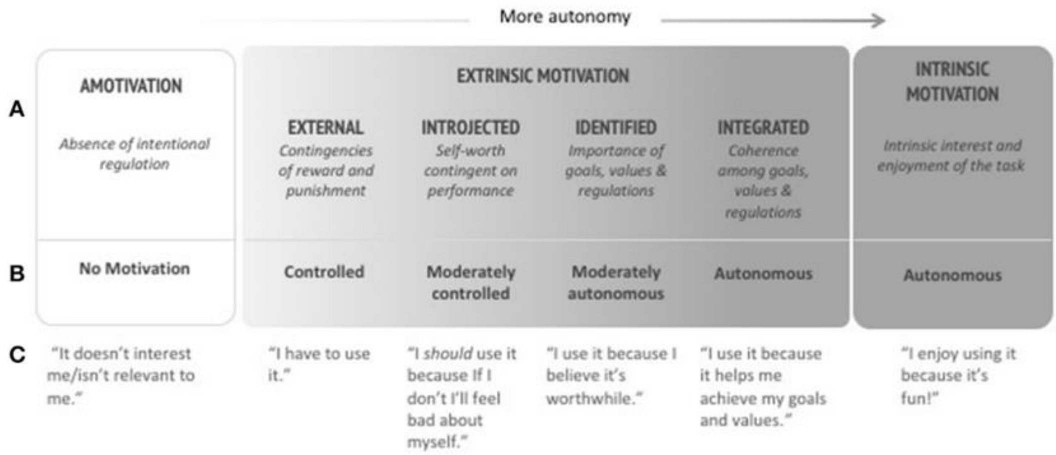


Figure 2.21 - Taxonomy of human motivation. (Peters et al., 2018).

As per the artefact typologies I reviewed in Chapter 2.1, I conveyed that utilisation of an increasing number of extrinsic attribute information in the music-player interfaces seems to have become an industry norm in the direction of instant access and feature richness, which is a good practice compliant to the premise of the more recent music-listening artefact. In alignment to that, in terms of extrinsic motivations in music-listening experiences, the availability of extrinsic attributes[16] may easily influence the user's motivations while choosing and appraising a piece of music: factors such as their preconceptions, their projected identities, media effect, desire for social connectedness etc. may sway their choices without even being aware of it[17]. As a result of that, a piece of music that would normally induce a gratifying experience to the user, might be traded-off for an option that seems more compliant to their extrinsic motivations, solely through the judgement of extrinsic attributes. The effect of the extrinsic influences is also valid for the appraisal of the music piece during a listening session, for example: a person's

[16] Examples: music name, artist name, cover art, popularity indicator, trivia etc.
[17] As in Section 2.2.2.2. intuitive processes are automatic and fast, which might be affected by the stimuli present (extrinsic attributes and presentation of them), subject to the heuristics and biases that give judgements as per the schemata related to the stimuli.

judgements towards the extrinsic attributes of the piece can bias (See 2.2.2.3) their perception of music[18], and hence their appraisal of it.

Owing to the discussions above, one's choice and appraisal of music as per one's free will may theoretically happen in the most intrinsically motivated way in a scenario where the pieces of music are detached from extrinsic attributes (leaving decision-making possible only on the basis of the sonic qualities of music).

## 2.3 Part III: Designing Interactive Music-Listening Artefacts for Wellbeing

Designers need to be mindful about the effects of their designs on the wellbeing of users, for which they need to be critical about the established norms and weigh on the realities and right sets of the circumstances.

Considering the convergent trajectory of the newer music-listening technologies that are fixated on on-demand access, high levels of control, and feature richness (See 2.1.5), I believe that it's especially valuable (see 2.2.5) to give priority to personal wellbeing in a RtD study for developing an alternative music-player to enable different ways of experiencing music. In my opinion, this emphasis is especially valuable due to varying uses and gratifications of music: many of which are non-compatible with all-in-one solutions. Diversification of means of music-listening for different uses and gratifications would be the best way of supporting wellbeing.

For the reasons I discussed above, in this part of the literature I'll first briefly introduce the concept of design for interaction; then, I'll review design for wellbeing concepts, bring up related approaches and resources, and convey the key considerations.

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[18] Look for Preconceptions, Expectations & Familiarity in Chapter 2.2.3.1.

### 2.3.1 Designing for Interaction

This research essentially revolves around enabling *interactions* between users and music-playing artefacts, the significance of which outweighs the other qualities of these artefacts. On the basis of that, I need to establish a common understanding on what interaction is. Bill Moggridge (2006, p. 660), to whom the term "interaction design" attributed, defines it as "the design of everything that is both digital and interactive." (p. 660), then further expands the definition thereof to the activity of designing for all user-product interactions that may be enabled by digital technologies such as computers, chips, and internet. This goes without saying that later epistemological discussions concluded that interactions, like experiences, can't be designed as they are ephemeral occurrences per se; hence, I will be addressing the activity as "design *for* interaction".

#### 2.3.1.1 User Experience in Design for Interaction

You may remember our glimpse at Judy's train commute located at the beginning of this thesis: that was an experience. That story encapsulated what she perceived about the things around her, what she felt, and her thoughts about those, all of which are part of her experience of that moment. Her interactions with her music-player was a small part of that experience; however, that part is the absolute extent of how designers can influence and enable an experience through design, whereas what to make out of it is up to the user: the experience triggered by interacting with that artefact is user experience.

Hassenzahl (2010) separates user experience to two dimensions of qualities complementary to each other: hedonic and pragmatic, for which he asserts that both of these dimensions are largely mutually exclusive (correlated with a mean of 0.24), yet mentions that there are rare cases of intersection. According to him, pragmatic qualities are better associated with supporting do-goals such as "making a phone call", whereas hedonic qualities are linked to be-goals like "being competent". Therefore, we see from Hassenzahl a mapping of pragmatic experiential qualities to "hows" and "whats" of interaction, whilst associating hedonic experiential qualities to "whys" of interaction. His arguments suggest that be-goals are superordinate to do-goals, implying that users rarely care for the do-goals as they are mostly the means for achieving be-goals (Hassenzahl, 2010, Chapter 4.1).

The same principles can be applied to music-listening experience. A particular piece of music, a weary turntable, or even a playlist would be largely irreplaceable, whereas the subscription to a music streaming service or a portable music player could be replaced once a better alternative becomes available as I discussed in Chapter 2.1.5.

#### 2.3.1.2 Temporality of User Experience

User experience is a temporal occurrence that evolves throughout the use of an artefact over a period of time: changing the relationship between user and the artefact. There are four phases of use: expectation before the initial use, orientation, incorporation into the user's life, and identification, respectively seen on Figure 2.22. Karapanos et al. (2009) assert that different facets of the experience become more pronounced at each phase of product use, pointing out that satisfying and dissatisfying experiences create quite divergent results. Accordingly, dissatisfied users don't report any stimulation and fail to identify (through personal and social significance) with the product in the last phase of the use, in contrast to satisfied users. The authors maintain that the *goodness* of the product is an imperative for identification of the product due to its role in orientation and incorporation, while *beauty* is the critical component of identification with the product[19].

[19] Goodness is associated with pragmatic and hedonic qualities whereas beauty correlates to hedonic quality in user experience as defined by Marc Hassenzahl (Blythe & Monk, 2018, Chapter 2).

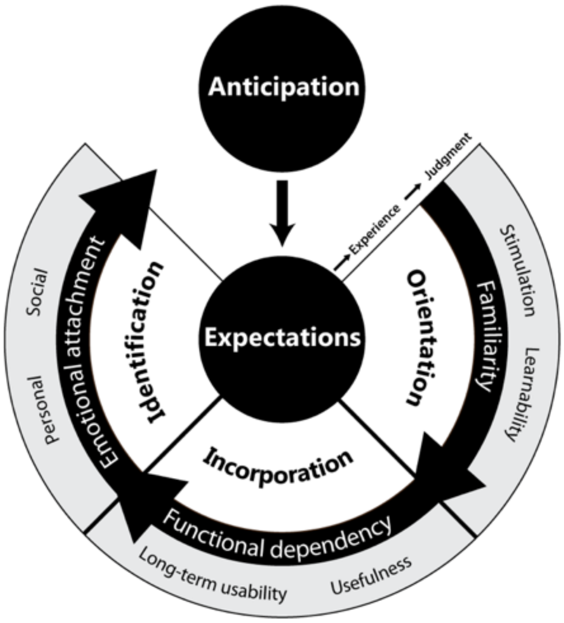


Figure 2.22 - Karapanos et al.'s representation of the temporality of user experience consisting of forces (in black arrows) and three phases: orientation, incorporation, and identification (2009).

#### 2.3.1.3 Levels of Product Experience

> While a beautiful piece of music can move us to tears, one can experience disappointment in response to a product that is not as elegant as was expected, or one can feel desire for delicious food. In these cases, the experience of (or the lack of) beauty and the delicious taste are aesthetic, whereas resulting disappointment and desire are emotional experiences. (Desmet & Hekkert, 2007, p. 6)

Desmet and Hekkert (2007) refer to product experience (and music experience thereof) with the example above, which encapsulates the reciprocity between aesthetic and emotional experience of music. In their framework, product experience includes aesthetic experience, experience of meaning, and emotional experience (Figure 2.23).

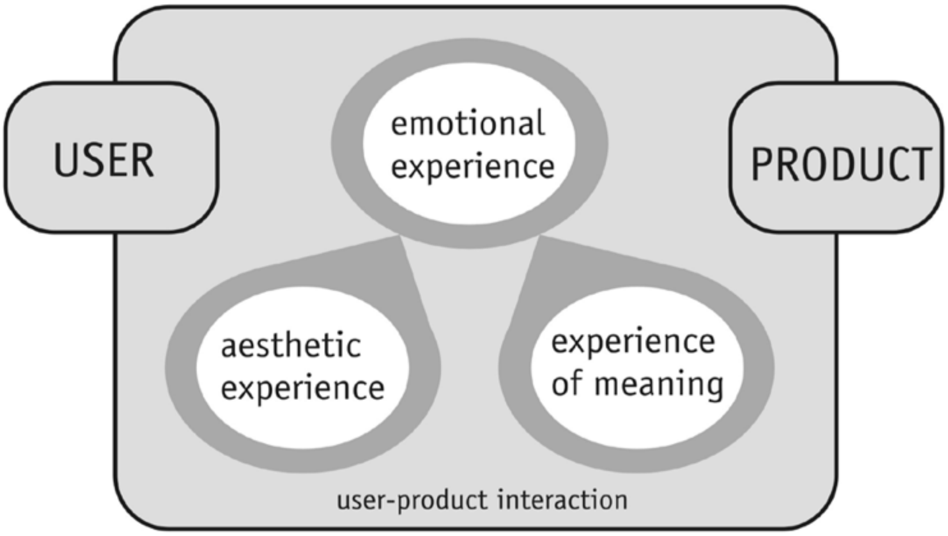

Figure 2.23 - Framework of Product Experience (Desmet & Hekkert, 2007).

**Aesthetic experience.** In Chapter 2.2.3, I referred to the concept of congruence as the basis of why the listeners might like a piece of music (W. W. Gaver & Mandler, 1987). In relation to that, it can be said that the harmony between the structure, order, and coherence of the signals received through the human perceptual system (including vision, hearing, haptics etc.) enables the aesthetic experience (Desmet & Hekkert, 2007): creating a pleasure or displeasure response.

**Experience of meaning.** Meaning corresponds to a cognitive process responsible in making sense of concepts, events, and entities; in relation to that, the meanings individuals associate to those things bestows subjectively constructed personalities to them, all of which are subject to differ from person to person (Desmet & Hekkert, 2007).

**Emotional experience.** According to Desmet and Hekkert (2007), emotional experience is the product of the appraisal of the situation for assigning it a value with respect to its relevance to a person: the emotions function as pull (attraction) and push (repulsion) mechanisms directed towards entities, events, and concepts, reflecting one’s feelings towards whatever it may be.

**Relationships between the three levels of experience.** As asserted by Norman (2013, p. 47): “Cognition and emotion cannot be separated. Cognitive thoughts lead to emotions: emotions drive cognitive thoughts." by continuing with "Cognition attempts to make sense of the world: emotion assigns value." and then adds "Cognition provides understanding: emotion provides value judgments. A human without a working emotional system has difficulty making choices. A human without a cognitive system is dysfunctional.". These statements sum the internal relationships within Desmet and Hekkert's three levels of experience framework (Desmet & Hekkert, 2007).

### 2.3.2 Designing for Wellbeing for Enabling Mindful Experiences

> Design for wellbeing should attempt not only to influence human actions and decisions in desirable directions, but also to make it possible for users to develop an active and critical relationship with these influences. Rather than designing possibilities to opt out, it is important to think about multiple ways to opt in. (Dorrestijn & Verbeek, 2013)

Designing for wellbeing has its roots in the antecedents of the *positive psychology*[20] movement. In contrast to the pathological approaches that dominated the field of psychology following the World War II, Seligman and Csikszentmihalyi decided to emphasise the need to focus on healthy functioning of the mind as a non-conformist approach than the traditional streams of psychology focused on the mind's dysfunctional state. In this approach, the emphasis was shifted to concepts for enabling the conditions for human flourishing (Calvo & Peters, 2014; Seligman & Csikszentmihalyi, 2000).

Consequential to the seminal work of Seligman and Csikszentmihalyi (directly or indirectly), design for wellbeing has been gradually introduced to the literature in the last two decades. There is a number of acclaimed and prominent works in the literature related to design for wellbeing, these are: design for experience

[20] The origin of the term is attributable to Maslow in 1954 (Desmet & Pohlmeyer, 2013).

(Hassenzahl, 2010), design for emotions (Demirbilek & Sener, 2003; Desmet, 2002), positive design (Desmet & Pohlmeyer, 2013), positive computing (Calvo & Peters, 2014), and positive technology (Riva, Baños, Botella, Wiederhold, & Gaggioli, 2012) – each of which propose their own approaches and converge under the notion of designing for the improvement of personal wellbeing.

Both psychological and design-centred streams of research created shifts away from the conventional paradigms; nonetheless, research and product designs with "positive" concerns started to become visible in the field of design since 2010 (Peters et al., 2018).

In the following sub-sections, I first will be writing about relevant schools of thought; following that, introduce eudamonic and hedonic viewpoints of wellbeing, character virtues, mental states, and mindfulness in relation to design for wellbeing.

#### 2.3.2.1 Positive Design, Technology & Computing

Desmet and Pohlmeyer (2013) made the following inquiry "How can design increase happiness and support people's efforts to lead full and satisfying lives?" (par. 4) to illustrate the most essential concern of *positive design* while introducing this term to the field of design. On the other hand, parallel to positive design, the *positive technology* idea by Riva et al. is focal on enhancement of the features of experiences to benefit wellness, personal strengths and resilience on an individual level (2012). Another parallel idea is *positive computing*, which emphasises supporting wellbeing and human potential by developing computational technologies through multidisciplinary efforts (Calvo & Peters, 2014). All of these 'positive' ambitions converge under the same core tenets, yet provide distinct frameworks for approaching the issue; because of that, I will be accepting the framework of positive design in this research due to its emphasis on the subjectivity and more open-ended nature (Desmet & Pohlmeyer, 2013). This framework has three tenets for enabling positive outcome as a result of design:

design for virtue, design for pleasure, and design for personal significance. The first is about nudging the user in a direction for virtuous outcomes, while the second involves minimisation of negativity and maximisation of positivity, and the third is achieved through a progression towards what matters to individuals (in a fashion similar to eudaimonia).

#### 2.3.2.2 Eudaimonic and Hedonic Views of Wellbeing

Technology is not only a resource for increasing the efficiency and effectiveness of tasks with pragmatic ends: it can also influence emotions and wellbeing of individuals. In relation to that, designers and design researchers alike started emphasising the hedonic facet of interactions with artefacts. Peters, Calvo, and Ryan (2018) draw an alternative discourse which is sceptical about the sole emphasis on the hedonic approaches, which they add, is not necessarily beneficial by itself for supporting a sustainable state of wellbeing – rather emphasising the need to account them both in design for wellbeing, which would ultimately produce a greater state of wellbeing. Although, I must ask the meaning of these concepts before going any further.

As I discussed earlier, there are two views of achieving personal wellbeing: hedonic and eudaimonic, which might be thought as complementary concepts rather than a strict dichotomy. Hedonic wellbeing represents the achievement of pleasure and comfort as a *result* of an activity. Whereas eudaimonic wellbeing might be defined as the journey of bringing the best in oneself that is focused on virtues, self-actualisation, and meaning, which is a *process* as itself. Studies indicate that hedonic activities generate strong affect for immediate or short-term gratification for emotional-cognitive regulation, leading to weak residue in the long-term. On contrast, eudaimonic activities don’t generate the experience meaning immediately, rather a delayed yet long-lasting elevation of the wellbeing as per the studies (Huta & Ryan, 2010). The effects of these viewpoints were confirmed through empirical investigations and repetitive studies with the emphasis telling that activation of both states produce the most favourable outcome in terms of wellbeing (Calvo & Peters, 2014; Huta & Ryan, 2010; Peters et al., 2018).

By looking at the facts and discussions about eudamonia and hedonia, it can be safely deduced that music-listening is a hedonic activity by itself. On the other hand, eudemonic effects happen *when individuals feel self-actualisation and a sense accomplishment through the progress*; with that in mind, eudaimonic effects may be realised through *reimagination of the process of music-listening as a journey*.

#### 2.3.2.3 Mental States, Flow, and the Music-Listening Experience

Flow is a mental state where a person is fully immersed in their current activity by maintaining high level of immersion and involvement throughout the duration of the activity, which is deeply ingrained within hedonic and eudaimonic views of wellbeing as per the indications by Mihaly Csikszentmihalyi (1991). Its functional principle – a certain balance between challenge and skill – applied in all kinds of designed interactive artefacts like software, smartphone applications, arcade games, and video games (Blythe & Monk, 2018; Calvo & Peters, 2014; D. Norman, 2013).

When considering the activity of listening to music, one might question whether music-listening is an activity that either demands skill or poses challenge to the listener. On the other hand, both of these concepts (skill and challenge) are valid when it comes to finding, choosing, or discovering music – all of which taking a certain amount of skill for operating the artefact that plays the music, and a challenge of playing just the right music for satisfying of one's listening goals.

On the other hand, empirical findings indicate that inducement of mindfulness can help music-listeners to reach the state of flow, assisting them to be immersed in the activity they're involved in (Diaz, 2013). This is a particularly valuable insight regarding task contexts involving work, sports, or study activities in which music-listening is a companion to the activity.

#### 2.3.2.4 Position of Mindfulness in Design for Wellbeing

> You get dressed, spill some coffee, put the cereal away in the fridge, pretend you're listening to your kids, and leave without the car keys. It's a typical day in the world of the modern Homo sapiens — a species that has largely lost its natural state of present awareness. We live on autopilot, lost in plans and reruns. (Calvo & Peters, 2014, p. 179)

Calvo and Peters illustrate these series of events when describing one's awareness about everyday occurrences, almost in contrast to Judy's state of mind during her train commute (see section 1): the recent example exhibits desensitisation from the present moment, which is especially relevant since people have to deal with an increasingly abundant number of issues competing for attention since information technologies have become embedded into their lives. On the other hand, our example, Judy, was in the state of mindfulness during her commute, in high awareness and with full attention on her surroundings and the experience of that moment, detached from the concerns of the past and the future.

Mindfulness is commonly defined as, in a broad sense, non-judgmental awareness of the present moment (Calvo & Peters, 2014, p. 179). As a part of the positive psychology, a state of mindfulness is argued to be beneficial to one's personal wellbeing due to sensitisation to what is at the centre of one's surroundings and attention: enabling people to immerse in, understand, and come to terms with whatever is at the centre of attention at the present moment. It is indicated that people project their concerns onto things when thinking about or experiencing them, whereas being non-judgemental brings clarity for understanding those things.

As the bottom line, our academic interest is neither systemic integration nor inducement of this concept through design, rather our interest is strictly limited to attainment of the means[21] for enabling (affording) the positive experiential outcomes it represents, through design.

### 2.3.3 Key Considerations About Users' Interactions with Music-Listening Artefacts

We identified five dimensions of considerations that are instrumental for eliciting the empirical research findings and designing the music-playing artefacts. Even though some of these concepts are known in the design literature, the involvement of media (music) adds another layer of variables to the design considerations. First and foremost is the divergent direction of this research going against the prevalent norms about the music-playing artefacts in the market (See 2.1.4). Secondly, the sparseness of applicable works of design and research (See 2.1.3) make the considerations in question valuable for making informed research and design decisions in the further phases.

The key considerations are: the level of control, assortment size and abundance of choice, information load, complexity of systems, and reward and gratifications.

#### 2.3.3.1 The Level of Control

> Control is deeply involved with complexity and interaction. If an artifact is completely automatic, and autonomous, there will be no user interface and no interface bottleneck. But there will also be no user control. In almost every design situation, designers face the question of whether to give the user more control or make the interface less complex. (Janlert & Stolterman, 2018)

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[21] With conscientious adherence to secondary sources (Ch. 2.2 & 2.3.3), empirical participant research findings, and reputable design principles and heuristics.

This paragraph highlights a critical property which designers need to be mindful of while designing interactive artefacts. Elimination of certain control features can actually be detrimental to user experience (for example, increased lethargy) due to the reduction of autonomy of users as per the existing study findings (Krause et al., 2015), while too many control features can generate confusion. So, a question arises: what should the designers be mindful about while designing control features as a part of their designs? Norman (2011) answers this question as follows: "We should complain about anything that makes us feel helpless, powerless in the face of mysterious forces that take away control and understanding." (p. 4). The reason behind this statement lies in what we may refer to as a salient theory of control: self-determination theory.

**Self-Determination Theory (SDT).** According to Calvo and Peters (2014, p. 22), people need to feel autonomous, meaning that they should be able to attribute the consequences to their actions, feel competent about their ability in executing the action, and feel secure and related to others.

The reduction of autonomy, competence, and relatedness hinder people's wellbeing while interacting with people and artefacts around them – resulting in negative psychological outcomes (Calvo & Peters, 2014). On the top of that, the literature asserts that self-determination is especially important for people to develop their musical identities (Cross et al., 2016), which strongly indicates that designed interactive artefacts should have a level of control that would satisfy the self-determination needs of users.

#### 2.3.3.2 Assortment Size of Choices

Assortment size is a critical determinant of the performance of individuals' choices. Can there be too much of a good thing? In that sense, the literature asserts that both abundance and deficit of choices can have detrimental effect on individuals' wellbeing.

Thirteen years ago, Leong, Howard & Vetere (2008) forecasted the following: "For if current trends persist, we will inevitably find ourselves dealing with ever growing repositories of digital content. In some situations, having to choose from such large digital libraries may be unpleasant, especially in the absence of a strong preference for a particular selection." (p. 723). Our music repositories have not only grown since, they have literally come to a point where virtually all music in the world has become available to us on-demand and without any immediate barriers of access.

Studies show that existence of multiple choices is a good thing for choosers; however, as per marketing and consumer psychology research findings, adding marginal choices to the assortment after a threshold results in a decreasing trend of consumer satisfaction and happiness. According to the existing research, choice overload occurs when people don't have strong preferences, when too many options are present, and especially in the case of hedonic consumption or variety-seeking behaviour (Chernev, Böckenholt, & Goodman, 2012; Hastie & Dawes, 2009, p. 305; Saltsman, Seery, Kondrak, Lamarche, & Streamer, 2019; Scheibehenne, Greifeneder, & Todd, 2010; Tang, Hsieh, & Chiu, 2017).

Choices are often paired with the extrinsic information associated with them, with users making their choices through utilisation of that information if it is available.

#### 2.3.3.3 Transmission of Information

The accelerating pervasiveness of information technologies has attracted increasing amounts of criticism over recent years – with a valid reason (Peters et al., 2018). Human beings may only cope with a limited number of stimuli effectively, whereas it is implied in the literature that an increasing load of information detaches individuals from the lived moment, increasing their stress levels; and consequently, diminishes their psychological wellbeing. Of course, it should be noted that this is a cumulative effect of the information intake happening throughout the day (Bawden & Robinson, 2009).

In case of post-streaming music-listening technologies, choices and information go hand to hand: options are often accompanied with several types of information, which I am calling ‘attribute information’ in this thesis. Studies show that increasing the amount of information that accompanies a choice is correlated with reduced satisfaction, indecisiveness, and confusion in varying levels of consistency. In addition to that, increasing the number of attributes and their distributions denote amplification of these effects (Hastie & Dawes, 2009, p. 305; B. K. Lee & Lee, 2004; Malhotra, 1982; Wilkie, 1974).

The design of music-listening artefacts can affect users’ music choice behaviour, which is especially relevant when we examine post-computer music-listening artefacts, especially the streaming services, where the pieces of music are often accompanied by several types of attribute information accompany music tracks (Krause et al., 2015; Morris & Powers, 2015) – potentially creating an overload effect as the users’ decision of which music track to play depends on the attribute information therein.

#### 2.3.3.4 Complexity of Systems

Complexity on the user end is an essential consideration when designing an interactive artefact. Each additional layer of an interface or an additional feature constitutes a level of complexity within the system. Janlert and Stolterman claim (2018) that “... designers have been hard at work trying to make complexity disappear from the user’s view, sometimes trying perhaps *too* hard.”, then adding “Designers tend to act as if they believe simplicity to be axiomatically *good* and assume that the user will be unable to interact with anything but the simplest tool.” (p. 78). In relation to this, Norman (2011) makes the following argument, warning about a common caveat:

> The trade-off is wrong because the real goal is understanding, usability, and, of course, whatever functions are desired. A trade-off assumes what is called a "zero-sum game": to get more simplicity one must get rid of complexity. But there is no need to trade essential complexity for the understanding that is just as essential. Complexity is often necessary. The design challenge is to manage complexity so that it isn't complicated. (p. 53)

The concept of complexity isn't necessarily a positive or negative when it comes to user experience; although, increased complexity comes naturally with the advancement of information technologies as per the account of Janlert and Stolterman (2018, p. 73), who attribute this to the elimination of technological barriers and increased connectivity. On the top of these, so they claim, user experience cannot be reduced between a trade-off between simplicity and complexity, it rather relies on the locus of complexity. They divide the loci into four parts (internal, external, interaction, and mediated complexity) among which the actual trade-offs occur. We believe being mindful about the following loci and trade-offs among them (Janlert & Stolterman, 2018) will be critical in the theoretical discussions and design activities presented later in the thesis:

**Internal Complexity.** Actual mechanisms on which the artefact functions on, comparable to the parts under the enclosure of the artefact.

**External Complexity.** This complexity represents the any given present state of the interface where the user interacts with the artefact.

**Interaction Complexity.** This form of complexity arises as a result of intertemporal interaction patterns that happen between the user and the artefact.

**Mediated Complexity.** Situated as neither internal nor external facets of the artefact, this complexity stems from the context that surrounds the artefact during the time of use.

In relation to these loci, the authors gave three example trade-offs – illustrating the possible causalities regarding the actions taken to mediate the complexity (Janlert & Stolterman, 2018, p. 85):

> 1. A trade-off between external complexity and internal complexity: increased internal complexity may require increased external complexity to enable the user to handle added (quality of) functionality (given a certain degree of user control);
> 2. A trade-off between external complexity and interaction complexity: decreased external complexity may lead to increased interaction complexity (as exemplified above); and
> 3. A trade-off between interaction complexity and internal complexity: relating to control and automation.

Loci of complexity and their trade-offs represent a pivotal balance between the elements of the interaction complexity; for this reason, recognition of this balance has a significant value to determine the directionality of the complexity.

#### 2.3.3.5 Reward and Gratifications

Music-listening is repeatedly proven to be connected to the reward and emotion mechanisms of the brain. Listening to music creates the same physiological effect as being rewarded, by increasing dopamine activity, the same mechanism that occurs in response to naturally rewarding activities like having sex or eating food (Blood & Zatorre, 2001).

Gratification happens as a result of such natural reward-inducing activities, whose delay is closely related to self-control ability of individuals. The famous marshmallow experiment exerts a reward deferral option with increased rewards, whereas instant consumption grants a lesser reward, in which conditions the children (a group with a low self-control) often choose to instantly gratify themselves instead of waiting for more marshmallows. This behaviour was closely linked to the reliability of the environment – indicating that those who perceive the environment as more reliable for producing the desired results would just as well prefer a delayed reward (Kidd, Palmeri, & Aslin, 2013).

These behaviour patterns imply a critical consideration to keep in mind. The music-listening artefacts should be able to bring music content that is reliable in gratifying the user's desires; in addition, it should be able to bring music content further in the queue that is just as gratifying as the currently playing music.

### 2.3.4 Approaches and Resources for Designing Artefacts that Diverge from Conventional Directions

We saw some unorthodox design approaches emerge in the past couple of years. Those approaches were (mostly) derived in response to the conventional discourse of the works of design manifested in the industry or academia, which were often designed in accordance to the normative paradigms. These are critical design (Bardzell, Bardzell, Forlizzi, Zimmerman, & Antanitis, 2012), design for reflection (Sengers, Boehner, David, & Kaye, 2005), and slow design (Grosse-Hering, Mason, Aliakseyeu, Bakker, & Desmet, 2013; Hallna & Redstro, 2001; Odom, Banks, Durrant, Kirk, & Pierce, 2012). These approaches signify that design research and the activity of design can be carried out with divergent considerations. For example: interactions with artefacts are deliberately decelerated in slow design in order to facilitate contemplation about the weight of the actions taken. The notion of divergence is in line with our research aims, as I am trying to find strategies for designing for unconventional ways of interacting with music-players to enable a meaningful music listening experience, whereas all of these approaches deliver valuable insights on the how to approach the issues.

Certain conventional and unconventional concepts can be utilised as resources for designing features of interactive products. Utilisation of these concepts may enable unorthodox interaction opportunities for users to experience product offerings in a brand-new light. These concepts include ambiguity (W. W. Gaver, Beaver, & Benford, 2003), randomness (T. W. Leong, Vetere, & Howard, 2006; Sener & Pedgley, 2012), automation (Hassenzahl, 2010; Janlert & Stolterman, 2018), recommendation (Tuck Leong et al., 2008; Morris & Powers, 2015), and frictions (Hassenzahl & Laschke, 2018).

### 2.3.5 Discussion

Not all interactive artefacts are designed with personal wellbeing particularly in mind, which is completely fine in some cases; however, in contrast, music-listening is a powerful activity that affects people in an innate manner in which design for wellbeing may have substantial benefit.

The literature (Chapter 2.3.1) indicates that user experience evolves throughout an artefact's use – altering the relationship between user and artefact. On top of that, the experiences with an artefact are bound to create affective responses: influencing the experience. These indicate that the relationship between an artefact and user is a dynamic one depending on how the qualities of a product may resonate with user.

Different from pathological approaches, positive approaches to design aim to improve the conditions for human flourishing. Listening to music differs from other hedonia inducing activities, because the activity thereof and the outcome are one in the same in this case. Nonetheless, music listening artefacts have potential to be designed in a way that enables a journey of personal growth through inducement of eudaimonic qualities, whereas pieces of music can be mindfully experienced for enhancing one's experience of the present moment: making it more likely to be positively meaningful for improving one's wellbeing (Chapter 2.3.2).

Thanks to the advent of technologies, like any information technology, music-listening technologies have started to be saturated with a high-level of control, choices, and extrinsic information, and also complexity: even though those are beneficial for one's wellbeing up to a point, as per the empirical evidence, an excess can tarnish the reward of the experience instead of benefiting it. For this reason, they are accepted as key considerations in this research (Chapter 2.3.3).

## 2.4 Part IV: General Discussion

I reviewed and discussed several facets of recorded music-listening experiences through artefacts, dividing the work into three parts. *In the first part*, I laid out the general evolutional direction of music-playing artefacts, the emergent use patterns, and made a case for finding means to diverge from this direction. *In the second part*, I illustrated how and why people listen to music, how their preferences and tastes emerge, which processes play a role in choice and judgement of music and the factors affecting those; consequently, I synthesised a model of the process and discussed the qualities of motivations behind the choices and judgements. *In the final part*, I discussed user experience phenomena of interactive artefacts, explored relevant design for wellbeing concepts, and conveyed key considerations and approaches for design. As a result of discussions on these, four distinct conclusions emerged, these are:

- More recent music-listening artefacts are being designed in adherence to normative directions that increasingly emphasise certain pragmatic qualities while omitting qualities of meaning, while experimental ones indicate alternative discourses (Chapter 2.1.5).
- Current models of music choice and judgement disregard the effect of music-listening artefacts to the process thereof; for this, I devised an enhanced model that includes artefacts (Chapter 2.2.4)
- Music-listening experience cannot be separated from the context and can be influenced by the features of – and extrinsic music information transmitted by – the artefacts, affecting a listener's motivation in choosing and judging the music (Chapter 2.2.5).
- Designing for wellbeing can act as a guide to achieving positive and meaningful music-listening experiences; nonetheless, the emergent key

considerations and design approaches need to be taken into account during the process of design (Chapter 2.3.5).

With respect to these conclusions, we can say that a radical divergence from the normative designs of music-listening artefacts calls for an elaborate research through design (RtD) process. On the top of that, music-listening is a complex perceptual and cognitive process where a great number of variables exist, with subjectivity and personal factors of virtually endless variety are mixed into the equation. This indicates that no outcome of our research will be one-size-fits-all; nevertheless, our goal isn't to achieve such a solution, but merely to make alternative directions that are disregarded in the current direction of music-listening technologies. At the heart of the matter is a liberty to tentatively explore a wide array of directions, yet we don't expect the whole array to be beneficial for the wellbeing of users; therefore, I will be taking a direction that is more likely to induce benefits in terms of wellbeing. For the reasons discussed previously, I summarised the bottom-line takeaways revealed from the discussions and conclusions down to three essential points for guiding the RtD process:

- Maintaining the user agency (self-determination) is a challenge without the existence of explicit user input due to lack of extrinsic attributes available to the user; hence, the design of the artefacts must be conceptualised for empowering users' agency as a feature of the process.
- Listening to music in the absence of extrinsic attributes would detach out-of-the-moment associations from the music; therefore, the objective is to facilitate a more mindful music-listening experience that stems from awareness and impression solely of the music in the moment.
- Fostering an evolving personal journey of music listening is more likely to induce eudaimonic qualities of wellbeing as the process would involve more intrinsically motivated choices and judgements: allowing the user to actualise oneself throughout the journey.

# CHAPTER 3

# PRELUDE TO RESEARCH THROUGH DESIGN

In his opening speech to the Design Research Society conference in 1998, Bruce Archer (1999) remarked that design research is about making a quantum leap from the current state of things into the unknown for the progression of human knowledge. This statement indicates criticising and seeking alternative discourses is a strength of design research against what is predominantly taken for granted.

The methodology incorporates a multi-phase generative empirical approach in naturalistic settings in a longitudinal timeframe. In the following phases of the research, I will first be exploring design strategies and concepts for enabling intrinsically meaningful music-listening experiences. For that, I will be employing in-depth empirical methodology for sensitising the participants to the notions that drive our research objectives, then generate ideas that challenge the conventional ways of listening to music in order to discover conceptual ideas for enabling user agency without utilising extrinsic attributes. Following that, I will process and analyse the outcomes of the previous phases as per the criteria including the notions and considerations that emerged from the literature and with respect to the research objectives. I then consequently will integrate our input (as researchers) to the previous outcomes by utilising formal design heuristics with respect to the criteria thereof. In conclusion, I'll be discussing all of the outcomes to the degree in which fulfil the research objectives.

## 3.1 Phases of the Research

The RtD consists of an initial prelude phase followed by three consecutive main phases: cultural probing study, generative participatory design workshops, and a solo design activity for refinement of the concepts, in a respective order. Each phase - excluding the prelude - will be following an identical structure: introduction and phase-specific methodology write-up, preparations for the procedure (*before*), the procedure (*through*), and analysis of the procedure (*after*).

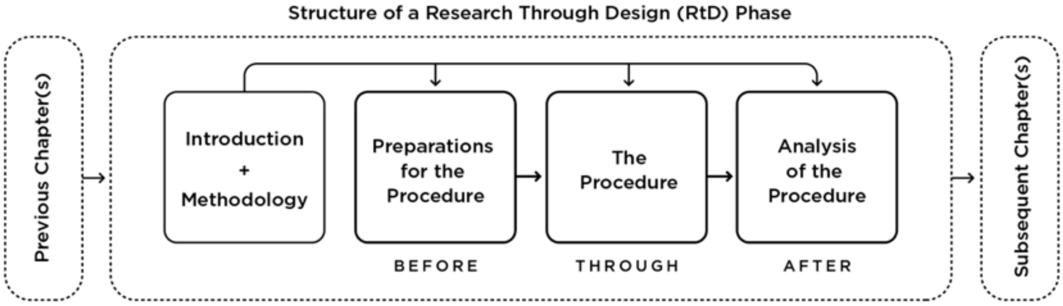


Figure 3.1 - Structure of a research through design phases of this research (chapters 4-5-6), divided down to their respective time periods relative to the procedure in those phases.

**The prelude** and writing thereof includes participant sampling and recruitment process, and discussions about this research's relationship with design research and research through design – parts that are meta to the subsequent phases.

**First phase** of the RtD is focal on getting preliminary information from the participants and sensitising them to concepts relevant to this study through the utilisation of cultural probe kits, in where they will be self-facilitating a generative activity as a part of the kits (dream cubes) at the end of that phase.

**Second phase** will take place in form of generative workshops for creating ideas as the continuation of the self-facilitated activity. There will be three parallel workshops that take place asynchronously. The process and outcomes of this phase will be analysed and interpreted to be utilised in the subsequent phase.

**In the third phase**, designer-researcher of this study will be analysing the whole process, eventually overtaking the designs where the participants handed them over. The researchers will assume designer's mantle continue the design process as a solo designer with respect to the analysed findings (and processes) while self-reporting the process.

## 3.2 Sampling and Recruitment of Participants

This research calls for attentiveness by the participants throughout different phases as it's a longitudinal in-depth study; because of that, I will be seeking those who are more likely to stick with the study in the whole of its duration. The investigation of abstract and potentially difficult-to-digest concepts is a fundamental characteristic of this study, which means that the success of this study calls for a type of participant well-equipped to tackle it. For this reason, I'll be employing three sampling criteria, through which I'll carry out the recruitment activities.

### 3.2.1 Sampling Criteria

**Technology Acceptance.** Familiarity with the technological change and acceptance of new technologies are two key traits I'm looking for in the participants. Millennials and Digital Natives are the most compatible generations in terms of those traits. This is due to the timeframe they grew up – equating to the years following mid-90s, a timeframe when technologies evolve rapidly, and product lifespans are shortened (Deal, Altman, & Rogelberg, 2010; Eastman, Iyer, Liao-Troth, Williams, & Griffin, 2014).

**Competencies.** The second set of traits is the participants' ability to dissect wicked issues, generation of ideas without developing attachment towards them, and self-criticism, all of which are evident in members of a discipline (Stolterman, 2008): industrial/product/interaction designers. Specifically, designers I am looking for need to have capacity to fulfil these criteria to a more specific extent (Pedgley & Şener, 2019; Yargın, Süner, & Günay, 2018) through possessing either of the following attributes: design graduates, graduate students of design, or designers with an extensive experience in the field .

**Motivation for Participation.** Last criteria is that the participants should have enough time, means, and motivation to allocate at least the minimally viable commitment towards the study. This is due to the fact that this study can be relatively demanding, which would cause an ethical distress that might cause them discomfort if the participants struggle to fulfil its requirements. Because of that, I will try to understand whether the candidates fit this criterion through the judgement of the researchers by employing Purposive Sampling.

### 3.2.2 Recruitment

The sample size is 12 participants, so I will be recruiting the exact number of people as per the research criteria due to the design of this research. The participants will be a part of the study from the preliminary interview up until the solo design phase, which respectively mark the beginning and the ending of the empirical part of the study. The researchers are natural participants of the study during the Solo Design Phase.

The most appropriate method of recruitment is Purposive Sampling and Snowball Sampling. In normal circumstances, these non-probabilistic sampling methods may induce bias into the results, which end up in unreliable result. However, I am not aiming to understand naturalistic phenomena, rather trying to understand strategies and output that can be produced by individuals through the criterion for certain sets of skills and qualities.

**Stratified Purposeful Multicriteria Sampling** represents a non-probabilistic sampling strategy for recruiting the study participants. The sample group is mostly homogenised, selected with respect to multiple criteria aligned with the research purpose (Collins, Onwuegbuzie, & Jiao, 2006). The summary of the criteria (as mentioned in Chapter 3.2.1) is as follows:

- Industrial/Product/Interaction Designers by experience or training.
- Members of Millennial (1980 to mid-1990s) or early Digital Native (mid-1990s to early-2010s) generations.
- Those who can spare their time and effort resources.

**Snowball Sampling** is yet another non-probabilistic sampling strategy for recruiting the study participants. It serves the purpose of expanding the recruitment network around the researchers through their connections and the candidates (Noy, 2008). I'll be utilising Snowball Sampling technique to reach participants who fulfil the criteria in a fuller extent in addition to the first strategy.

#### 3.2.2.1 Sample Size and Saturation

This research will be employing methodology that will allow a 'deep dive' to the participants' thoughts, whereas this methodology, naturally, will be yielding a rich dataset from each individual participant. This methodology includes context-mapping toolkit, semi-structured interviews, longitudinal probe kit studies, and design workshop sessions. Diverse backgrounds of the participants will allow a well-spread ground coverage among those who we might consider design experts/specialists who will be selected from practitioner and academia backgrounds (see 3.2.2.2 for details). By referring to the facts above, we can decide on an acceptable sample size that will provide adequate of data saturation from the research.

Khalaj and Pedgley (2019), per the comparison of research methods in their research (that has comparable qualities to this research per se), assert that data saturation only marginally increases beyond n=20, their discussions on the other hand, indicate that 'n=12 rule' rests on homogenous participant groups and consistent techniques, both of which apply to this research. On the other hand, due to the utilisation of Contextmapping in this research (albeit modified), alluding to the methods' foundational research, any group size between 4 and 6 is adequate in terms of subgroups within the sample (Visser, Stappers, van der Lugt, & Sanders, 2005). Owing to the literature aforementioned, we can safely say that a sample size (n) equal to or greater than 8 ($n \geq 8$) will give us a viable amount of data. However, due to the needs of this research (see 5.2), there will be need for employing a size equal to a multiplication of 4 (n=4,8,12,16...). For this reason, *12 participants will* *be recruited* into the research as a measure against the possibility of participants dropping out through the longitudinal period of the research.

#### 3.2.2.2 Participants of the Study

Those who were recruited into the study is a diverse group of people as per the sampling criteria; although, it is apparent that high majority of them possessed a direct academic affiliation either as an academic or as a (graduate-level or higher) student during the time of the study, yet the sample had a slight deficit of professional practitioners (Table 3.1). This dispersal was expected due to the sampling method per se.

To give more detail: In terms of their professional attributes, we'll be going over their higher education degrees and occupations. We'll first be looking on the distribution of their earned degrees. For the Bachelors: 10 of the participants have Bachelor of Industrial Design (BID) by ~83%, one has a Bachelor of Science (BSc.) by ~8%, and the last participant has a Bachelor of Arts (BA) degree ~8%. When it comes to graduate degrees: one participant has a PhD by ~8% and two of them have an MSc. by ~16%. On the other hand, the outlook becomes heavily academic when we look at active studentships: Occupation-wise, 5 of them are PhD candidates by ~42%, 4 are MSc of ID students by ~34%, one is an MSc student by ~8%, whereas two of them are not students by ~16% – signifying that a highly significant majority of ~84% them are graduate-level students or higher. Profession-wise: at 7, most of the participants are research assistants by ~58%, there are 4 professional designers among them by ~34%, one of them is a mechanical engineer by ~8%, one participant is an assistant professor by ~8%, whereas the last participant isn't engaged with professional pursuits – equating to ~66% as academics and ~42% as professionals, whereas ~16% of them are both.

Demographically speaking, majority of the participants were female: 7 out of 12 in overall that translates to 58%, which is an insignificant deviation. In terms of age, the median was ~26 whereas standard deviation was 1.81 – in accordance with the study requirements, all of whom can be classified as Millennials, yet four of them can also be equally classified as Digital Natives (P5-9-10-11).

Table 3.1 - Participants of the study with group classifications, professional attributes, and demographics thereof in the duration of the research.

| **Classification** | | | **Professional Attributes** | | **Demographic Attributes** | |
|---|---|---|---|---|---|---|
| **Participant Code** | **Group** | **1st Pairing** | **Degrees** | **Occupation(s)** | **Gender** | **Age** |
| **P1** | 1 | w/ P2 | BID, MSc. ID | PhD Candidate, Research Assistant, Former Professional Designer | F | 29 |
| **P2** | 1 | w/ P1 | BID, MSc. ID | PhD Candidate, Research Assistant, Professional Design Consultant | F | 32 |
| **P3** | 1 | w/ P4 | BSc. Mech.Eng. | MSc. ID Student, Human Factors Engineer | M | 30 |
| **P4** | 1 | w/ P3 | BID | MSc. ID Student, Research Assistant | F | 26 |
| **P5** | 2 | w/ P6 | BID | PhD Candidate, Research Assistant | M | 25 |
| **P6** | 2 | w/ P7 | BID, PhD of ID | Assistant Professor of Industrial Design | F | 31 |
| **P7** | 2 | w/ P8 | BID | PhD Candidate, Research Assistant | M | 26 |
| **P8** | 2 | w/ P5 | BA | PhD Candidate, Research Assistant | F | 26 |
| **P9** | 3 | w/ P10 | BID | Professional Designer | M | 25 |
| **P10** | 3 | w/ P9 | BID | MSc. ID Student, Professional Designer | M | 25 |
| **P11** | 3 | w/ P12 | BID | MSc. Student, Professional Designer | F | 25 |
| **P12** | 3 | w/ P11 | BID | MSc. ID Student, Research Assistant, Former Professional Designer | F | 27 |

Group classifications were included to this table retrospectively after the workshops to give an overlook of the way the participants were distributed into their respective groups, shown along with the attributes of theirs. You can see the considerations regarding the group distributions in the Chapter 5 of this research (Page 149).

## 3.3 General Background for Methodology

In this research, complex sets of tools and approaches will be employed while bringing a tailored structure and strategy into the research along a longitudinal timeframe. This empirical research is designed in a way that demands an elaborate and rigorous implementation for producing a significant output that would satisfy our research goals.

In case you may want to see the methodology of individual phases, you can find them as in following:

- Research through Design Phase I: Cultural Probing for Sensitisation in (see 4.1)
- Research through Design Phase II: Design Workshops for Concept Development in (see 5.1)
- Research through Design Phase III: Solo Design Activity for Advancing the Concepts (see 6.1)

### 3.3.1 Design Research

Design Research is unique in a way that it is distinct from the Science and Arts traditions in the academia; although, their methodology and approach can be utilised for understanding and explaining phenomena related to design. The purpose of design research is to project upon the future for overcoming wicked issues that can’t be resolved in contrived settings; ascribable to that, design is about making sense of high level of non-measurable complexity and coming up with solutions that can make the complexity manageable through the ‘designerly’ way of problem solving (Archer, 1999; Pedgley & Wormald, 2007; Stolterman, 2008).

I need to define an outline of what constitutes as a design research In order to understand it; in this case, the following five characteristics defined by Bayazit (2004) contribute to drawing quite a well-defined outline:

- Design research is concerned with the physical embodiment of man-made things, how these things perform their jobs, and how they work.
- Design research is concerned with construction as a human activity, how designers work, how they think, and how they carry out design activity.
- Design research is concerned with what is achieved at the end of a purposeful design activity, how an artificial thing appears, and what it means.
- Design research is concerned with the embodiment of configurations.
- Design research is a systematic search and acquisition of knowledge related to design and design activity. (p.16)

For all intents and purposes, I will be employing the approach and methodology of Design Research in this dissertation as outlined above, as our concerns in this research are an aim and its objectives that might only be fulfilled through the means of a design research.

### 3.3.2 Research through Design

Research through Design (RtD) can be essentially defined as integration of design activity to a research as means to fulfil the objectives of that research. Nonetheless, we see two camps that propose different approaches to RtD: there is a rigid and HCI-aligned camp that is closer to the science methodology on one side (J. Zimmerman, Forlizzi, & Evenson, 2007); and almost in contrast to it, we see a camp that emphasises open-endedness and subjectivity (W. Gaver, 2012).

Objectives of this research can be fulfilled by generating knowledge through the design of artefacts that are yet to be conceptualised – focusing on what-if questions, dissimilar to what-is question of scientific research. Nonetheless, RtD conforms to the theories that come from the science, with the aim generating theoretically successful research outcomes as a result of the underlying design activity (W. Gaver, 2012).

In the case of this research, I am trying to empirically and generatively accentuate experiential qualities of interaction antagonistic to the prevalent patterns of accessing to and interacting with media (that are in explicit direction); over and above, I’ll be doing so while conforming to the scientific theories and findings. In other words, answering a what-if question generatively in the direction of scientific truths.

# CHAPTER 4

## RESEARCH THROUGH DESIGN PHASE I: CULTURAL PROBING FOR SENSITISATION

Concepts that participants will be involved with and which form the heart of the study[22] can be difficult to grasp for the study participants without properly introducing the concepts to them. However, informing the participants about those concepts (thus making them aware of which) can affect their attitudes and actions during the research – polluting the process with bias. Nonetheless, introducing certain aspects of those concepts through an array of activities can effectuate them in shaping their own thoughts about such without risking induction of bias. In that sense, by (figuratively) circling around the concepts of interest throughout the sensitisation process, both the participants' original thoughts can be captured, and the concepts can be introduced to them without making them aware of them. Therefore, cultural probes provide an apt opportunity for utilisation of this strategy throughout a longitudinal timeframe in the participants' natural settings.

In this phase, I will be writing the relevant methodology (see 4.1), preparations for the procedure (4.2), the procedure of this phase (4.3), analysis of the procedure (4.4), and discussion of the findings of this part and implications thereof for the next phase (4.4.4).

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[22] Effect of transmission of explicit information by an artefact about the available choices therein to a user: informing them about the extrinsic properties of the choices with or without engaging with the intrinsic qualities of them – affecting their decision-making behaviour and motivations. Ex. Movie posters (or trailers) next to the ticket booths.

## 4.1 Methodology

### 4.1.1 Preliminary Semi-Structured Interview

Gaining an understanding of participants' thoughts and their dispositions is of paramount importance before the participants are affected by the contextmapping process; otherwise, it can become difficult to gain an understanding of the participants' ways of thinking at the start of the research through design process. The interviews will serve as an origin point: allowing retrospection for making sense of the participants' actions and the decisions they make throughout the process.

Music-listening is a subjective topic with a potential of stretching and contradicting; in relation to that, questions within an interview (while open-endedly inquiring about music) may overlap or conflict with each other depending on the direction of the interview. Because of that, a semi-structured interview would be less rigid than a structured one and provide the adequate support for getting the necessary information (Leech, 2002; Wood, 1997).

### 4.1.2 Contextmapping for Sensitisation

As a toolkit incorporating different methods over a timeline for gaining in-depth understanding of elusive concepts, Contextmapping constitutes itself as a potent, yet gruelling method in terms of implementation. This toolkit was developed in Delft University of Technology and was initially published in 2004 for generating design insights from an empirical research process; albeit this doesn't necessarily mean it is well-integrated to the activity of designing.

Contextmapping's aim in the initial sensitisation phase is to cultivate memories and experiences of participants to bring their deeper (latent) thoughts and dreams to surface to make those more accessible in further stages of a study. Sensitisation is followed by a generative session with the participants, where they generate ideas and express their recently surfaced thoughts. These are intricately recorded (through generated artefacts, photos, and video recordings) in all phases of the study for researchers) to understand the process and analyse it. The analysis outcomes are then interpreted in an expressive way for them to be communicated to the designers in an orderly manner (Visser et al., 2005). However, in this research, they will be assuming the mantle of designer during the study. Moreover, I (the researcher) will interpret the outcomes for utilising those outcomes myself as I will be developing the designs in the subsequent phase (Pedgley, 2007) after analysing process and the outcomes of the Contextmapping phases.

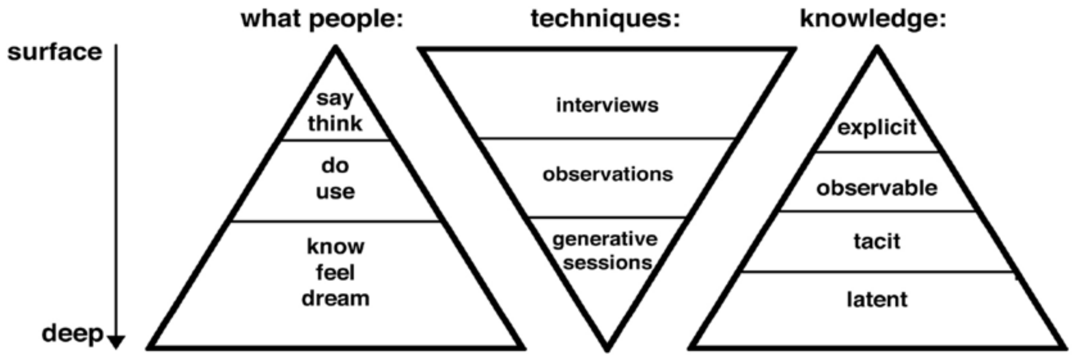



Figure 4.1 - Different levels of knowledge and the how they are accessed by different techniques (Visser et al., 2005).

Upon going through the literature, I see that this toolkit is often utilised in two scenarios: either in cases where the participant groups need to be approached carefully, or when dealing with evasive concepts where the researchers and the participants need to be on the same page. In case of this research, it is the latter.

I found that it is only appropriate to divide it into two phases for the purpose of this study: firstly, a cultural probe kit study for sensitisation; and secondly, a workshop as a form of generative session. This phase is primarily about sensitising the participants to an unfamiliar concept regarding how they listen to recorded music and secondarily about learning about the subjective dispositions of the participants. Sensitisation of the participants to the study’s concepts and outlying facets thereof, then making them actively participate to generating ideas about those concepts through introduction of certain design goals and imposition of constraints thereof. Generation of ideas will continue in a group setting in the next phase: Design Workshops for Concept Development (See 5.1).

### 4.1.3 Cultural Probe Kit as a Research Tool

As initially conceptualised by researchers at the Royal College of Art (W. W. Gaver, Boucher, Pennington, & Walker, 2004), Cultural Probe Kits serve as valuable tools for design researchers. Gaining an empirical understanding of subjectivity and bringing it under the spotlights help design researchers to approach wicked problems in a unique way; after all, attempting to gain a foothold on such issues can be ineffective through conventional research approaches.

Cultural probe kit will be mainly contributing to the sensitisation phase of the Contextmapping study; although, I will be analysing it and its elements to assess their contributions and value as methodological tools. It includes several elements within for engaging the participants to the matter and opening them up. The duration of this part is monthlong (30 days) before it concludes. It will be left with the participants throughout that duration.

In normal scenarios, a probe kit usually includes a disposable camera and objects that might evoke thoughts and responses. In contradiction to that, I decided not to include any elements that would emphasise the participants relationships to the existing artefacts and objects with attributable properties, this is because of that this research is interested in users’ relationships and interactions with an explicitly temporal phenomena – music-listening experience. I am interested in making them look critically at their relationships with the music-player rather than making the participants bring traces of those along, while making them wonder about and gradually focus on how it might be in a certain way that does not yet exist.

## 4.2 Preparations for the Procedure

The procedure of this phase had two parts: a preliminary semi-structured interview and a probe kit study. I meet up with each participant face-to-face and make an interview, then hand over a probe kit to each participant after the conclusion of their interview. Each participant will then be occupied with their probe kit that will stay with them for a month up until the commencement of their workshop session.

### 4.2.1 Planning and Designing the Semi-Structured Interviews

Even though these interviews will be done to capture thoughts, attitudes, and behaviours of participants at the start of the study, rigid and close-ended questions would only serve in capturing attribute information, which is not-so-relevant to this study. Letting the participants' minds wander; therefore, making them reveal deeper pieces of information could yield results beneficial to the study in a face-to-face setting.

For the motivations stated above, four clusters of questions oriented towards music-listening were prepared (Leech, 2002; Martin & Hanington, 2012):

- First cluster consists of **warm-up questions** for capturing relevant attributes while getting the participants up to speed for opening up. In spite of the superficiality of these questions in contrast to the depth of overall methodology of this research: in-depth questions are probable to intimidate the participants; whereas, given enough intrinsic motivation about the topic (one's tastes are more probable to be related to such, see 2.2.5), the participants may give insightful and in-depth answers to superficial questions (Blood & Zatorre, 2001; R. M. Ryan & Deci, 2000).

  Ex. *If you have a favourite piece of music, is there any specific reason for that?*

- Second cluster is about **self-perception questions** for getting deeper answers about their motivations and significance of music for them. These inquiries are more open-ended than those of the other clusters, the reason being: self-perception can be difficult to navigate and the participants might not prefer to discuss it so it rests on them to take full initiative through these questions.

    Ex. *What is the effect of music on your identity?*

- Third cluster is made of **inquiries about habits and contexts** for getting a sense of the participants' past experiences of music-listening. Understanding one's habits, routines, opportunities and constraints they face, and contexts and what ways of those afford for music-listening is needed for understanding the bounds and basis of how they listen(ed) to music (see 2.2.3.3).

    Ex. *What do you think and feel about the music-listening devices you have ever owned?*

- Listener **attitude and behaviour questions** are about understanding what the participants do to listen music: the series of actions they take to get to the point of listening, act the way they act throughout the process of listening, and what those approaches might entail for the future behaviour of those participants.

    Ex. *How did you come across the music you discovered (that you liked) most recently?*

### 4.2.2 Planning and Designing the Probe Kits

Design of the probe kits is one of the most time consuming and meticulous parts of this research. This is not due to data collection issues, but rather for the purposes of making the study more interesting and worthwhile for the participants. Initial stage of our probe kit design process was to explore and pinpoint the types of probes included into the probe kit. Then, the probe materials (regarding content) were planned and organised. Thirdly, a common visual language and narrative for the probe kit elements was created. This process was iterated upon and passed through these stages multiple times – those iterations were consolidated in their respective parts of the process for simplification.

#### 4.2.2.1 Stage I: Exploration of Existing Methods and Tools

Cultural probes are a acknowledged method for sensitising study participants for a contextmapping process (Visser et al., 2005) as they are both longitudinally done and also constitute a way for leaving physical artefact for documentation and reminiscence (W. W. Gaver et al., 2004). For this end, probe kit related resources in the literature and also amongst non-academic sources, their design processes and strategies for designing them, and examples of the existing probe kits were examined for future implementation.

Existing applications of probe kits aside of Gaver et al.'s seminal work (2004) on cultural probe kits are found in the wild in the form of blog or social media posts, and even videos. Those examples comprise similar proponents to the probe kit of the aforementioned work, most commonly such as: diary, map, writing/drawing tools, disposable camera, sticky notes, tags, and so on. Major differences only happen in relation to the themes of the kits and how they are presented.


Figure 4.2 - A probe kit found on the Internet, whose elements are adorned with a clean and minimalistic theme. [Photo: Designing Cultural Probes, 2018, medium.com/@catherinelegros]

Storytelling is a flexible tool for conveying the concepts to participants by altering the conditions into whatever befitting for the scenario: encouraging the participants to think outside-of-the-box (Umulu & Korkut, 2018).

Enactment of a scenario through a journey; on the other hand, another tool that allows the participants to put themselves into their own shoes in a what-if scenario: allowing them to think about what might be through enaction through a sequence of tasks, creating conditions for one to empathise with the needs and wants of their own selves (Şen & Şener, 2019).

Playfulness, on the other hand, is a notion that affords to be utilised as a tool for making activities engaging and enjoyable, both of which become especially important once the activity becomes a longitudinal one in which one needs to self-regulate themselves.

#### 4.2.2.2 Stage II: Designing the Activity Ingredients

I created the content of the probe kit materials, which took a multitude of iterations to establish their final structure. The plan was to foster reflection while the participants actively participated in music-listening activities, and then poke them to give answers to the questions and provide solutions for the challenges.

Users get desensitised with the recorded music-playing artefacts as they become accustomed to them, so do the participants as users themselves. Purpose of the probe kits is to cultivate a process for the participants, who normally do not think about the effect of their interactions with their music-players on their music-listening experiences. For this reason, probe kits are designed with three considerations in mind:

- Prompting the participants to reflect on their past and present experiences with the music-players, which is imperative for the participants to think critically about their existing music-players.
- The participants will be sensitised to the behaviours and habits, in which they generally access the recorded music through the utilisation of attribute information in music-playing artefacts.
- They should be able to engage with the materials in reasonable levels without feeling pressure for participating.

In relation to these considerations, I designed eight elements to include in the probe kits: each one having a unique purpose for fostering reflection and creativity.

Named as ‘Deep into a Peculiar Radio: Experiential Explorations’, the probe kit was created throughout a lengthy planning, design & manufacturing process. The probe kits are designed in ways to engage the participants and to make them feel appreciated by communicating that a considerable effort was put into them. The probe kits have elaborated and light-hearted graphics that share the same design language – each of which bearing a relevant graphical representation of its purpose. Elements that might be utilised for analysis (the numbered elements) will be collected by the researchers, the rest will be left to the participants as a gift and a keepsake for them.

The following elements constitute the contents of the cultural probe kit. Name on the left indicates name of the *envisioned quality of the activity*, whereas one between the parentheses indicates *finalised form of the activity*. Moreover, the listed points signify the required features of the respective element:

**Probe Kit Enclosure (Cloth Bag).** Thought as a bag that contains the constituting probe kit elements, conveying the study identity through the graphics that has the name and personality of the probe kit study printed on it. Its purpose would be to contain the other elements and communicate the identity of the kit to the participants.

- Its minimum dimensions are required to cover the cumulative size of all probe kit elements.

**Introduction Material (Instruction Sheet).** It should serve as a map that contains general information about the purpose of the study, the participants' involvement of it, contact info of the researchers, and a diagram illustrating the activity order and timing of the elements, each of which are given a number.

- There should be an appropriate introduction, outline the probing process, and guide the participants about how to proceed.
- A disclosure about the ethics and a reassurance about the confidentiality of their privacy.
- Contact information of the researching party inviting the participants to establish communication should they need to do so.

**Temporal Comparison Activity (Playlist Creation Task)** The point of this task is instructing the participants to create a playlist that represents their tastes compiled together either through a streaming service or by hand. It is the first element to be completed by the participants before starting the other ones. Forefront purpose of this activity is to invoke reflection and introducing concepts to the participants, serving as a solid material to compare and contrast their listening behaviours over the weeks – time being the variable (Holyoak & Morrison, 2005).

This task and playlist update task (as in below) are aimed to create points of reference for the participants to record and reflect on their experience with the study, giving them a broader perspective with how they choose and engage with the music. On the other hand, it will allow the researchers to see what the participants listened to at the beginning of the study and to what extend the activities affected their tastes by the end of it, serving as snapshots over time. There should be two pieces of information given in the activity that need to:

- Instruct the participants on how to create their playlist(s).
- Include a contact address for submitting their playlist(s).

**Inquiry Cards (The Illusory Cards)** consist of questions that are aimed to evoke reflections and foster thoughts either about the participants' preferences or out-of-ordinary music-listening scenarios in an open-ended manner: pushing them out-of-the-box.

Scientific research often seeks to quantify and often work on concrete ground; however, there is merit to ambiguity (and even chaos) when it comes to design research. Putting incongruous questions that may foster self-reflection (W. W. Gaver et al., 2004; Martin & Hanington, 2012), whereas storytelling prompts can impose constraints and goals in a playful manner that would otherwise be neither engaging nor imaginative (Umulu & Korkut, 2018).

The prompts in these cards are open-ended and sometimes imaginary: like 'What is your guilty listening delight, why?' and 'How would you find music in a music store in an alien world?'. The participants will be permitted to answer these inquiries throughout the time period, like *snacks*.

**Activity Diary (The-What-Was-It-Like-Journal)** is for participants to select one of their music-listening activities that happen within their days and to reflect on them at the end of the days. They will be encouraged to try out new mediums;

additionally, diversify their music-listening experiences to different formats if possible. For this, the participants are needed to:

- State what prompted them to start listening to music
- Identify the initial music attribute (like a song or artist)
- Tell the time of listening, the spatial context, and the artefact
- Convey of they felt during that listening session through using standardised emotion indicators (see second-to-last element)

Diary activities are frequently utilised tools in many traditions of research; on top of that, they are especially valuable in design research for seeing the participants' responses towards the usage of an artefact of experiencing thereof over time, which creates a comparative picture that shows the deviations (Hassenzahl, 2010; Martin & Hanington, 2012; Visser et al., 2005). However, the interest point of *journals* in this research is to pinpoint the differences between music-listening scenarios in changing contextual scenarios as we'll already be seeing what the participants listened to over time through their playlists.

**Challenge Prompts (Music Discovery Challenge)** are a set of scenarios that add modifiers to the participants' control over how they select and listen to music. These prompts are for listening to:

- A radio station unknown to them
- An artist they don't know
- A different genre
- A playlist out of their tastes
- Less popular songs of an album
- Something random
- Skipping or committing to listening to a music in the first seconds
- A reflection to all of these elements

Then after listening to each of them, they'll be asked about:

- The intrigue of making that selection

- Their afterthoughts with standardised emotion indicators
- Likability of the outcome
- An open-ended summation in three words

It’s a common knowledge that human beings are creatures of habit, most of whom don’t often seek experiences out of their comfort zones in their day-to-day affairs. Even though it was common to listen to radio (or tape) in the 90’s, it is more convenient to stream music to play *just the thing one wants to listen* at the swipe of a finger (Brown & Krause, 2020; Datta, Knox, & Bronnenberg, 2018). One might need to be reintroduced to a type of friction that forces them out of their comfort zones and thus face the *disparity* (just like music-listening itself); therefore, their own responses to it (W. W. Gaver et al., 2004; W. W. Gaver & Mandler, 1987).

The participants will be given tasks like listening to an artist they don’t know or a genre they’re unaccustomed to; therefore, reflecting on the experience while reporting it.

**Veiled Appraisal (Veiled Listening Session)** is an activity that shows single or multiple attributes of pieces of music on the front side of each card, whereas giving a link to that piece of music on its backside. Front side asks about what they think about that piece of music with respect to the shown attribute on a scale, then asking about the how it matched what they expected about it on the backside. There are 30 cards in total, all sets of cards are identical to each other and the music in them were selected through a random number generator (RNG) to prevent subjective bias. Participants are allowed to do this activity in any time during the day. Only certain attributes of the music elements will be shown before listening to the music, these attributes are:

- Song name
- Album name
- Artist name
- Album (or cover) art
- All of above

Just as we discussed in the literature review, users' and music listeners' motivations for listening to music can be swayed by concerns like self-image, social status, or only by their expectations. Decision heuristics and biases push us towards certain choices and pull us away from the certain ones. We're making assumptions about pieces of music even before listening to them (See 2.2). This activity is aimed to see the disparity between extrinsic and intrinsic qualities of pieces of music: both for the participants and the researching party.

**Temporal Comparison Update (Playlist Update Task)** is the follow-up (or conclusion) of the playlist creation task for showing the participants (and also researchers) how their playlist might have changed through the effect of the previous elements. The participants will be doing this activity (to stop updating the playlist) towards the end of the study before starting the break-up letter and the dream cube.

**Transitional Activity (Breaking-It-Up)** is the second-to-the-last activity of the probe kit that should encourage the participants for changing their mindsets from reflecting on their experiences (as in previous activities) to generating ideas and making statements: easing them for design activities. Its purpose is to make the participants think critically about what they dislike about their preferred way of listening to music – making them reflect on what they would have liked instead of that.

Love and Break-up Letter technique possesses applicable qualities for this process to commence. In short, just like its name implies, the participants write either a love or break-up letter to verbalise what they might have thought in a scenario where they decide to act on their wants (Martin & Hanington, 2012). In this research, it is befitting making the participants write a break-up letter rather than a love letter for pushing them to criticise what they dislike in their music-listening artefacts.

**Generative Activity (Dream Cube)** is a generative activity that will utilise the participants' experiences throughout all the elements they engaged with in the probe kit.

The participants will be asked here to roughly conceptualise a music-listening activity per the design goals and constraints provided to them in this activity; thus, they'll be starting the design process prior to the workshops. This part will be comprised of:

- An instruction card that communicates goals and constraints pertaining to the activity, on which it'll be read as "Conceptualise a music-player that affords interactions without allowing the utilisation of attribute information as input and output. Examples of such are genres, album art, song and artist names, playlist names, and any piece of information that can be associated with the music tracks. You can conceptualise any type of interface: the cube is an abstraction of your ideas".
- A sheet of base template on a material that could be fold into a shape and modified by hand. In this case: a millimetre-thick sheet of solid cardboard to be cut with a laser-cutter.

**Standardised Emotion Indicators (Set of Emotion Stickers)** includes eight stickers representing emotional responses that might be given in relation to music-listening experience. They are tools to help the participants to express their emotional responses primarily in activities 02 and 04, whereas they might utilise them anywhere they want throughout the study.

In this study, it was aimed to create sets of dichotomies that effectively correspond to certain affects and emotions for attaining answers with more dimensions than simple affectual responses. For these ends, literature distinguishes between mood, affect, and emotion; moreover, introducing layers and diverse richness therein. Although, not every emotion is applicable for the intersection of product use and media consumption (music-listening); therefore, even though the product emotions span up to 25 items (Desmet, 2012), most of them are not relevant for music-listening experience through an artefact. Nevertheless, Desmet and Hekkert's Circumflex Model (2007) is more applicable and relevant (Figure 4.3). However, the model required a layer of simplification for music-listening experience through the product in question.

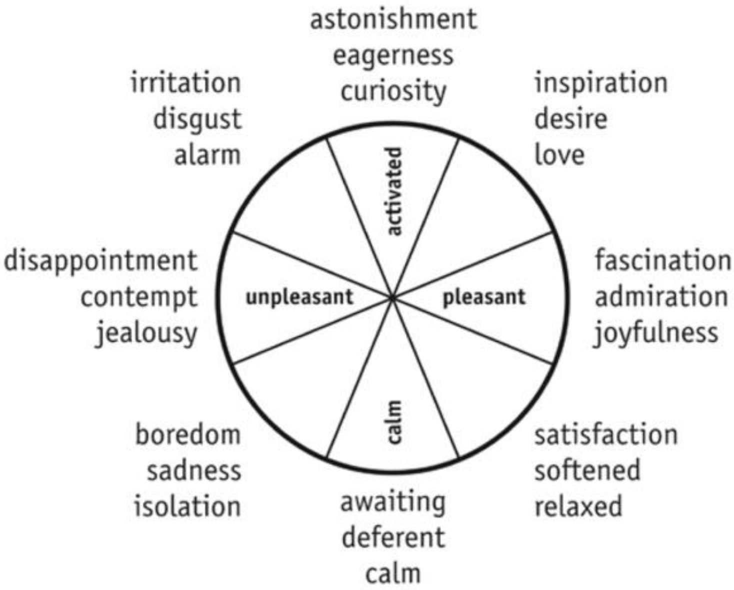



Figure 4.3 - Circumflex model of core affect with product-related emotions (Desmet & Hekkert, 2007)

The simplification was done to convey the *experience of* listening to a piece of music (recorded, not live) through a music-listening artefact. Some emotions in the original circumplex were deemed too extreme (e.g., contempt, disgust) for this experience, whereas some were simply inapplicable (e.g., deference jealousy). Although, some of the words received shifted responses during the pilot tests; as a result, they were rearranged in a different manner (e.g., dissatisfaction and irritation). The revised array of emotional responses as dichotomies are as follows:

- Satisfaction and dissatisfaction: for milder affective responses
- Joy and irritation: for more visceral affective responses
- Excitement and boredom: for arousal during the experience
- Surprise and indifference: for arousal in expectation to experience

**Writing Tools (Set of Coloured Pens)** Writing tools needs to complementarily be included as a courtesy of the researching party, yet inclusion of a diversely coloured writing materials would afford the participants to express their writings/drawings in a flexible manner.

#### 4.2.2.3 Stage III: Aesthetical Language and Its Implementation

As design research aims to solve rather convoluted (or wicked) issues, the research methodology may need to be formulated in an intricate way. Probe kits are tools that are used to motivate and inspire the participants to open the up to more unconventional way of thinking, which is known to be fostered through a skill likely to be possessed by a design researcher; that is, aesthetical (specifically visual) communication. Adorning the research with aesthetic elements support the research in a twofold way: First of which is to enhance the intrinsic motivations of the participants, second one is to create a visual language that acts as a system of signifiers to support the participants' engagement with the kit (W. W. Gaver et al., 2004).

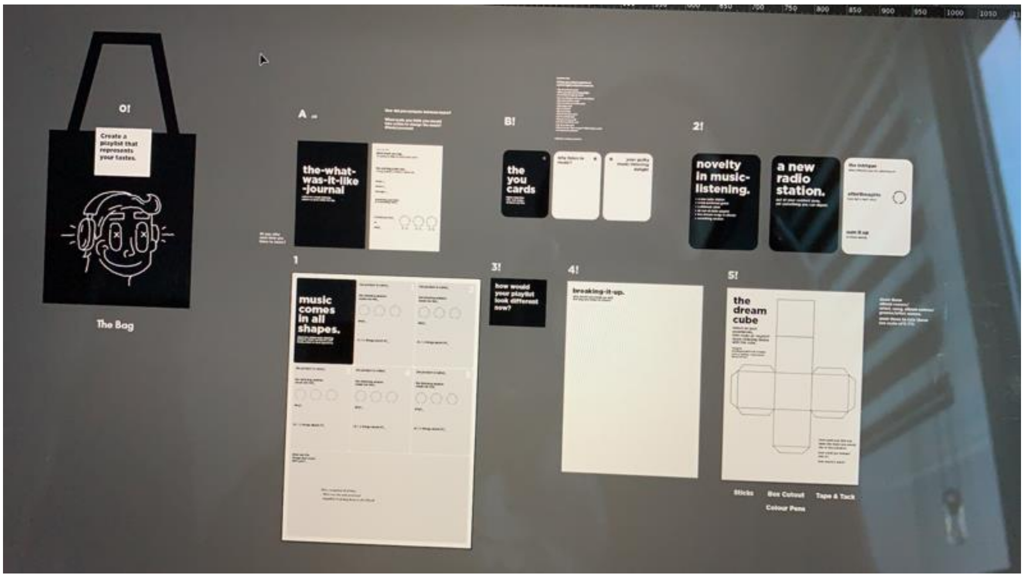



Figure 4.4 - An early stage of designing the aesthetical language of the probe kit in a similar manner to wireframing (layout planning), which were prototyped on paper to see the legibility of the sentences and feasibility of the spaces.

A lengthy research that demands significant amount of effort and time from the participants needs to compensate them in some manner in order to ensure their voluntary commitment to a research of such (Wiltfang & Berg, 1990). For this reason, firstly, enhancing the probe kits with aesthetic appeal is more likely to motivate the participants. Secondly, this appeal is also a gesture of the researcher's regard and effort towards the participants. As per the literature on motivations (R. M. Ryan & Deci, 2000), both aesthetic appeal and a demonstration of a positive gesture can motivate the participants better in an intrinsic manner as opposed to an extrinsic motivation like compensation through money or the participant's need to fulfil a social obligation towards the researcher.

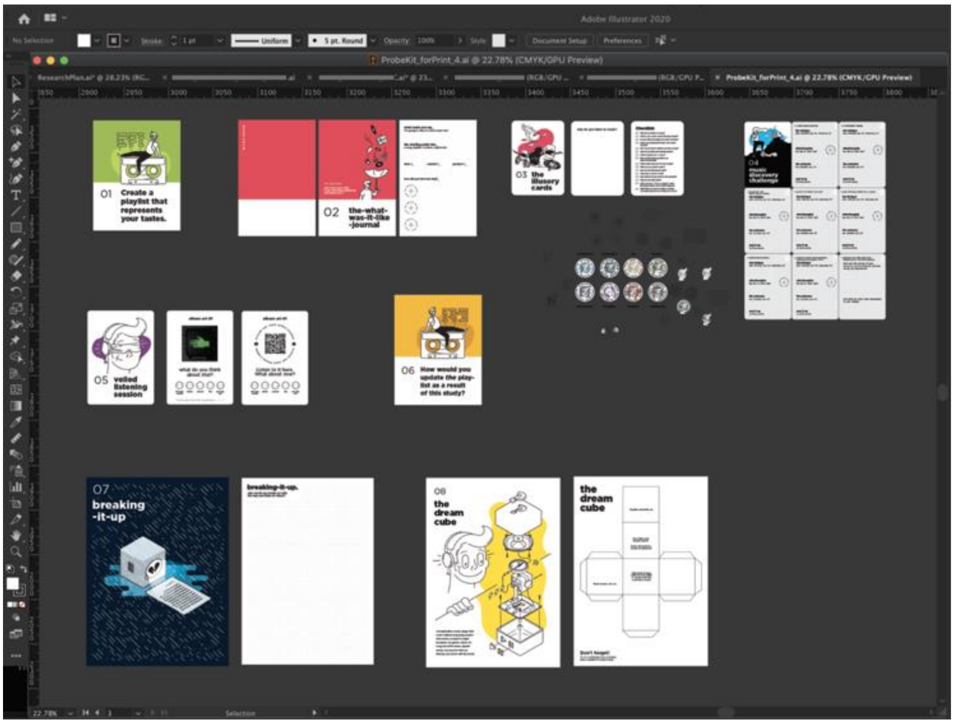



Figure 4.5 - A screenshot from prior-to-manufacturing timeframe of design process of the aesthetical language of the probe kit in Adobe Illustrator.

It can get exhausting for the participants to partake in a research in their naturalistic environments as they cannot get assistance from the researcher at their moment of need (Csikszentmihalyi, 1991; W. W. Gaver et al., 2004). A way to overcome this obstacle is to employ a visual language that helps the participants to distinguish the ambiguities and guide them towards a direction in an array of activities. In this sense, aesthetics are proven to be providing valuable utility in helping users (participants can be deemed as the users of a probe kit) (Nielsen & Molich, 1990).

To implement a visual language, a series of design standards and guidelines were defined to follow throughout the probe kit. These were: typefaces, colours, and shape properties, as well as a certain tone of copywriting. Playfulness and a mild tongue-in-cheek humour were adopted as the main themes to create illustrations and copy to accompany them. The basic elements of which are as pointed below.

- **Gotham** (a sans typeface) was selected as the typeface due to it being finely crafted and its flexibility to carry the probe kit's overall playfulness with a weight for preventing a child-like effect.
- **Mildly saturated colour tones** would further convey the playful effect while supporting individual pieces to attain distinctive characters and recognisability. However, only a single colour is permitted to use in each element to keep things simple.
- **The shapes** had to complement each other throughout the kit, so single-weighted fine outlines with simple curves were utilised.
- **The copy**, in general, needed to convey a not-so-elaborate and casual language (with occasional slangs) to complement the playfulness factor and open-endedness of the study.
- **The illustration set** is the closest thing that would give the probe kits a *personality* for it to communicate with the participants: faces for them to talk to.

All of these elements were selected, created, and/or designed (except the typeface) from ground-up specifically for each activity they correspond to, making them unique to this research.

### 4.2.3 Manufacturing the Probe Kits

As one might expect, as the researcher, I needed to act within certain constraints to succeed the manufacturing requirements. For this reason, I established communications with several manufacturers and concurred with those who could supply for my requirements thereof adequately.

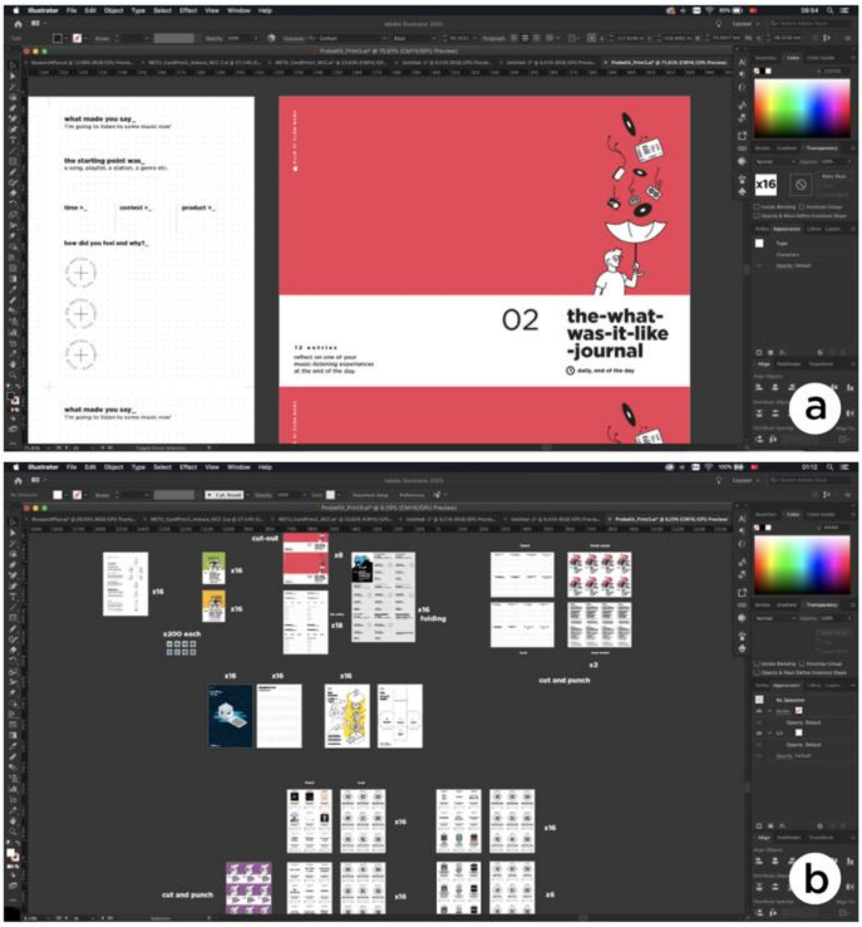



Figure 4.6 - Designs of the probe kits as they were readied for batch print process, their arrangements optimised for assembly following the printing.

First of which (a copy centre) was the manufacturer of 15 sets of elements numbered 01 to 07, for which who supported me with the requisition of materials, printing and cutting them, binding and moulding those required to be done so, and laminating. Second manufacturer (an industrial printmaker) sew 15 backpacks and printed the graphics on them, also mass producing about ~1500 plastic stickers to be distributed into the kits. However, I found that there was a problem in heat-transferring the graphics to the plastic bases, causing the graphics to peel off (Figure 4.7c). In the end, the set was remanufactured: holding true against the conditions. Third manufacturer (pen brand) factory-supplied 15 sets of acetate pens of 8 colours, shipping them to my address. Lastly, I laser-cut the dream cubes onto 2mm thick solid cardboard bases (unassembled) in the model workshop of METU Faculty of Architecture.


Figure 4.7 - Several photos from the manufacturing process: insertion of rivets into 'The Illusory Cards' and cutting the springs into keyrings for 'Veiled Listening Session' activities (a), testing the properties of the cloth bag and how it holds the research material (b), a close-up from the defective (peeling) batch of stickers that failed to adhere onto polypropylene base which then was corrected (c).

Consequently, I brought all of the components together in my workshop – handling the probe kit's fine-tuning needs and formulating an applicable manner of presentation of the kit packages to be sent to the participants. 16 unique parts consisting of the probe kits elements, supplementary material, and stationery were assembled and put into an order; in the end, placed into their respective enclosure bag for all 12 probe kits (Figure 4.8).

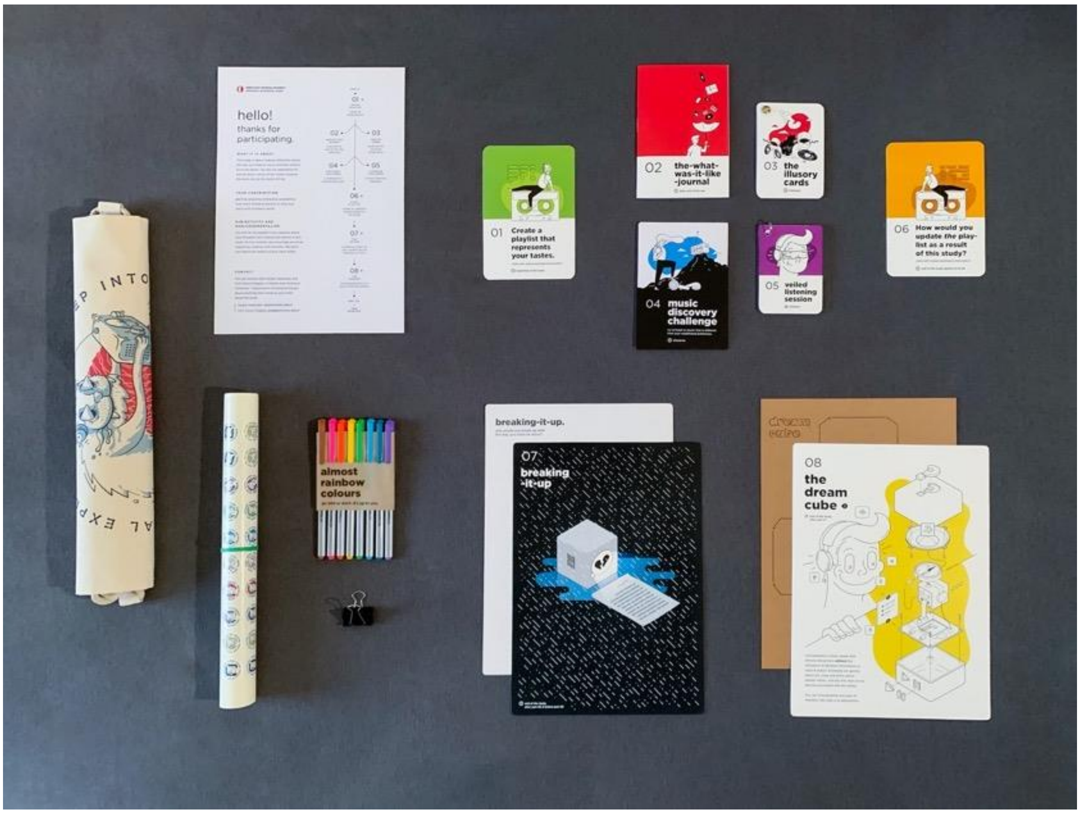



Figure 4.8 - All elements of a probe kit in a single frame (left to right and top to bottom): A canvas backpack with a research-themed canvas backpack, instruction sheet, playlist creation task, the-what-was-it-like-journal, the illusory cards, music discovery challenge, playlist update task, sticker set, a set of coloured pens, a clamp, breaking-it-up activity, and the dream cube.

## 4.3 Procedure of the Cultural Probing Study

As the participants were recruited before the study procedure, its execution began by shipping out the probe kit packages to all 12 participants via postal service. Even though the original intention was to hand the packages to the participants face-to-face, I ended up sending the packages via shipping them due to COVID-19 restrictions – reformulating the presentation of the packages; regardless of that, rest of this phase wasn't changed: interviews were done (see 4.3.1) and a month-long sensitisation process with probe kits (see 4.3.2) was ensued.

### 4.3.1 Carrying Out the Preliminary Interviews

In total, 12 interviews were done with the participants: ranging from 25 to 40 minutes per interview. Each participant brought their unique insights to the research, in addition to generating data to support the allocation of whom to groups and pairings for the workshop phase. As per the manner of semi-structured interviews, a set of questions were asked, yet loose flexibilities were taken whenever necessary without deviating from the scope of the questions.

Figure 4.9 – A still from a one-to-one Zoom conference in which a participant is showing their headphone. Being at home has been beneficial for the participants to support their narratives with their music-listening artefacts at their disposal.

The interviews were carried out through Zoom rather than face-to-face; however, this method has proven itself to be more effective in terms of its utility. The reason is that Zoom allows recording the video calls, which enabled recording of the interviews in a higher fidelity than voice recordings, enabling the capture of gestures and gestural depictions by the participants while preventing environmental noise and distractions (Figure 4.9). Another thing to note for was that all of the participants seemed to be at ease throughout the online video interviews, who have shown no sign of discomfort in spite of live video feed from their personal spaces.

Aside from that, the participants had a chance to look through the kits and ask their questions after the interviews rather than a simple briefing that introduced the probe kits. Lastly, the interviews have been beneficial for getting to know the participants better for manually allocating them to suitable workshop groups (RtD Phase II) for enabling the desired group-dynamics. All of the interviews were carried out in the beginning of the probe kit study and recorded to be analysed.

The interviews started with relatively superficial questions (in relation to the following clusters of questions), most participants took their times whereas others gave straight responses in answer to which. Due to that reason, abstentions were taken from asking questions that would end up in duplicate or low-quality answers if a participant expanded upon the territory of a forthcoming question; although, gaps were prevented by asking follow-up questions.

All of the sought responses were captured in the interviews; and surprisingly, there were insightful answers that contained value to be utilised in further phases. Highlights and analyses of the interviews can be found in Chapter 4.4.2.

### 4.3.2 Administering the Probe Kit Study

Study participants were briefed about the probe kit elements one-by-one following the conclusion of the interviews; in addition to that, their questions about the kit and its elements were answered. Those probe kit elements (as in 4.2.2) are:

- Instruction Sheet
- Playlist Creation Task
- The-What-Was-It-Like-Journal
- The Illusory Cards
- Music Discovery Challenge
- Playlist Update Task
- Breaking-It-Up
- The Dream Cube

Participants were left to their own devices and carried out the probe kit activities following the interviews in naturalistic settings, except of bi-weekly reminders up until 30 days of study duration was done for the completion of the probe kits. Throughout this time, the participants were occasionally assisted by elaborating on their questions (to a certain degree) regarding certain parts of the probe kits via messaging or phone calls per their convenience.

The only distinct type of support query made by the participants throughout the duration of the probing study was about the nature of Dream Cubes: either about how to construct them or the purpose of the kits. The latter was expected due to the deliberate obscurity of their purpose; because of which, a few participants wanted to ensure that they got the design requirements right. Remaining queries were limited and rather isolated cases that have risen from the open-endedness of the study, for example: a participant wondered what 'Ever want to let go and live in the moment?' in The Illusory Cards, who wanted to learn whether that moment was during music listening activity or rather in general part of life. The answer to that query stands as 'Can be both, either, or none – it is open-ended, thus at your discretion'. These inquiries might be attributable to participants being accustomed to the emphasis on rigid and articulate research approaches rooted in Science tradition of research – it should be noted that this research is devoted in its adherence to the Scientific Method, albeit acting in accordance with the philosophy and approach of Design Research (see 3.3).

Upon the conclusion of the study period, the probe kits were recollected either via postal/delivery services, or through socially distanced meetings per the participants' convenience due to COVID-19 situation.

## 4.4 Analysis

Analysis of this part of the study is divided to two parts: firstly, analysis of the preliminary interviews for insights (that are unaffected by the probe kits) that might provide value in the third phase; secondly, the analysis of the kits for information derived from them for the phase thereof, in addition to analysing the kits' effectiveness.

### 4.4.1 Preparation for Analyses

Data preparation for analysis calls for deliberation in order to cover the requirements of a mixed-method RtD. As the means for doing so, rather than going with a single qualitative coding method, an eclectic set of multiple methods of coding were employed.

**For the data from the social exchanges.** Initially, the video recordings needed to be uncluttered due to the abundance of raw data, a significant portion of which possessed no value for benefiting the research. In the first cycle of qualitative coding, these recordings were marked and transcribed through *Structural Coding*[23], enabling:

- An efficient approach for eliminating ritual interactions and ordinary conversations from the dataset.
- Categorising the data clusters and conversations per their affinity pertaining to certain common themes.

Following these, meaningful information needed to be extracted from the retained data left from the previous step; for this reason, Axial Coding[24] was utilised as it possessed the qualities for proceeding further. This is due to the fact that axial

[23] Structural Coding is a division and clustering of data of inquiries into similar themes resulting from specific queries made during the interview. Thereafter, those similarly coded parts get coalesced for further steps of the analysis (Saldana, 2009).
[24] Axial Coding is for reassembling the fractured pieces of code for finding out more dominant codes (or notions) and ones that are less important. Unnecessary and repeating codes are eliminated to focus on more relevant concepts (Saldana, 2009).

coding is more appropriate in studies where a complex combination of data sources is present.

Unlike the interviews, the probe kit data will not be analysed in detail through a coding process, rather the thought process of select participants will be given as examples; however, this approach to analysis will be also put to use for analysing the workshops (see 5.5.1).

### 4.4.2 Analysis of the Preliminary Interviews

Asking simple questions like "what is your favourite piece of music?", then expanding on them through *why questions* helped us to build a gradual rapport for understanding the underlying mechanisms that led them to such conclusions – yielding valuable insights about how they choose the music they're going to listen to and the way they appraise it. Structural Coding of the interviews provided 213 clusters of qualitative codes, which were then analysed for the salience for underlying themes.

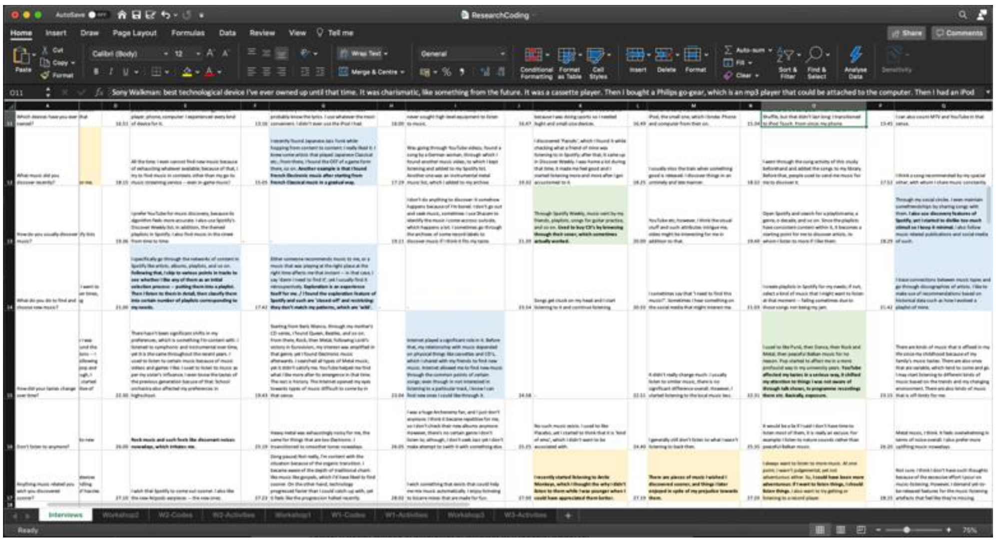


Figure 4.10 - Coding process of the interviews, where salient codes were marked with colours in accordance with their affinities in Excel.

Before moving on to the salient themes, the common emergent quality of all interview responses needs to be laid out: it has become apparent that each participant has distinct preferences, attitudes, and behaviours when it comes to listening to music; on the other hand, there are convergent themes in where it is apparent that their motivations (functions) for listening to music revolve around similar points. Single common takeaway of the information garnered is that *the how* rather than *the why* people listen to music matters more (as far as this research is concerned) when it comes to choosing a music piece while interacting with music-listening artefacts. Unless a music-listener is interested in listening to a specific (piece of) music, the how they choose what to listen is dictated by the qualities of their interaction with the music-listening artefact. As a consequence of these interviews, the three emergent themes per their prominence are: permeability by artefacts, uniqueness of listening behaviours, and ever-evolving tastes.

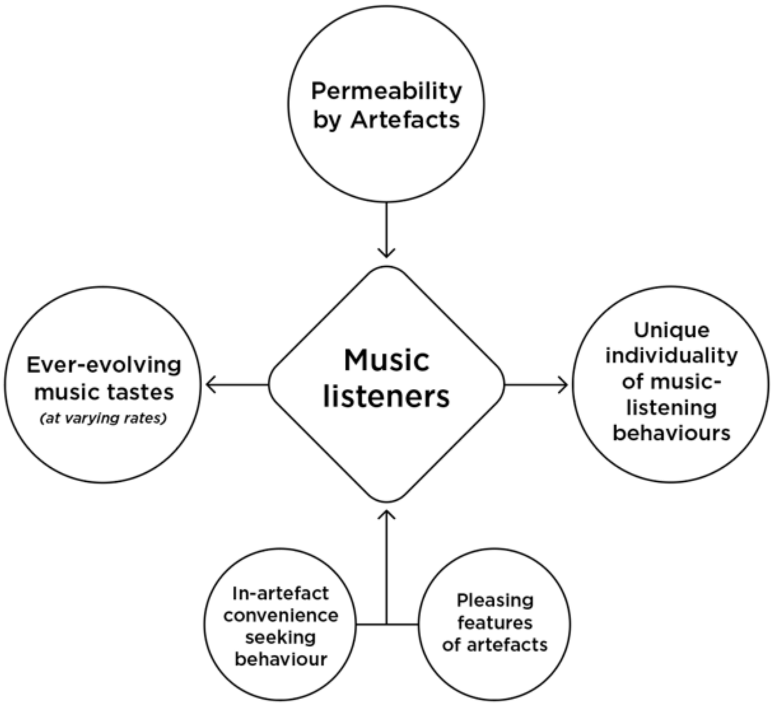



Figure 4.11 - Emergent themes per analysis of the interviews and how these themes relate to music-listeners.

**Permeability by Artefacts.** Participants' walkthroughs of processes they go through for and while listening to music indicate that they are permeable to extrinsic factors, which affect their choices through the information channelled to them at the time of interaction, as it was also indicated in the literature (see 2.2.3 - 2.2.5). Simply put, the stimuli given to the users in form of extrinsic attributes, order, and placement thereof through the interface affects the users' actions in absence of a dedicated motivation to listen to a specific (piece of) music. In short, interview outcomes support the elicitations from the body of literature.

**Uniqueness of Listening Behaviours.** Every participant conveyed a relatively unique approach to exert their music-listening motivations, albeit in influence of inherent qualities of the artefacts. Upon considering the participants' answers regarding their listening behaviours, unique pathways of music-choosing behaviours emerge as per constituent qualities of schemata.

**Ever-Evolving Tastes.** Interestingly, every participant, even the self-admittedly most rigid and conservative ones (in terms of music-listening choices), revealed clear signs of transforming tastes. Although, it should be noted that this sample group is slightly biased towards openness due to music-preference traits of their ages (Cross et al., 2016; Datta et al., 2018; Rentfrow & Gosling, 2003). In spite of this, with respect to their varying individual sensitivity towards change, flexibility in terms of music choice over time exists. Therefore, varying degree of their sensitivities are of vital importance in this matter. In spite of clear signs of evolving tastes, not every person has the same tolerance for how different something they listen can be for them to enjoy.

***Bottom Line*.** On the account of *the how*, the responses show the *permeability of the participants* to the stimuli they receive and affordances they interact with while choosing and listening to music. The experience is subject to change throughout the listening journey rather than depending on a static point of reference that starts the listening experience through *a why*. It is very unlikely for one's thought process to adhere to a very specific playing order of specific tracks at any given time: rather evolving with respect to what is given to them. As a consequence, ends doesn't really have a significance as music-listening activity is all about the experience itself; not the end result (unlike most day-to-day activities).

### 4.4.3 Analysis of the Probe Kits

Upon the recollection of the kits, they were labelled and categorised to be analysed with respect to certain aspects. However, their detailed analysis will be avoided due to the scope of this research, to which an analysis in detail serves little to no purpose. The analysis will be done in higher levels for conveying the participants' experiences with and general response to the cultural probe kits.

Each participant took a distinct approach for tackling the requirements of the activities as we'll be going through three select cases of which (Participant 1-6-11, in respective order) under individual headings to communicate an approximate sense of the procedure.

**Note that** the cases were inspected intricately for divulgence of the process; therefore, it is recommended to bypass these three cases to see the brief analysis rundown and outcomes (Chapter 4.4.3.4).

*Each of the aforementioned participants will also be seen in a separate workshop group (amongst 3 workshops) next in Research through Design Phase II / Chapter 5.4.*

#### 4.4.3.1 Case I: Probe Kit of Participant-1

The responses and solutions of this participant are prominently elaborate and well-thought besides of being the first participant to receive a probe kit, which is why their case was selected as the first one to be discussed.

**Playlist Tasks.** The most prominent feature seen in the playlists of this participant is that they imported successive songs from individual albums, playlists, and artists multiple times, which give us clues about their music-listening habits. Firstly, (in spite of being an avid radio listener) they have no reservations about re-compiling chunks of the aforementioned items in their original order. Secondly, this is an implication that they like listening to music as it was compiled originally. On the other hand, there are dramatic jumps between the sequential music pieces that are seemingly uncorrelated in a linear way: indicating that they are comfortable navigating/listening to music at their will as there is no clear trend in the playlist.

**The-what-was-it-like-journal**. The journal of this participant, in consistence to their playlists, signifies an open-minded and even risky music-listening behaviour (in expense of negative affect): they continued to seek uncertainty or continue playing the same medium even after they felt discomfort after coming across a piece that irritated or bored them (See left page in Figure 4.12).

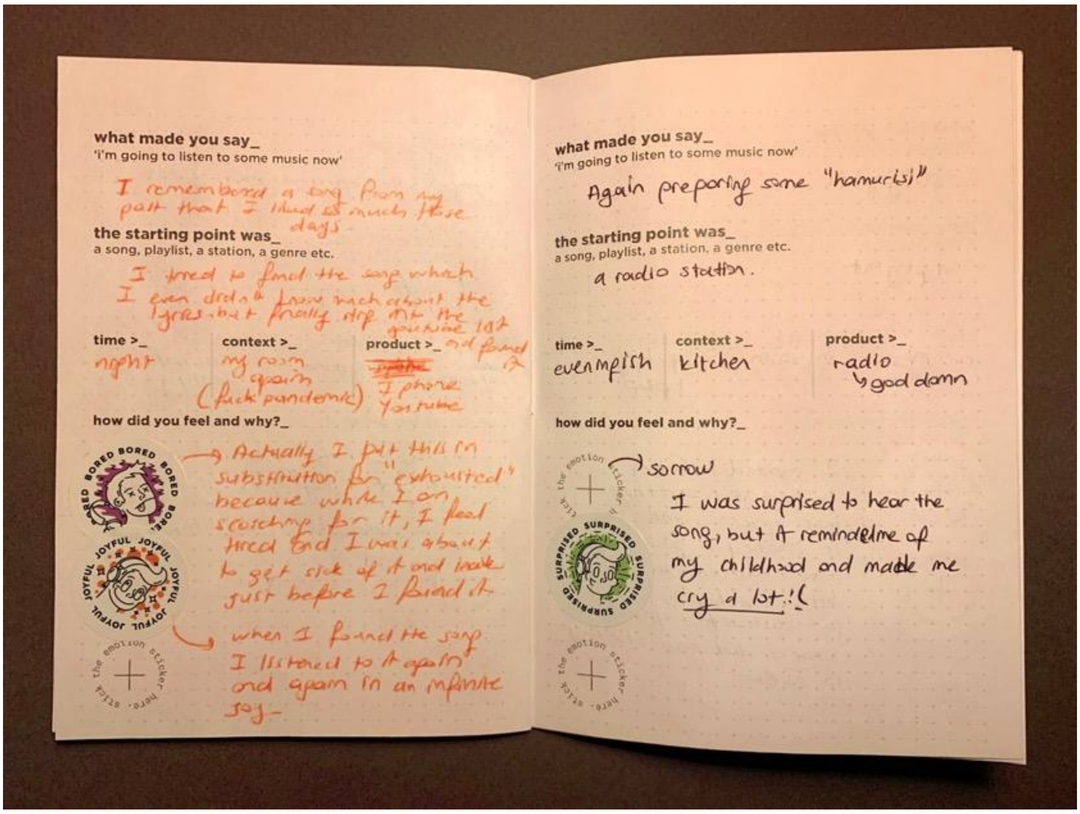



Figure 4.12 - Three sequential sticker slots were almost always used by participants to support their responses in descending chronological order, in spite of not being specified of such an order (left). On the other hand, participants occasionally resorted to writing some

music-specific emotions (right, “sorrow”) as they weren’t a part of the sticker set (instead, for music/product emotions).

**The Illusory Cards.** An inquiry about finding music one might like in an alien music store might be an oddball question, yet this storytelling-like approach bears the most dwelled-upon responses, actually challenging the participants to engage with the situation throughout a relatively elaborate train of thought (Figure 4.13a). Provided, the participant dwelled upon somewhat tortuous methods of discovering the music pieces then simply remarked that they would simply listen to the tracks, or as they said initially: “I would draw from a hat”. In line with that, they would just skip the tracks if the participant doesn’t like the song or it fails to resonate with them at that moment (b), which is very similar to how majority of the participants answered the questions.

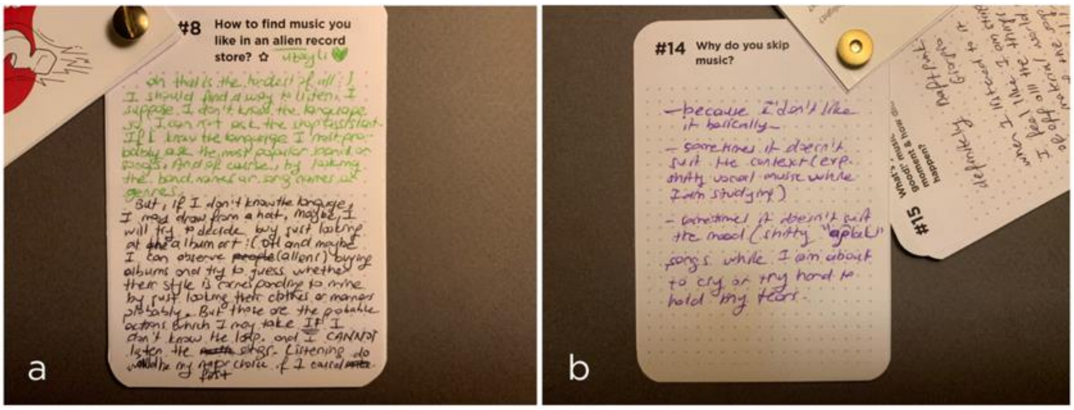



Figure 4.13 - The alien music store inquiry (a) and a question about why one might skip a piece of music (b).

**Music Discovery Challenge.** The participant gave strong affective responses to this challenge – rarely responding with milder emotions. Consistent with their answers to the previous activities, although unexpectedly, they responded more strongly to challenges that afforded less movement space (Like an artist or a certain radio station as opposed to a genre or skipping/committing to something). Even though having more flexibility makes them to attain a more positive emotive state, they still may still choose to tolerate the listening activities that give them discomfort. As a consequence, a relationship between *flexibility and tolerance* emerge as prominent notions in this activity: allowing varied range of emotions to be seen throughout (Figure 4.14).

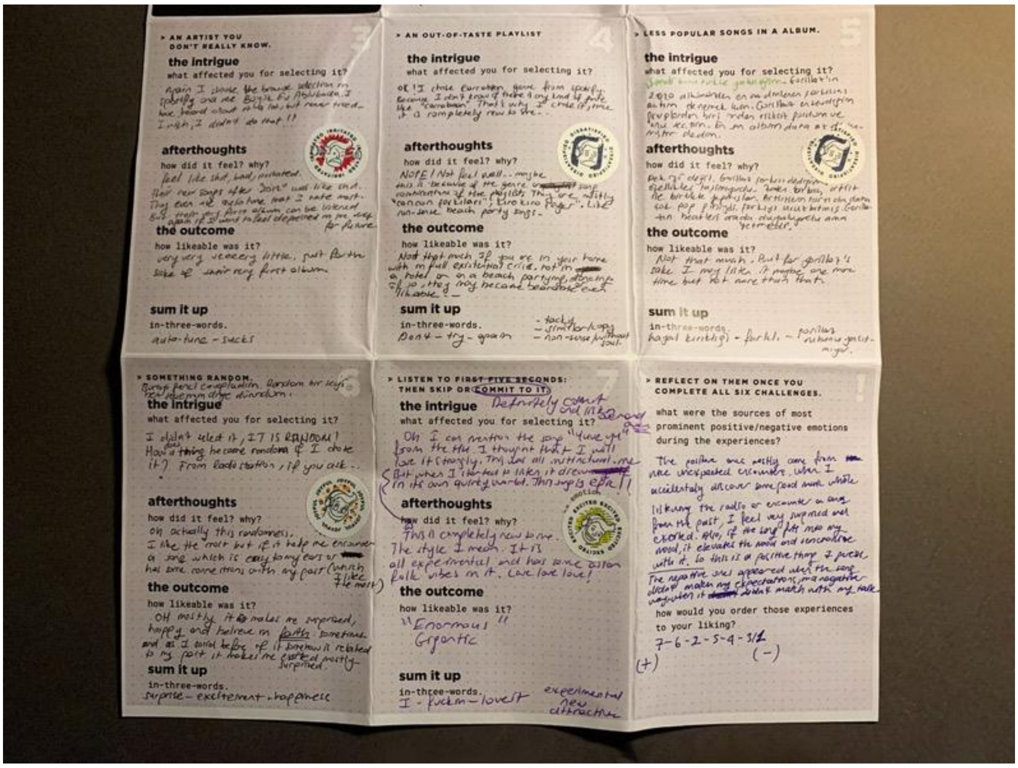



Figure 4.14 - An array of emotion with varying intensities (stickers: irritated, dissatisfied(x2), joyful, excited) can be seen in the participant's responses to this activity as seen on the photographed sheet.

**Veiled Listening Session.** As you'll be seeing in the introspective analysis of how this participant has done the next activity, their expectations (or "prejudices", as they put it) per the extrinsic attributes of a music (piece or media) sometimes significantly mismatched with their after-listening impressions. Again, self-admittedly, this discrepancy provoked a strong response and self-reflection about how they approach the music (Figure 4.15).

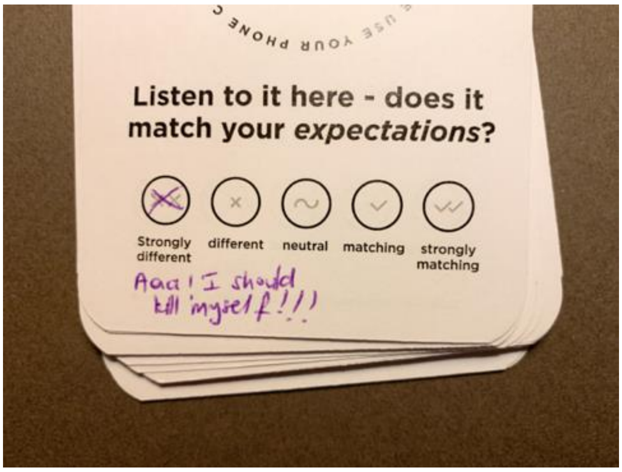



Figure 4.15 - The participant's response to a mismatch between their expectations and after-listening impressions as seen on the image.

**Breaking-it-up.** In fact, the participant admitted that they misinterpreted the purpose of this activity: accepting it as an appraisal of the probe kits' effect on their tastes rather than breaking up with the way they listen to music. Although, it provided a concisely written feedback about the probe kit study as well as an introspection about it.

Unironically, the participant gave responses about the thoughts this activity attempted to evoke in its second half: criticising the current state of the way they listen to music rather than upfront approaching it as a break-up. The participant indicated: "...but perhaps (I should) add new genres or *openness* to my strict choices. For example, the part where we discovered new songs helped me break my prejudices on *Metal* music by introducing *The HU*[25] to me..." then added, "I didn't think or expect that I could listen to Metal at this age (late 20s) but I LOVE this version of Metal!". These sorts of introspections help seeing the effect of probe kits by sensitising the participants to behaviours they might have been desensitised over time, providing a glimpse of the evolution of their thought processes.

[25] An item in *Veiled Listening Session* in the probe kit. It's a Mongolian Metal band that that rose to prominence in late 2010's and synthesises local guttural singing traditions (of Mongolian Folk) with Heavy Metal music.

**The Dream Cube.** The concept P1 came up with is an (almost) all-screen and highly tactile artefact that is conceptualised for interacting with users dynamically – standing out for its vibrance. In spite of eliminating explicit interactions per the activity briefing, they actually employed screens for enabling more ephemeral and intrinsic experiences. Multisensorial interactions are its defining quality as users may interact with it through physical (haptic and tactual), visual, vocal, and sonic mediums (see Figure 4.16).

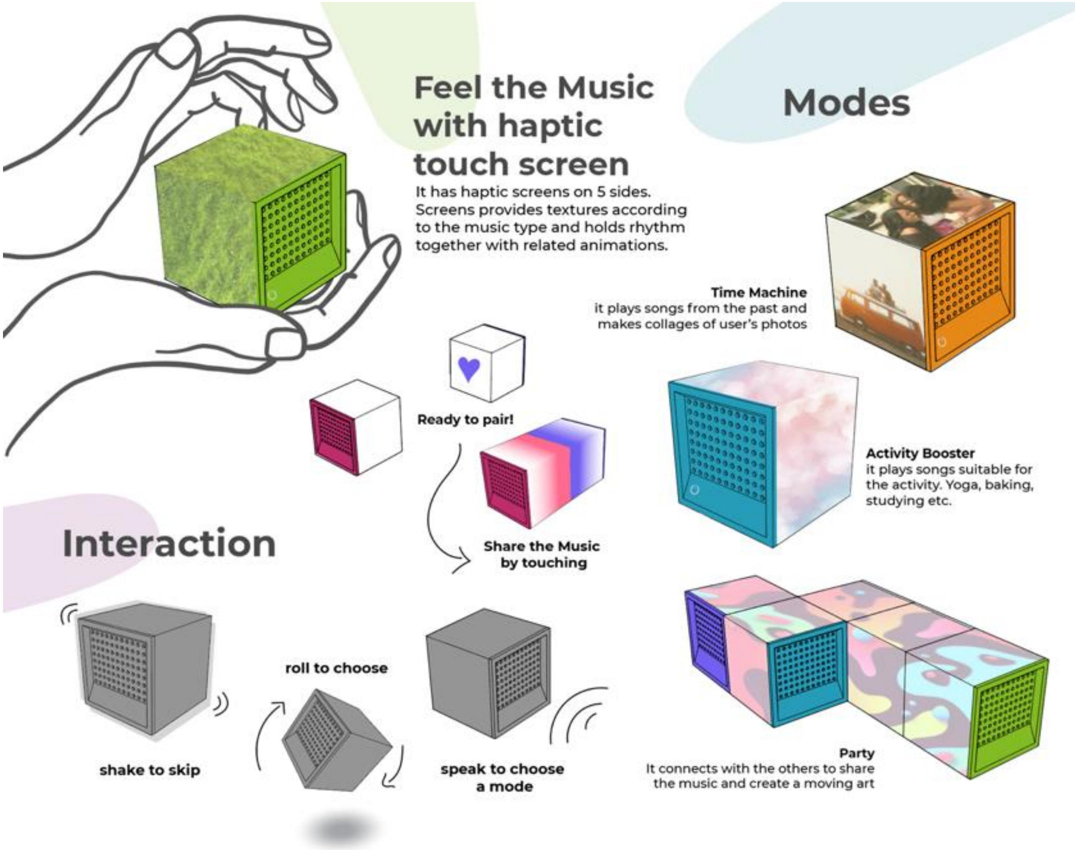


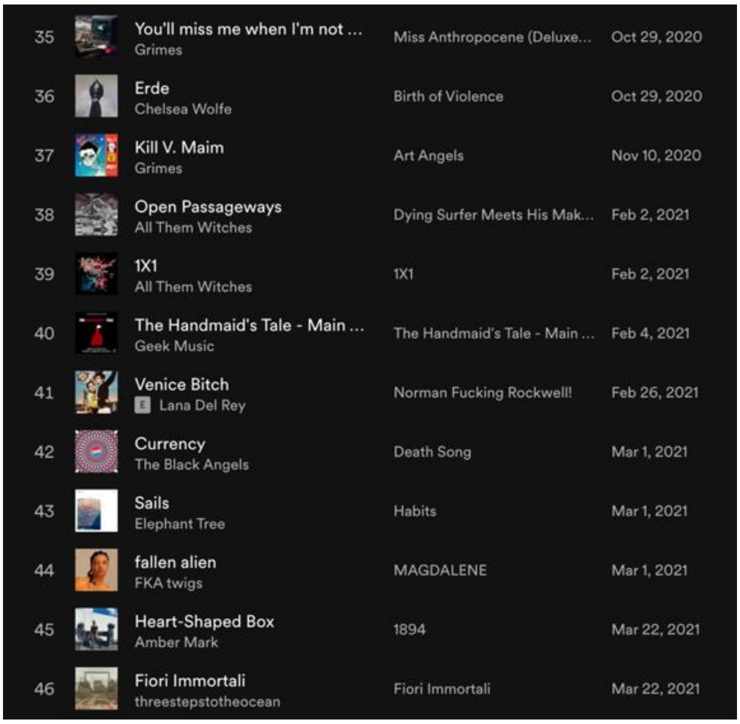

Figure 4.16 - P1's Dream Cube, which augments the music-listening experience through multisensorial media enhancements such as tactual and visual feedback: relying on tangible interactions as the control scheme.

*Participant-1 will also be seen as a member of the 1st workshop group in the subsequent phase (see 5.4.1).*

#### 4.4.3.2 Case II: Probe Kit of Participant-6

This participant completed the activities by providing information-rich responses and solutions. In addition to their interview data, this richness has been beneficial for outlining their preferences and behaviour relating to how they listen and respond to music pieces as discussed below.

**Playlist Tasks.** Music pieces within the music playlist the participant compiled as a part of the study have certain prominent qualities that changed ever-so-slightly towards the later parts of the list. Even though all music pieces within the playlist shared darker tones, the playlist became brighter (albeit still dark) as it progressed; moreover, the music in the playlist became more varied in terms of its intensity and brightness through this progression in comparison to the initial pieces (Figure 4.17).



| | | | |
|---|---|---|---|
| 35 | You'll miss me when I'm not ...<br>Grimes | Miss Anthropocene (Deluxe... | Oct 29, 2020 |
| 36 | Erde<br>Chelsea Wolfe | Birth of Violence | Oct 29, 2020 |
| 37 | Kill V. Maim<br>Grimes | Art Angels | Nov 10, 2020 |
| 38 | Open Passageways<br>All Them Witches | Dying Surfer Meets His Mak... | Feb 2, 2021 |
| 39 | 1X1<br>All Them Witches | 1X1 | Feb 2, 2021 |
| 40 | The Handmaid's Tale - Main ...<br>Geek Music | The Handmaid's Tale - Main ... | Feb 4, 2021 |
| 41 | Venice Bitch<br>E Lana Del Rey | Norman Fucking Rockwell! | Feb 26, 2021 |
| 42 | Currency<br>The Black Angels | Death Song | Mar 1, 2021 |
| 43 | Sails<br>Elephant Tree | Habits | Mar 1, 2021 |
| 44 | fallen alien<br>FKA twigs | MAGDALENE | Mar 1, 2021 |
| 45 | Heart-Shaped Box<br>Amber Mark | 1894 | Mar 22, 2021 |
| 46 | Fiori Immortali<br>threestepstotheocean | Fiori Immortali | Mar 22, 2021 |

Figure 4.17 - A screenshot from the participant's playlist added in chronologically ascending order. A high degree of variety in conventional terms can be seen amongst the pieces, yet there is consistency and sequentiality in terms of brightness and intensity.

**The-what-was-it-like-journal**. Their journal, on the other hand, provided insights about the participant’s openness to novelty and variety, and also their behaviour in and motivations for listening to music. Overall, their responses suggest that this participant is open to variety and novelty, whereas their motivation for music-listening is companionship; and commonly, the listening experience in itself (Figure 4.18).

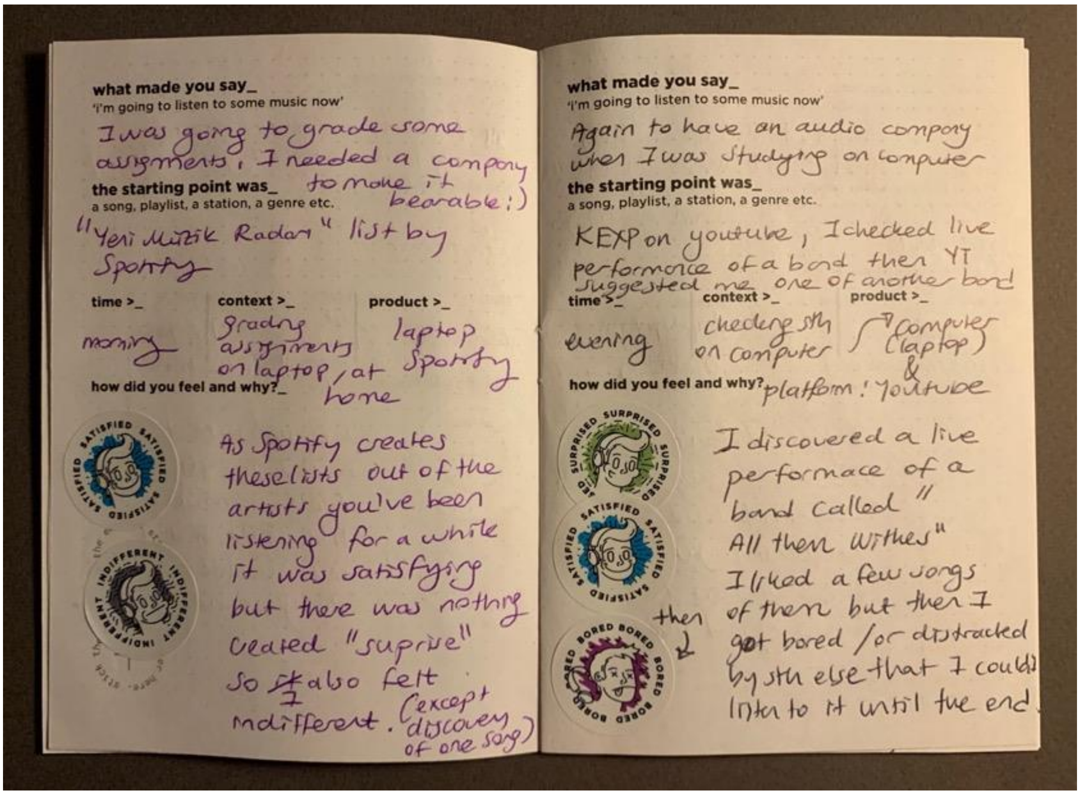



Figure 4.18 - A fold from the participant’s The-what-was-it-like-journal, where they described the prompt and starting point of the listening session, through which they also gave contextual information followed by their emotional responses for that particular experience.

**The Illusory Cards.** There were a plenty of in-depth thoughts that the participant shared through these cards. These subjective thoughts transposed what may objectively be known as notions about which-music-is-what: revealing a unique schema. Their answers to more open-ended ‘how might be questions’ give more practical insights, for example: In response to “How to find music you like in an alien record store?” they answered, “I’d try to listen to it [the records], at least get a glimpse of a few songs (let’s assume I can hear them when I touch them :P) or I’d sing a song I love and let them choose one for me.” (Figure 4.19), which in itself a practical approach for un-obfuscating the barriers imposed to them (and a clue for design for interaction in itself).

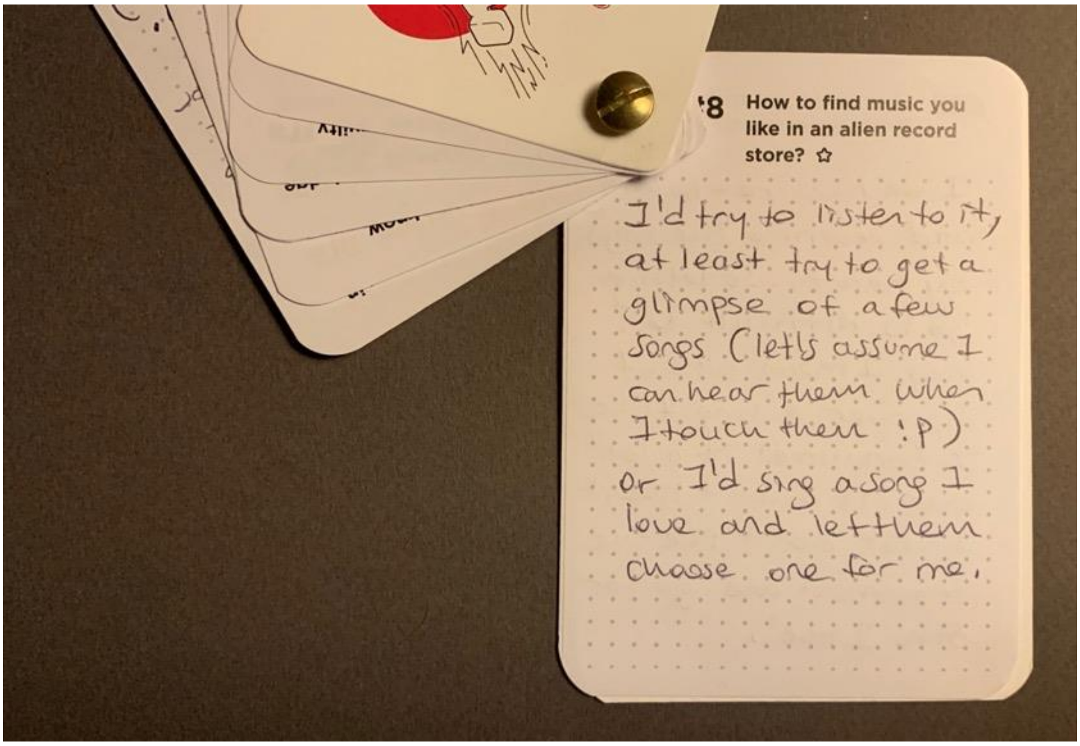



Figure 4.19 - The participant’s response to a what-might-be question, one among a set of pocket-sized questions that they could answer throughout the day at their convenience.

**Music Discovery Challenge**. In this activity, the participant decided to skip its first part as they had no point of reference for radio-listening experience. For the rest, in spite of that the activity tasks are ungeneralisable (for the participant), the participant had unambiguous answers to those tasks: allowing a glimpse into what kind of discovery they’re open to and where their boundaries lie for doing so (Figure 4.20). Listening to *something random* yielded the most favourable outcome for them while a new genre was the least favourable for them.

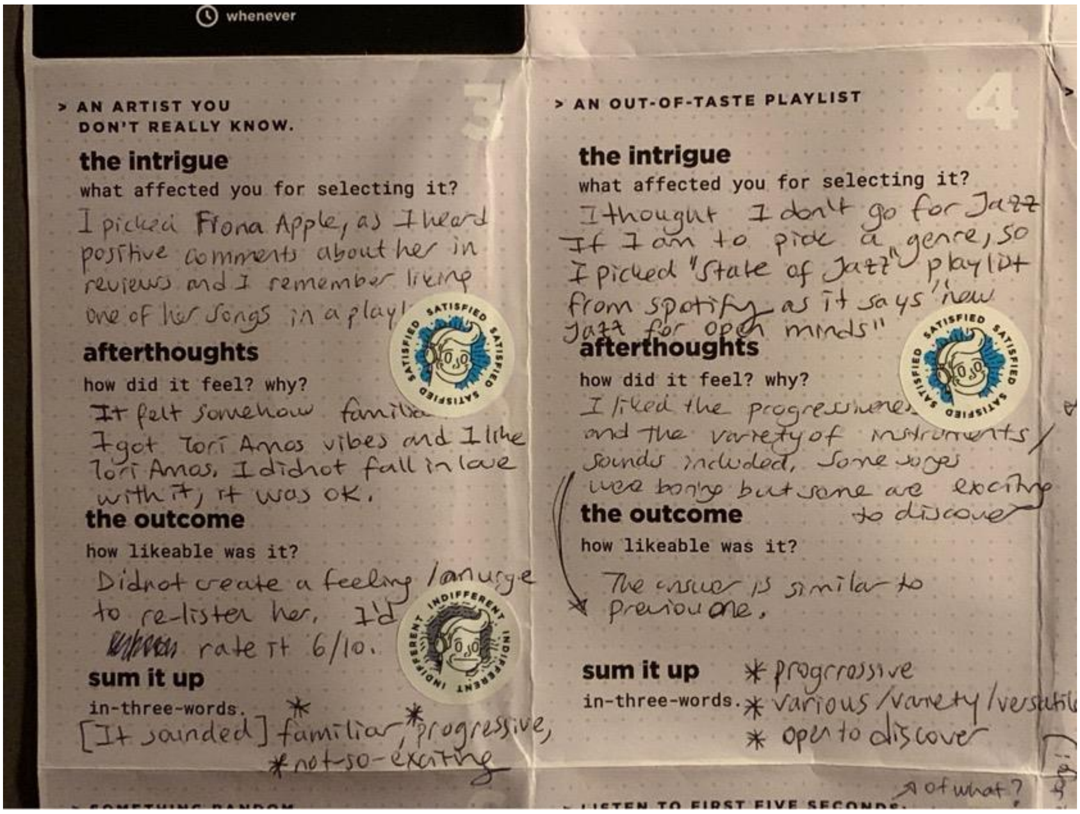



Figure 4.20 - A close-up of Participant-6's Music Discovery Challenge.

**Veiled Listening Session.** The participant's responses in this activity indicates a significant disparity between their expectations in response to extrinsic attributes of the music pieces and the responses they gave after listening to those pieces. Overall disparity leans towards a positive after-listening reception. In this case, results of this activity indicates a mismatch between the self-reported subjective responses extrinsic and intrinsic qualities of what they listen to (Figure 4.21).


Figure 4.21 - A back page (left) and front pages (right) of a Veiled Listening Session. The participant's affective response in parentheses points out a missed opportunity for including affect besides measuring the difference between the participant's before-listening expectations and after-listening experiences.

**Breaking-it-up.** This break-up letter written by the participant to their way of music-listening (indirectly) implies that listening to music this way entraps them in a filter bubble[26]: preventing them from discovering more music that might interest them. The participant also criticised themselves, suggesting that they were the one who created an echo chamber feeding unto itself through one's way of music listening. A criticism also goes to one from themselves: an apt metaphor might be

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[26] Filter Bubble refers to a situation in which a user becomes gradually more imprisoned in an imaginative bubble. This is due to reinforcement of the strength of that bubble by the bubble's reference to a sample space based on the user's past preferences, whilst also suggesting the same sample space it referred to in the first place. For example: A user starts listening to Alt Rock, prompting system to suggest more Alt Rock, and creating a feedback loop after the user listens to that suggestion: reinforcing the system for it to conclude that it should bring more Alt Rock to the user (Matt, Benlian, Hess, & Weiß, 2014).

that the artefact (Spotify as a music-streaming service in this case) functions as an echo chamber rather than the source of the echo itself, whereas the author further prescribes to themselves to be more open for (even) the negative experiences for being able to experience more diverse music (Figure 4.22). This is a thought that might seem counterintuitive at first as people tend to avoid negative things, yet there might be merits to it as also suggested by Fokkinga and Desmet (2012).

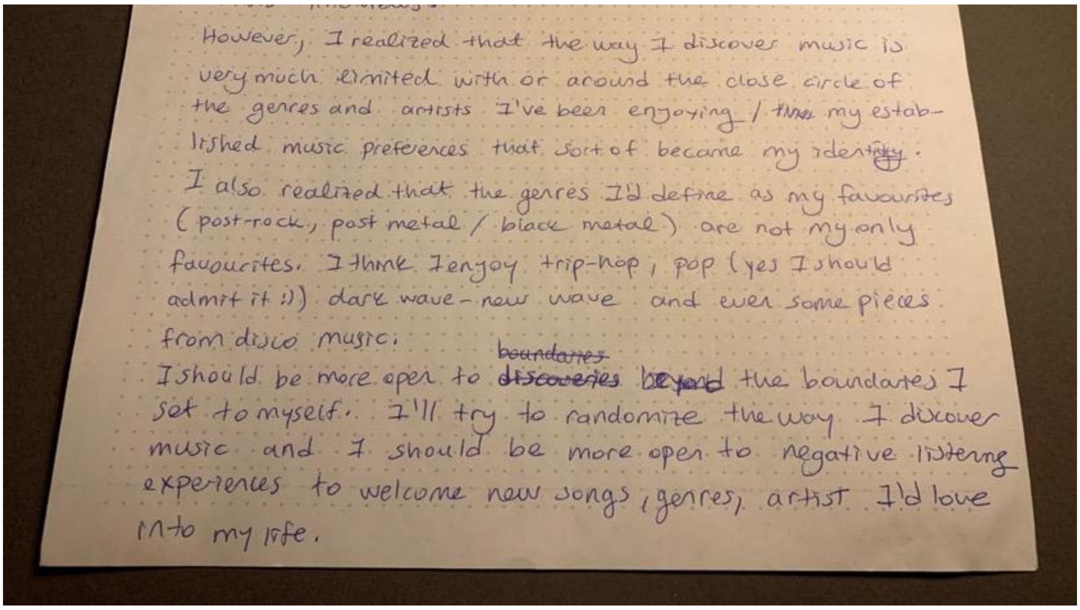
However, I realized that the way I discover music is very much limited with or around the close circle of the genres and artists I've been enjoying / ~~the~~ my established music preferences that sort of became my identity.
I also realized that the genres I'd define as my favourites (post-rock, post metal / black metal) are not my only favourites. I think I enjoy trip-hop, pop (yes I should admit it :)) dark wave - new wave and even some pieces from disco music.
I should be more open to ~~discoveries~~ ~~boundaries~~ beyond the boundaries I set to myself. I'll try to randomize the way I discover music and I should be more open to negative listening experiences to welcome new songs, genres, artist I'd love into my life.

Figure 4.22 - Bottom end of the participant's break-up letter, in where they also criticised themselves as a music-listener to be more open-minded (in terms of music discovery) aside of criticising the artefact.

**The Dream Cube.** This participant decided to 'break the grid' when shaping their cube – transforming the cube shape into a *truncated cube,* again, a *uniform polyhedron*[27] just like a cube, albeit more complex. Doing this gained the shape more faces to interact with and also making it take a lengthier time to land on a side (due to making it *rounder*). Interestingly, the notions the participant put forward for

[27] A three-dimensional object whose faces are regular polygons and vertices that are harmonious within the entire shape.

interaction also reflect the traits define their taste profile, like brightness and intensity (Figure 4.23).


Figure 4.23 - A Dream Cube with an altered form (by the participant). The cut-off edges add more dimensionality to the artefact and make it a truncated cube: affording more faces to interact with.

Furthermore, the participant considerately attached an addendum to their Dream Cube for elaborating on its **interaction timeline and features.**

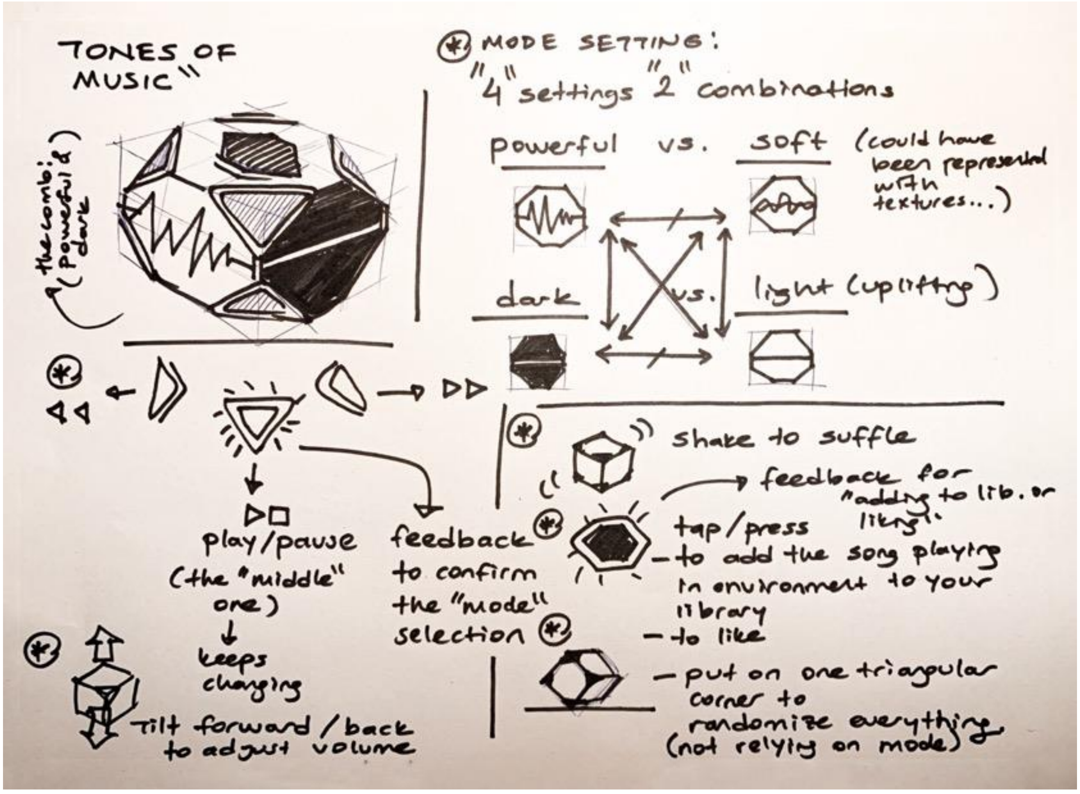


Figure 4.24 - The main faces were broken between dichotomies located at two opposing faces: *Soft* and *Intense*, *Light* and *Dark*, and two randomisation faces for shuffling. Furthermore, the cut-off corners work like an extension of traditional music-player controllers for starting, stopping, and winding forward the music pieces, while also enabling randomisation if it stands on a corner after rolling.

*In conclusion*, this participant demonstrated a unique taste profile that went beyond genres or well-defined types of music; in elaboration, their taste was rather defined with musical traits such as a certain brightness, intensity, and themes of the music pieces (all of which are intrinsic qualities of music) with very little regard to popular typologies. On the other hand, their approach for ill-defined issues is head-on as they're willing to trade hedonic utility for eudaimonic growth. Consolidation of their responses a illustrate their own schema adhering to the aforementioned qualities of music they listen to and how they respond to it, diverging from popular definitions thereof.

*Participant-6 will also be seen as a member of the 2nd workshop group in the subsequent phase.*

#### 4.4.3.3 Case III: Probe Kit of Participant-11

This participant demonstrated playful engagements with the probe kit activities, whereas their answers were concise and to-the-point.

**Playlist Tasks.** Music-listening behaviour of P11 somewhat differs from the former participants. A general assessment of their playlist indicates that the participant often returns to their music-listening *nucleus* after going through and listening to certain types (or maybe clusters) of music. Let's visualise it: like drawing a line by following the outer outlines of flower petals, the line returned to the central flower cap the petals connect to upon each revolution of the line.

**The-what-was-it-like-journal**. First and foremost, social aspect of music-listening stood out for this participant throughout the journal; in addition, they usually seem to listen to music for stimulation and mood regulation. A great variety of music-listening compositions (why, when, through what, how etc.) also indicates the aptness of the playlists for the occasion: poorly suited line-ups evoked detrimental emotional responses as vice versa (Figure 4.25).

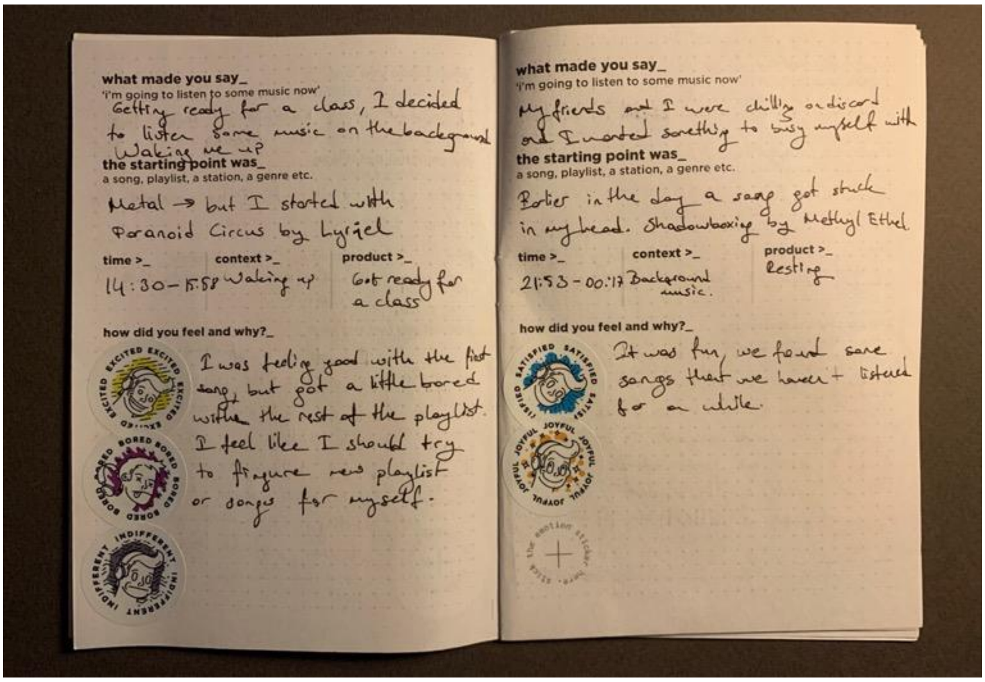


Figure 4.25 - Even though an initial music piece may seem apt for an occasion, it doesn't mean that a pre-curated playlist will be befitting in its entirety for the occasion (left page); in contrast, a more actively supervised music line-up is more likely to yield more satisfying results (right page).

**The Illusory Cards.** In a light-hearted manner, the participant supplemented their responses with bite-sized illustrations. An outstanding response is also coincidental with a journal entry of theirs, where they wrote that Eurovision is their guilty music-listening delight in spite of being an avid Metal listener who prefers dark and intense undertones; Metal, after all, is quite contrasting with the general characteristics of Eurovision entries. Interestingly, in spite of trashing the archetypes of the contest, they still enjoyed it (during a road trip) more than their preferred type of music as it proved to be a communally amusing listening session for them (Figure 4.26).

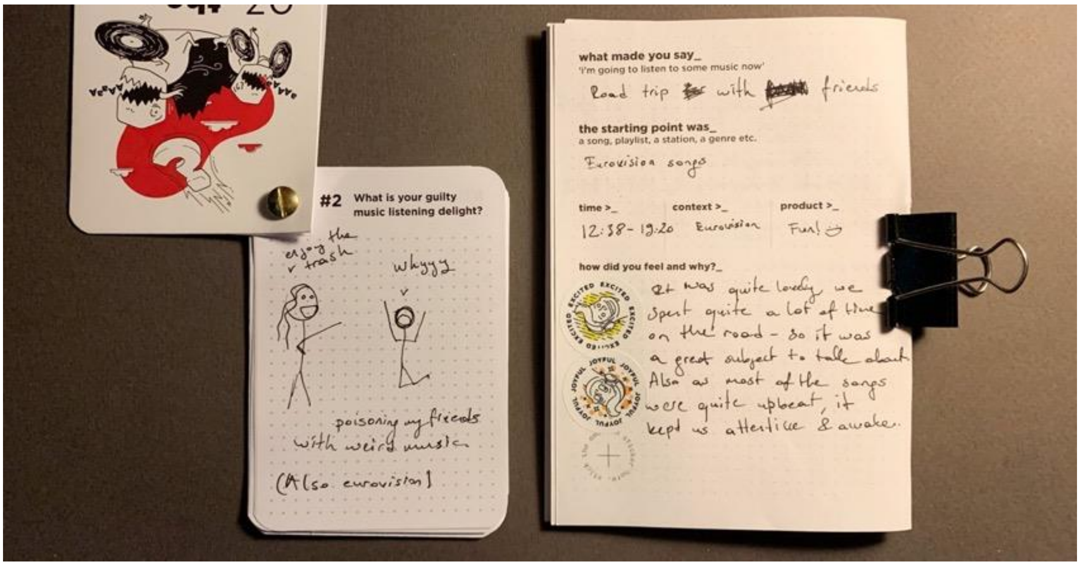


Figure 4.26 - Two entries that cross-over with each other: narrating the amusing facet of listening to Eurovision entries as they resonate as silly music pieces for the participants amongst a group of Metal music listeners.

**Music Discovery Challenge.** With the most positive appraisals given through this activity (in comparison to the responses given by other participants to the same activity), this one stood out; for this reason, it was examined more closely. There were two commonalities between P11's responses to this challenge: firstly, they always went through a bridge that connects their own tastes and the subject of challenge such as a new radio station or an artist they like; subsequently, they went over the extrinsic attributes of the music in front of them and take a heuristically-charged action.

**Veiled Listening Session.** Once again, the discrepancy between expectations and post-listening impressions is apparent. Although, there is an indication why another dimension would have been beneficial to include into this activity: a Likert-like scale in addition to matching of expectations. Comparison of two dimensions would have beneficial in drawing a more complete picture as fulfilment of expectations is not an equal of affect (Figure 4.27).

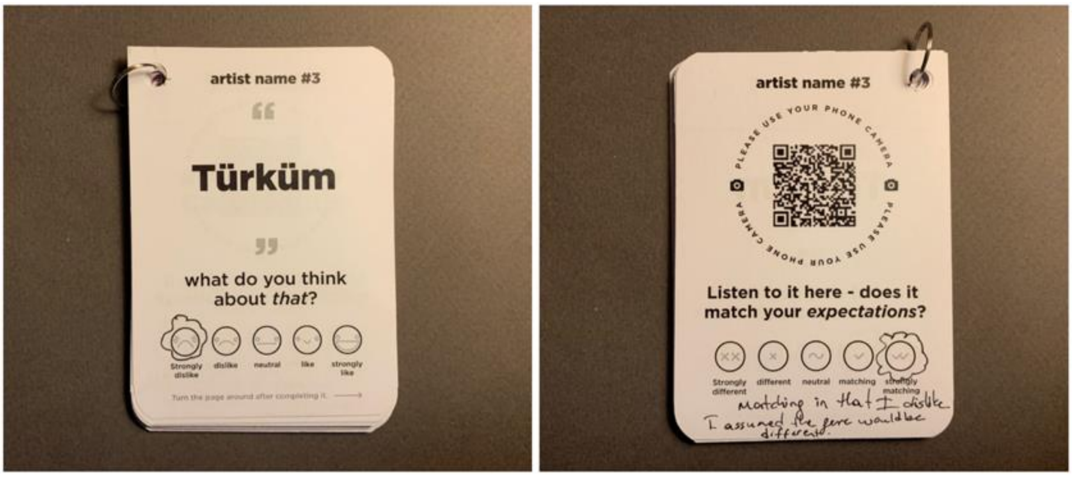


Figure 4.27 - Front and back sides of a Veiled Listening Session card. The participant expected to listen a piece of a certain genre (‘Türkü’ stands for Turkish Folk Music; ‘Türküm’ makes the word possessive), whereas they were met with a piece of metallic-sounding Electronic Dance Music, still to their dislike.

**Breaking-it-up.** In a manner similar to P6, this participant’s break-up letter also involved self-criticism towards how they listen to music. The criticism, again, is centred around the participant’s conservative attitude and behaviour whilst listening to music. Interestingly, their tendency to stay within the bounds of their taste profile was much more apparent in comparison to the other participants; however, their appraisals were much more positive overall, which was an unexpected finding. This doesn’t mean that they have more tolerance than the other participants, only that they have a greater potential to appreciate and enjoy music out of their comfort zone due to their limited previous exposure; moreover, we also need to consider that they didn’t make radically long ventures.

**The Dream Cube.** P11 utilised most faces of their cube for communicating an array of gesture-based interactions; three of the faces have on-surface means of interaction, and two out of these three possess screens. Even though the faces aren’t mapped with respect to each other, this cube communicates the (participant as) designer’s intentions.


Figure 4.28 - A number of controls can be seen in P11’s cube: shaking for a dramatic change-up, rolling for simple shuffling, waving for continuing on the same direction, turning a wheel to input one’s mood, a display showing what one enjoys, and a basic start and pause control, in no particular arrangement.

*Participant-11 will also then be seen as a member of the 3rd workshop group in the subsequent phase.*

#### 4.4.3.4 Discussing Outcomes of the Probe Kit Study

In general, the outcomes match with the ones that were expected and more; furthermore, providing in-depth understanding about the thought processes and noteworthy notions of interest. In spite of the answers seeming like niche and subjective in their own; they cumulatively pained an in-depth picture about the music-listener behaviours, albeit within a limited sample[28]. *In spite of* the constrained sampling, the outcomes about music-listening attitudes and behaviours came out to be significantly divergent, giving pieces of evidence to be utilised in the final design phase. Aforementioned outcomes are as listed below:

- **Varying emotional responses.** Range and intensity of emotional responses towards what they listen to vary considerably from a person to person.
- **Serendipitous patterns.** Consistent with the interview findings, every participant demonstrated unique listening patterns that hardly match each other: the flows of individual music-listeners' actions don't fit into generalisable models by themselves.
- **Only way is through.** Artefacts' affordances *do affect* how people choose what to listen to through affordances and constraints; moreover, affecting the manner the people appraise the music they listened to.
- **Mutual exclusivity of experiential qualities.** Possession of extrinsic information enhances more extrinsic experiential qualities of the experience; however, it also inhibits the emergence of certain intrinsic experiential qualities: there seems to be mutually exclusive qualities (beside of common ones).
- **Riffling as a heuristic.** Quickly skipping through parts of a piece of music is a consistently reliable heuristic for a listener for them to see how much they're going to like that piece.

[28] However, there is a sample bias towards the participants carrying the common characteristics of university-graduate young adult designers.

- **Optimal over extreme.** Complete neutrality (randomness) for music selection is a strategy that is likely to yield interesting, albeit undesirable results, whereas complete personalisation entraps the music-listener in a filter bubble: strategies that lay between them show most promise for enabling the most pleasing music-listening experiences.

### 4.4.4 Conclusion of the Analyses

As we initially discussed, the main purpose of this phase (interviews & cultural probes) was to get initial information about the participants' original attitudes and behaviours (prior to the research), and also for sensitising them to the relevant concepts. Nevertheless, the research data has also been instrumental in eliciting valuable information in accordance with the a-priori conclusions from the literature – emphasising the hypothetical concepts of this research[29] further. On the other hand, the participants' reception in general towards the probe kits was positive in salience, whereas they attributed their positive reception to the diversity of activities, which they thought to be intriguing; moreover, open-endedness and playfulness of the probe kits were noted for motivating for the participants to proceed with the activities in the kits.

In the end, integration of the findings of interviews (see 4.4.2) and probe kits (see 4.4.3.4) with each other into a holistic frame resulted in a complex model with a set of relationships pertaining to clusters under music-**pieces**, music-listening **artefacts**, music-listener **attitudes**, and music-listener **behaviours**; in consequence, all of which connecting to **music-listeners** as the focal node within the context of human-artefact-media interrelation (see Figure 4.29).

[29] How the qualities of extrinsic information communicated by an artefact to a user (prior to interacting) may influence that user's attitude/behaviour in their interactions with the artefact: affecting the user's appraisal of the experience.

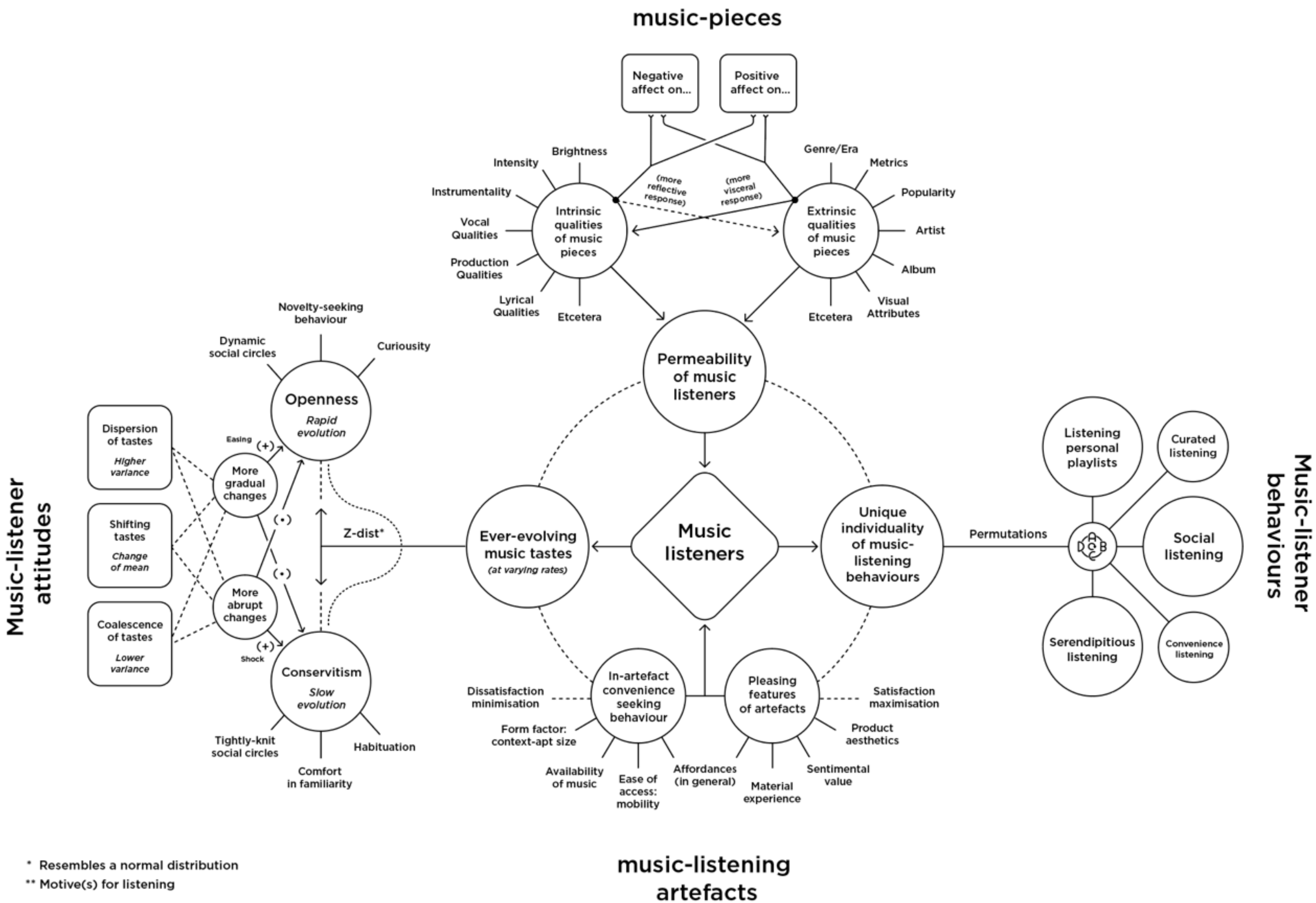


Figure 4.29 - Model of User-Artefact-Music Relationship; showing the coalesced analysis results of this phase in detail.

# CHAPTER 5

# RESEARCH THROUGH DESIGN PHASE II:
# DESIGN WORKSHOPS FOR CONCEPT DEVELOPMENT

Workshops will commence in the wake of the sensitisation process, through which the participants obtain attitudes towards the underlying concepts (explicitness/implicitness of interactions), who are also expected to reflect their attitudes through the Dream Cubes. Serving as the precursors to the workshop activities, those cubes are the beginning proponent of the design activity in which the participants take part long before they get together in workshops – note that the analysis of those cubes will be made later in this chapter as a part of the design process. In this phase, three parallel and identical (in terms of structure) workshops will take place for three distinct groups: members of these groups will be collaboratively furthering the designs of the cubes in two stages of the workshops per se (see 5.4), which then will be dissected and analysed (see 5.5). In the subsequent phase (Chapter 6), outcomes of those design processes will be finalised in a solo design phase after the analysis of which.

## 5.1 Methodology

### 5.1.1 Workshops as Contextmapping Sessions

Contextmapping involves doing a session after sensitisation (probe kit study) of the participants into the topic. The purpose of this part is to enable a generative activity where the ideas sensitised to them start to take shape.

In Contextmapping, a session is usually done to provide design insights to the designers for them to utilise in a future design activity; however, participatory design activities will be taking place in which the participants utilise their experiences and ideas from the previous phases. Another distinct employment of Contextmapping in this research is that the participants start designing artefacts as early as in the sensitisation phase to be utilised in the workshop, which gives them means to have more in-depth involvement with generative activities.

In this research, the session is done as a workshop where multiple participants come together – the reason why this is done instead of doing sessions with the participants one-by-one is to foster a creative environment, in where the participants can collaborate and naturally clash their ideas. As the participants have design background, this activity carries a vital importance for deliberately preventing design fixation – a pitfall where designers are prone to fall in love with their creations (Jansson & Smith, 1991).

## 5.2 Planning for the Workshops

### 5.2.1 Allocating the Participants into Groups

The design of this research demands division of the participants to their respective groups and pairs in a deliberate manner. This is due to the conflicts of interest between the participants and ethical considerations of this research; in addition to that, because of probable circumstances in which some participants may dominate their groups – outspeaking or silencing their partners, which needs to be avoided to get as rich as possible and most pronounced data from each of the participants. There are three reasons for this arrangement as discussed below.

Firstly, possible conflicts of interest may emerge due to the hierarchical relationship and significant distance between the fields of expertise of the participating parties. For example, it might be possible for an MSc student to be intimidated by an instructor/lecturer in their respective institutions; for this reason, they need to be put into different groups. On the other hand, the aim of this research is to allow outlying and even unorthodox thoughts to emerge, which can be hampered if there is a discrepancy between the level of expertise of the participants.

Secondly, personality traits can affect the participation of the participants. For example: a dominant person can drag their group mates easily to their way of thinking, who might (unbeknownst to themselves) easily suppress others without the proportionate resistance from someone.

For the reasons mentioned above, the participants were divided into their respective groups and pairs, which is as is, as shown in the diagram in the following heading.

### 5.2.2 Outline of the Workshops

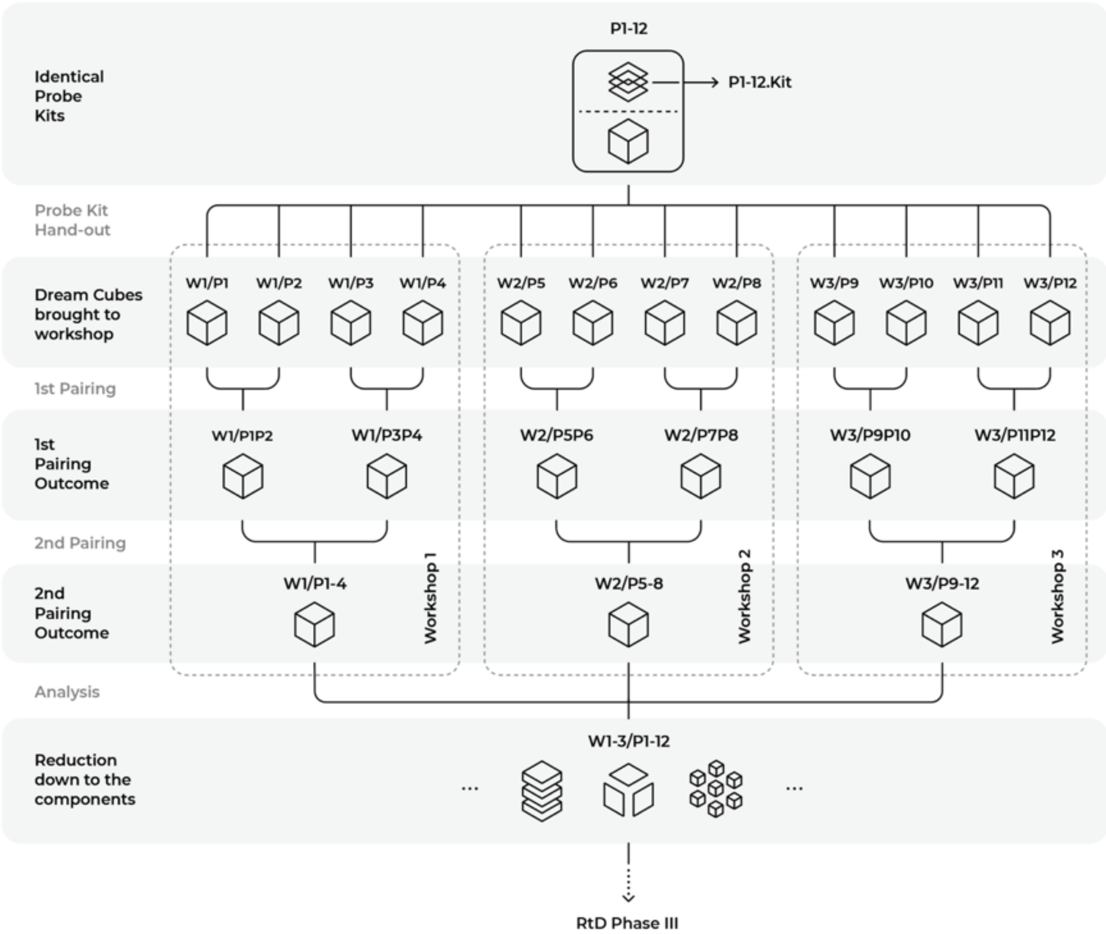


Figure 5.1 - A diagram detailing the outline of the workshops (session part of contextmapping), and flow and handling of the data generated.

As previously mentioned, each participant was given a ‘Dream Cube’, the aftermost activity included into the cultural probe kits. Each participant is expected to conceptualise a music-player with respect to their understanding and interpretation of the cultural probe experience with reference to the design requirements given to them in that particular activity. Having created those conceptual artefacts, everyone will have their own ideas about how this kind of an artefact should work when they arrive to the workshop session. Each workshop will take place once the monthlong duration of the sensitisation (cultural probing) phase for each of all four group members culminate. Time and place of the workshops will be determined with respect to the availability of the group members.

A tailored approach will be utilised in the workshop sessions. The aim is to initiate discussions by fostering conflicts, compromises, and wild ideas throughout the sessions. There will be three sessions consisting of groups of four: equating to 12 participants in sum, in which two phases of design activity will happen by progressively coalescing the participants into pairings (Figure 5.1), and eventually merging them into a group of four. Some ideas will emerge while others will be eliminated through each phase; because of this, an idea-generation and combination tool will be given to the participants to aid them with a more structured approach and standardise the process (see Figure 5.2).

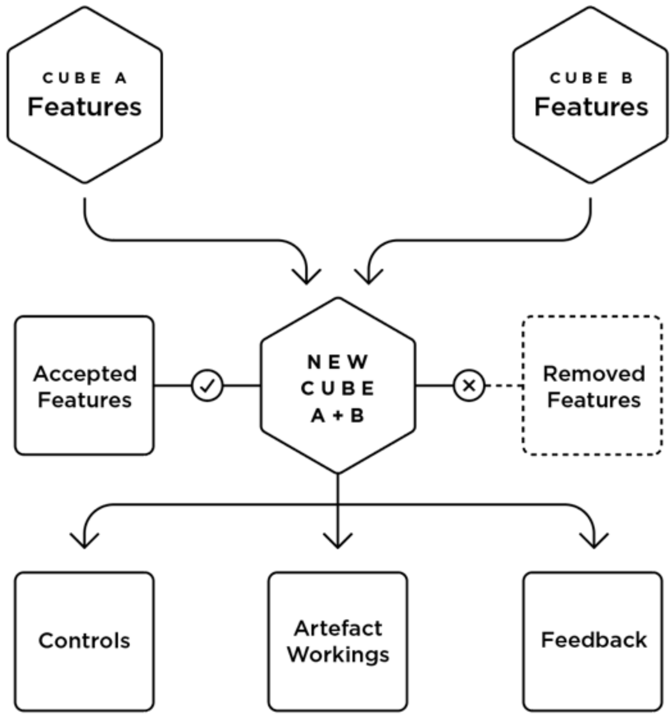


Figure 5.2 - Idea combination (mash-up) approach that'll be utilised in the workshops to aid idea-generation process after each pairing.

### 5.2.3 Materials and Software Used in the Workshop

Even though workshops used to be done co-spatially, advancements in technology allow them to be done remotely, yet afford taking actions in them in a manner as if it is co-spatial. A number of affordances need to be enabled to take the places of stapled tools of physical workshops. First of which is face-to-face communication, second one is a space, and the last kind are the stationaries such as sticky papers and pens and such. Fortunately, with the advent of social distancing (Per COVID-19 pandemic), the tools became ubiquitously accessible to the users and became more robust than ever before in terms of their features and stability. Ones we'll be utilising are as follows:

- **Zoom.** Zoom is an Internet-connected communication platform. Its purpose is audio-visual communication between the workshop participants. In addition to that, this software also allows the audio-visual media to be recorded in an efficient manner.
- **Miro.** This platform functions as a virtual space that acts like a work surface that allows collaborative editing of text, shapes, media, and elements of such in real-time: replacing a physical workshop space. Workshop materials made to use in Miro are as follows:
    - Idea Mash-up Canvases for combining cubes into iterations
    - Drafting Canvases for visualising the iteration results
- **Dream Cubes.** Even though the cubes are physical objects, the participants were given identical templates thereof, who received the cube templates shipped to them alongside the probe kits (section 4.2.2).
- **Computer and Internet.** Participants need to possess those both to participate in the probe kit activities and to run Zoom and Miro.
- **A Presentation.** Lastly and most importantly, a presentation will need to be made for orientation of the participants and to supplement the workshop with visual material, as it'll be elaborated on the following heading (see 5.3).

## 5.3 Introducing and Discussing the Prototypical Definition of Explicitness of Interactions

For the workshops to commence, there will be a need to constitute a common language about the concepts that'll be discussed. As the participants are designers, they already share a common language. However, in order to convey a common understanding focal concepts of the study that are yet-to-be-defined, they were indirectly sensitised to those concepts through employment of surrounding concepts they're already accustomed to. Therefore, in order to facilitate more focused discussions about the yet-to-be-defined concepts, open-ended prototypical definitions will need to be conveyed to the participants.

For facilitating the discussions mentioned earlier, the workshops will begin with a presentation, which includes points of discussion where participants will be invited to talk about their Dream Cubes concepts and the thought process went into conceptualising them throughout the final part of their probe kit activities.

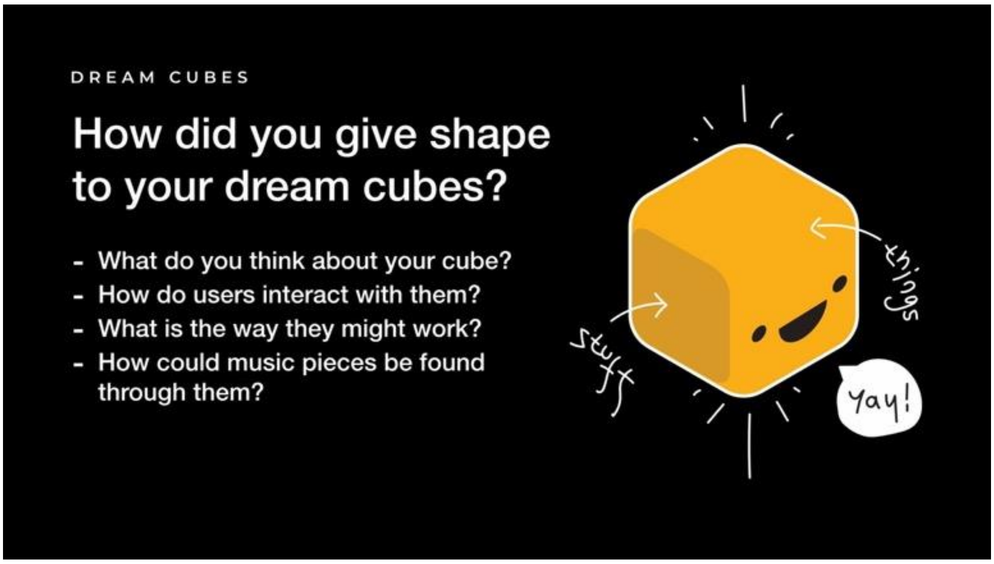


Figure 5.3 - Participants are asked about how they designed their Dream Cubes in the third slide, at which they tell about their designs and discuss about them.

After wrapping-up the discussion about Dream Cubes, the participants need to be introduced to a prototypical definition of the hypothetical concept they were indirectly sensitised to.

Absence of a concept that may pertain to what we'll be referring to as *Explicitness of Interactions* (let's abbreviate it as EoIX) within the Interaction Design literature called for a prototypical definition of what might it represent; for this reason, a prototypical definition was devised, and the participants needed to be conveyed about it (EoIX) before commencing the in-workshop design activities.

***Related background between-the-lines***. As initially imported to the Design (and HCI) literature from Environmental Psychology field by Norman, the concept of affordances[30] – and its cohort[31] – have become a cornerstone of the aforementioned fields since. However, upon going through the literature for something that may pertain the uncertainty facet of affordances, no well-corresponding concept surfaced from the literature.

The import of affordances per se correspond to linear functions of an artefact from the perspective of a user, overlooking a range of effects uncertainties may have on user experience. This is natural because of its implementation to the related fields prior to 2000s when computerised artefacts' capabilities were quite limited (as also discussed in 2.2.3.2); in comparison, those computerised artefacts now afford exponentially high possibilities at one's whim thanks to their capabilities. Uncertainty is a notion that is often disliked by designers and computer scientists for good reason: it is not preferrable for them and also for the end user to have to deal with something uncertain or unexpected. These notions were (and still are) normally associated with malfunctioning or poorly designed systems with the exception of the ones that intentionally generate uncertainty like gambling devices

[30] The actions things allow (or *afford*) animate beings to execute through themselves (Gibson, 1986).
[31] Concepts such as signifiers, feedforward, mapping etc.

and games. On contrast, the concept of uncertainty needs to be discussed with diligence when talking about interactive artefacts in today's world. For example: A music-player may afford playing any piece of music, and array of music pieces, or a certain piece: each of which can enable a whole different experience.

Moreover, we shouldn't forget that these computerised devices are also known as *information systems*: able to separately (or jointly) afford interactions as information and control, affecting the user on many convoluted levels. This is particularly interesting due to the significant differences between a *thing* from Gibson's (also pre-2000s Norman's) time and now: things were as what they seemed to be (except illusions), and static or quite limited; whereas, given enough power, a computerised artefact is able to coalesce things in such manners that it is even able to affect how a user experiences time and space, with respect to the mental and cognitive resources of a person[32]. In hindsight, the manner an artefact affords (the communication of) information and agency to the user may can affect their experience significantly: think about a game of chance (or logic) or a multiplayer game, the process of deciding on where to eat or what to watch, and also merely listening to music through varying types of artefacts (also see 4.4.3.4).

**A prototypical definition of EoIX** was devised as "Explicitness of interactions is a degree of certainty in which the artefact communicates its future state to user, who in turn manipulates the determinants of the system's future states while interacting with the artefact."; followed with a simplified TLDR[33] definition: "How the device informs and empowers you about the future result of your interaction."

[32] Apart from the artefacts we'll be talking about, an example about the extent of the blurring the experience of space and time might be given as a social media platform (like Facebook). In a manner completely different from a physical artefact, a social media platform is virtually unattached from one's real context and may present media irrespective of a certain chronological or spatial order in spite of offering information and user agency to a great extent, which one might expect to make things more concrete, albeit resulting in a partial detachment from one's sense of time and space.

[33] Abbreviation of "too long, didn't read".

On the other hand, participants need to be given examples that mirror this concept; therefore, two examples at the opposing ends of the explicitness range (even ones in-between) need to be given to the participants to communicate and exemplify the concept of Explicitness of Interactions, two arms of which being *implicit* and *explicit*.

**A prototypical definition of *implicit* interactions.** Before giving the examples, in relation to the forthcoming workshop activity goals, a prototypical definition of the implicit half of the range needed to be devised in consistence with the definition of EoIX. Therefore, the prototypical definition of implicit interactions was devised as in Figure 5.4. Even though the *explicitness* end will not be deliberated upon, to conserve limited time and attention resources, an inversed definition of *implicit* interaction will be assumed to suffice as the workshops are focal on *implicitness*.

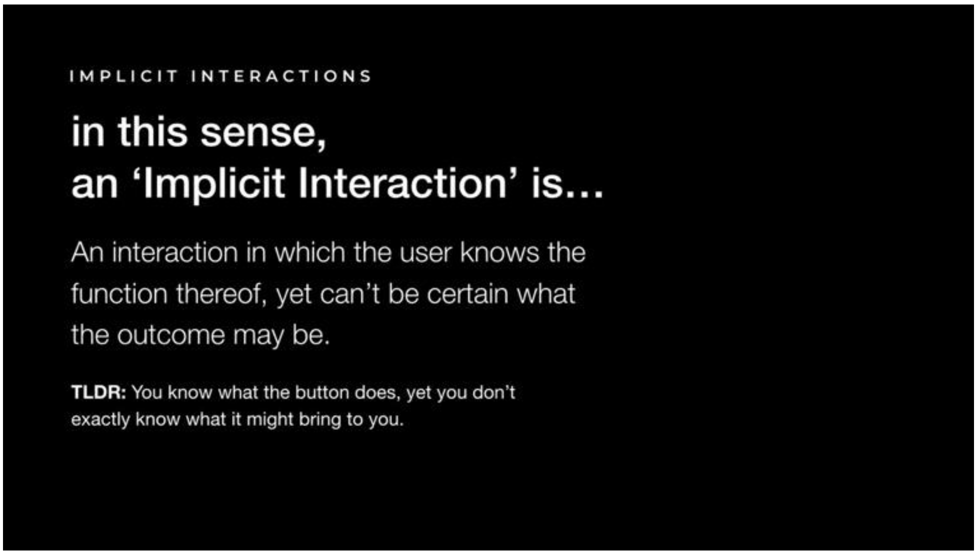


Figure 5.4 - A slide from the workshop communicating a prototypical definition of implicit interactions.

**Discerning the applicable examples.** As examples, let us consider two hypothetical artefacts on the opposing ends of EoIX range (Figure 5.5), in which control scheme is held constant with a single button. Most *explicit* one transmits an array of information regarding the consequence of user's interaction (left); on the other hand, the most *implicit* one conveys no information about the future but that there is possibility something will happen upon pushing the button on it.

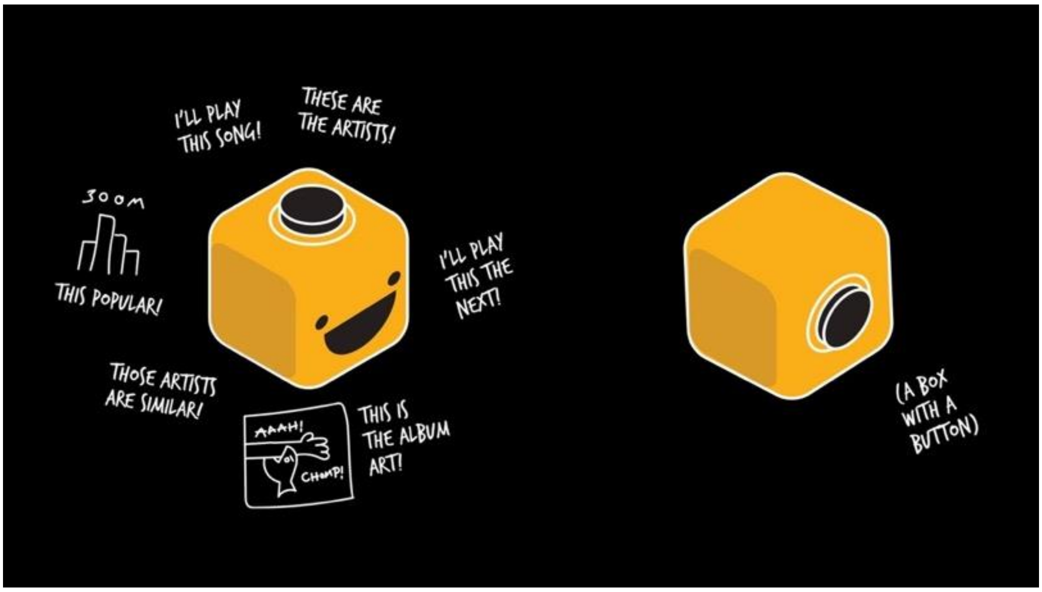


Figure 5.5 - A slide from the presentation depicting two hypothetical artefacts on the opposing ends of EoIX range.

In spite of creating hypothetical artefacts at the ends of the range, other possible examples that may lie on the interval of that range need to be given. This is done for prompting the discussions with more material to deliberate about in order to see where those examples may correlate to this hypothetical range as per their properties.

For the aforementioned end, subsequent to a self-induced thought-experiment, certain artefacts were decided upon to be given as examples. As the researcher, I prompted this experiment by asking "What might be the (interactive) artefacts that give as much as possible information about what'll happen following the interaction, prior to that interaction? And what might be counterparts of those (interactive) artefacts that give as least information as possible?" to myself. A few examples made themselves evident: counterparts of which lying before and after the digital transformation of 2000's. These are analogue and digital cameras, analogue radios and mainstream music-streaming services, and also the non-digital artefacts that give limited and uncertain information about what what'll happen upon interacting with themselves, such as a dice. These were put on an axis to be opened-up for discussions during the workshops (Figure 5.6).

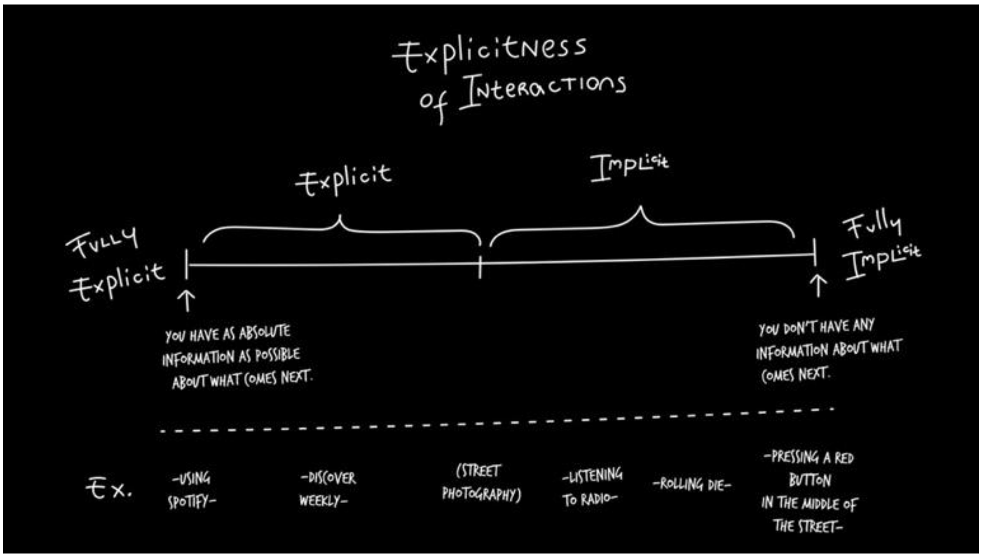


Figure 5.6 - A follow-up slide from the presentation for discussing what may lie on the interval of EoIX.

**Briefing the Participants for the Design Activities.** In subsequence to the 15 to 30 minutes-long discussions about EoIX, workshops will commence by briefing the participants about the design goals for the workshop activities (Figure 5.7) that'll be worked-on in two phases of subsequential participant pairings; the participants will be designing as a full group of four in the latter phase of the workshop.


Figure 5.7 - Design goals of the workshops: designing a highly implicit music-playing artefact whilst giving the user as much agency (control) as possible.

**Post-Workshop Discussion.** Subsequent to the design activities, groups will be prompted to discuss what they designed, how their design evolved, and the extent and manner they achieved the briefed design goals.

## 5.4 The Workshop Procedure

Each workshop commences once all four participants and the researcher (moderator in the workshops) meet up in the designated time and location. All events are supervised/supported by the moderator(s) of the workshop. The procedure is organised with respect to the following sequence-based events:

1. **Discussion About the Cubes.** Each participant will be presenting their dream cube and their thought process behind creating it, which also a warm-up activity to open up the participants.
2. **Presentation for Introduction and Design Briefing.** Initially, a presentation about facets of Design for Interaction (D4I) is made that is followed by an introduction to explicitness of interactions.
3. **EoIX Discussion.** Subsequent to the presentation, a discussion will be made regarding the participants' understanding and thoughts about EoIX to

advance the prototypical notions thereof: developing impartial concepts and discovering their basic properties.

4. **First Stage.** Participants will initially be coupled in pairs for discussing and generating a new idea through conflicting and compromising, I am assuming that this composition will help bringing out the weaknesses and strengths of each of their initial concepts.
5. **Second Stage.** The activity will be repeated once again by grouping up all members of the group together into one group, which is planned to enable a second iteration layer, processing the concepts even further.
6. **Discussing the Results.** A post-workshop discussion will take place for the participants to discuss/express their thoughts regarding the research elements they interacted with up until that point to bring final remarks to light.

**Note:** *From now on and throughout the subsequent chapters; as the author, workshop facilitator, and solo designer (of RtD Phase III) of this research, I will be referring to my own actions and perspective through the first person due to assuming a more direct and active role.*

### 5.4.1 Workshop 1: Mixed Group

Composition of this group is comprised of a mixture of individuals from academia, practice, or both (P1, P2, P3, P4).

The first workshop took about 4 hours (from 9am to 1pm) to complete including a few breaks within a single day of a weekend, to which all the designated participants attended throughout its whole duration. The participants and the moderator met in a Zoom meeting; in addition to which, participatory design activity was done within a single shared Miro board. The workshop process was video-recorded through the point-of view of the moderator (and an assisting participant to amplify the coverage) through Zoom.


Figure 5.8 - Beginning of the presentation as it was being made to the participants, whose feed are seen through a frame at top-right of the screen.

All participants were invited to a Zoom meeting and spent the first 15 minutes for greetings and social interactions unrelated to the research.

#### 5.4.1.1 W1: Sharing the Dream Cubes

Initially, all participants talked about their dream cubes to warm-up at the beginning of the session; however, two of them did not have it in-person, so that they conveyed the qualities of their cubes through other means. The presentations were done on volunteer-basis, taking place as in the following order: P4, P3, P2, and lastly P1.

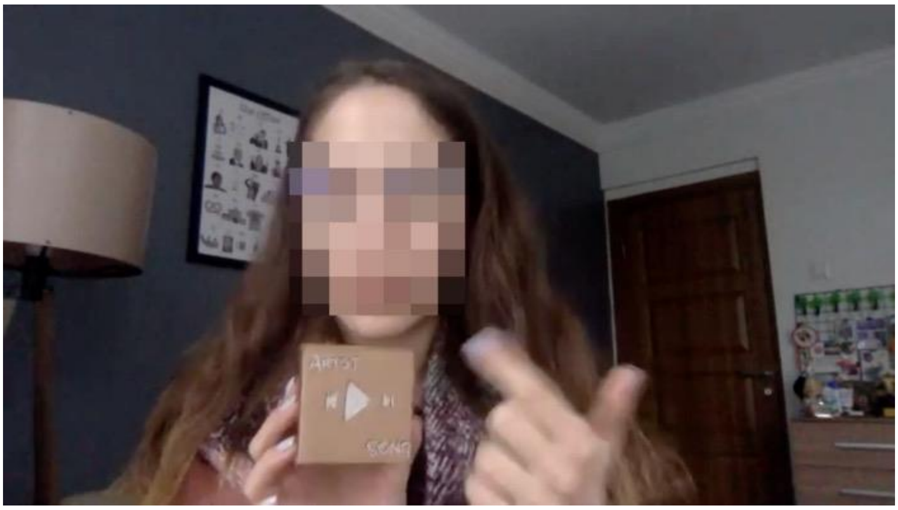


Figure 5.9 - Participant-4 presenting their Dream Cube at Zoom’s spotlight.

**Cube of P4 [W1/P4].** The first volunteer was P4, who designed their artefact in very close semblance to conventional digital music players. It displayed song, artist, playlist, and album art information whilst affording playing, going back/forward, and search controls.

**Cube of P3 [W1/P3].** In a manner similar to P4, this participant took a rather conventional route yet emphasised on the sensations the artefact may induce by saying “...my whole experience changes after looking at the lyrics. I also like the playlists based on moods: apart from artists or albums, I like finding music through based on what kind of a sensation I seek.”.

**Cube of P2 [W1/P2].** This participant, on the other hand, designed an intelligent artefact that responds to their emotions and mood through sensing them. The reasoning behind it in their own words is “I'm looking for something that senses my mood to recommend music tracks – more like something I need. Rather than thinking about what'll be on faces of the cube, I want to see personalised track recommendations per my moods.”, meaning that they seek somewhat an intimate listening experience.

Figure 5.10 - In-spite of being physically distant from each other, playing around with camera filters has been greatly beneficial for lightening the air and easing everyone into participanting to the discussions.

**Cube of P1 [W1/P1].** Last presentation was made by P1 (also see 4.4.3.1), who elaborated on quite unorthodox concepts in a manner diverging from rest of the group. Their design was conceptualised around directly mapping emotions to corresponding actions/gestures taken through the artefact. Like rolling for randomisation, throwing for conveying disliking a piece of music, or caressing for inputting being pleased with the music.

#### 5.4.1.2 W1: Discussions About Explicitness of Interactions

Following the previous step, I (as moderator) started the presentation titled “Online Workshop: Designing Artefacts for Implicit Interactions” as per the sequence shown under The Workshop Procedure (Chapter 5.4). The participants proceeded with the discussion by trying to make the meanings out through giving examples that could solidify the concepts in their heads.

**Power-up button of PlayStation 4.** P1 gave power-up button of the original PlayStation 4 as an example, they then suggested that it might be an implicit interaction due to its almost-camouflaged location. This example sparked a discussion about what the extent of explicit and implicit interactions might be, concluding with a consensus indicating that the concealed button, in fact, is rather a hidden affordance. On the other hand, upon a further discussion, we concluded that an implicit interaction would be related with the uncertainty of what that button might do. Let's say, hypothetically, we know that particular button's function is powering-up; it would be an implicit interaction if we don't exactly know what pushing that button might bring to us: whether it's a PlayStation menu, or an Xbox menu and etc. Furthermore, we can also say that it is debatable whether the uncertainty of that button's function for being a power-up or something else is a property of an implicit interaction, or not. These indicate that contextuality, like it is in affordances, is a consideration of an interaction's explicitness.

**Binary uncertainties of opening a door.** Another example is a more classic one[34], given by P4: a door handle, which actually opens the door up for more debates. You see, without context that pertains whether that door can be opened or not, which directions it might be opened to, and even whether it shows what is beyond them could also be factors that make that interaction an implicit one. Could we then consider that implicitness might be a pertinent trait of affordances?

**A coffee machine without indicators.** Lastly, P4 expanded on the topic through their coffee machine, a machine shows no indicator about the doneness of the coffee. User knows that the brewing process will commence by pushing the sole button on the machine (given the ingredients are in place); however, they have no idea when the coffee will be done and how well it'll be done at a certain point at where they stop brewing it, which can mean that that interaction may be an implicit one. This would require either vigilance or a cumulative experience for dealing with that machine on the user's part, which then brings the user's past experience as a part of their agency into the equation.

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[34] As originally given by Norman in his seminal work (2013).

#### 5.4.1.3 W1: First Phase

Each participant was matched with a partner to ensure a balance between their personal and professional competencies for the first stage of the workshop as follows: P1 with P2, P3 with P4. Each pair was then placed into their respective breakout room.

**First Pair [W1/P1P2].** This pair decided to go with a more playful route, about which they were inspired by their daily lives. They conceptualised an artefact that sensed the user's mood (through sensors that recognised the emotional states and the context) and responded accordingly. In addition, they believed it was essential to support the experience through multisensorial feedback due to the lack of explicit features (see Table 5.1 for case-specific details).

*As this is the initial case of the repeated processes employed in the workshops, it'll be supplemented with images as a walkthrough thereof.*

Firstly, the pair was supplied with their respective personal canvases atop their common mash-up canvas for them to effectively communicate their dream cubes to each other either putting a picture thereof or drawing them. Then, they're needed to transfer the prominent features onto their personal sticky notes (coloured blue and yellow in Figure 5.11). Following it, they are required to combine their selected ideas through a set of sticky notes (green) to integrate them to their mutual concept and eliminate the rest (orange). On a side note, the mash-up process is a practical interpretation of the idea combination model (see Figure 5.2).

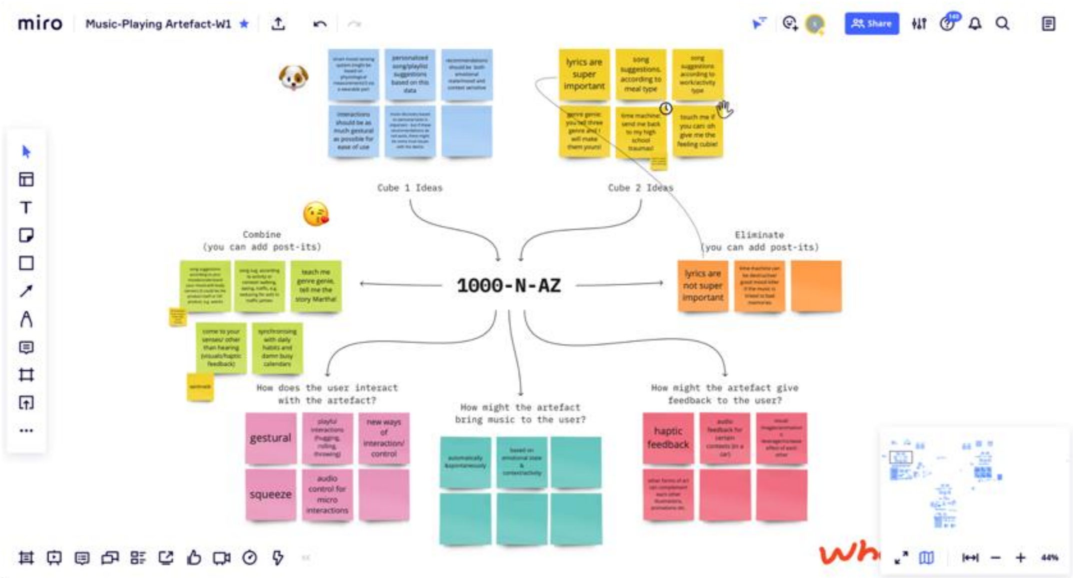



Figure 5.11 - P1 and P2's Idea Mash-up Canvas in Miro as a pair. See Figure 5.2 for the workings of this step.

In sequence to the previous step, they're directed to divulge controls (pink), artefact workings (mint green), and feedback functions (red) to respective sets of sticky notes, which they'll be employing in the Conceptualisation step.

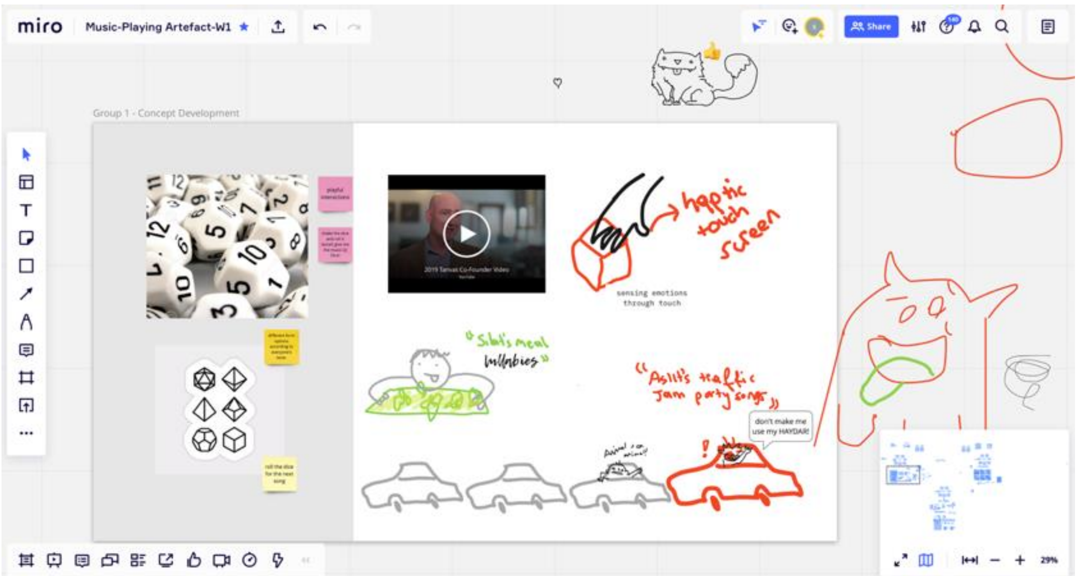



Figure 5.12 - P1 and P2's Conceptualisation Canvas in Miro as a pair.

In the Conceptualisation Canvas (Figure 5.12), the participants are required to conceptualise the features they divulged about in the previous step into mock-ups with a fidelity of their choosing. In this case, the participants were preoccupied with communicating the daily life scenarios with each other; in consequence, they could not visualise the conceptual artefact in a limited time.

Upon the conclusion of this phase, the pair (P1, P2) was grouped up with the other pair (P3, P4) that worked on their concept in parallel simultaneously – so will the other pairs in first phases of the remaining workshops.

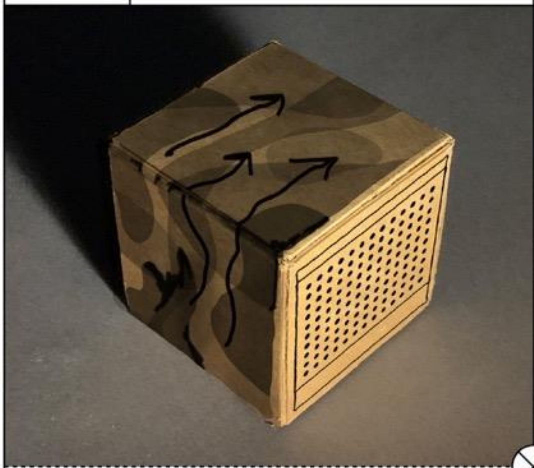
**Second Pair [W1/P3P4].** On another line of identical canvases, this group worked together to eliminate the explicit features which they integrated to their respective dream cubes and decided to make up for the reduced means of control through devising an artefact the recognised the behaviour of its user through machine-learning and matching that info with the contextual data it would sense (also see Table 5.2).

#### 5.4.1.4 W1: Second Phase

Consequential to the first phase, both teams were merged into a single group in which they repeated the same process by referring to the artefacts they conceptualised in that phase, only as a group of four instead of two.

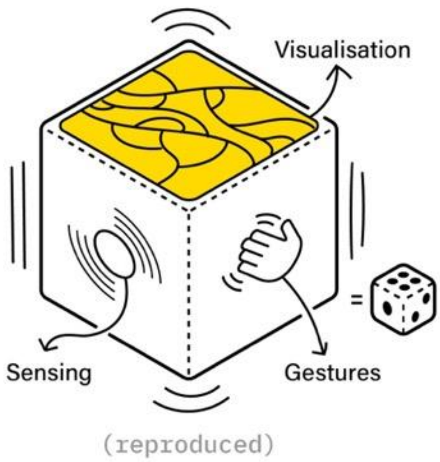
Through the incorporation of playfulness and mapping the user behaviour into manual physical and tangible interactions (instead of sensing), they conceptualised a plush alien-like music-player that recognises the user's behaviour towards itself and brings music accordingly. An example might be shaking for bringing more upbeat and dance-like tunes while squeezing for recommending more intense tunes. In relation to its somewhat anthropomorphic persona, it communicates its understandings and prompts verbally through a screen and/or voice (see Table 5.3).

Table 5.1 - Combination process of the cubes of W1/P1 and W1/P2.

| W1/P1 | P1's CUBE | W1/P2 | P2's CUBE |
|---|---|---|---|
|  | |  | |
| Speak to it, shake and roll it to interact / touching them shares music / multisensorial feedback / time machine displaying past art and images for experience enhancement | | Mood-sensing features that recommend music to the user / gestural interactions / personalisation / context-sensitivity | |

| | |
|---|---|
| — | Lyrics, music attributes / time machine |
| + | Context-sensitive recommendations, suggestions for user's mood and emotions / multisensorial feedback / story teller, visualiser / syncs with daily activities / gestures |
| W1/P1P2 | "1000-N-AZ" |






CONTROLS ⟵ WORKINGS ⟵ FEEDBACK

Playful and gestural interactions | Audio controls for not-so-important interactions

Emotional state sensing | Context and activity sensing

Automatic and spontaneous

Haptic or multisensorial → Else: audial

Animations to enhance the listening experience

| KEYWORDS | Emotion and Context-Sensing; Playful, gestural, Multisensorial Interactions |
|---|---|

Table 5.2 - Combination process of the cubes of W1/P3 and W1/P4.

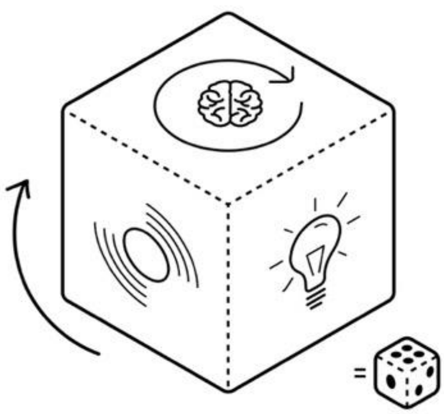
| W1/P3 | P3's CUBE | W1/P4 | P4's CUBE |
| --- | --- | --- | --- |



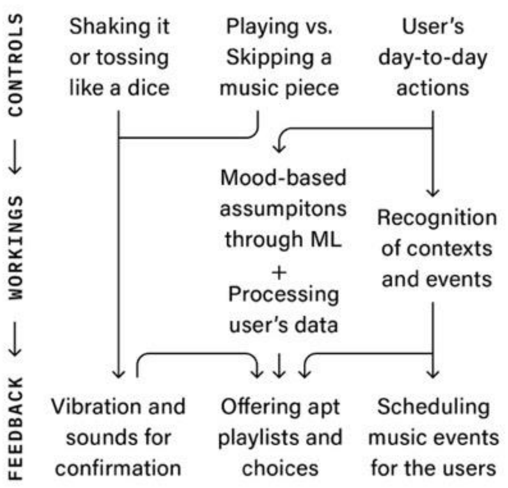
Lyrical overlay / mood-based playlists, mood sensing and suggestions, skipping-triggered machine learning occasion-based suprises

Search, album cover, lyrics / scheduled releases / randomised suggestions / gamification

| | |
| --- | --- |
| — | Trivia, lyrics, stories, album cover, album name, song name |
| + | Accessory-based assumptions, mood-based assumptions and learning, activity and context-based assumptions (walking, being in enclosed spaces, parties etc.) skip-triggered ML / scheduled surprises / small size |
| W1/P3P4 | "GENIUS" |

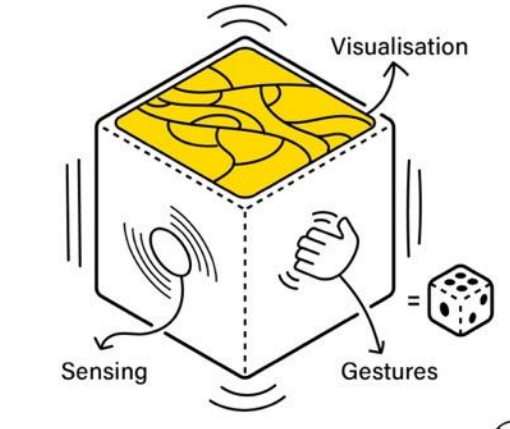
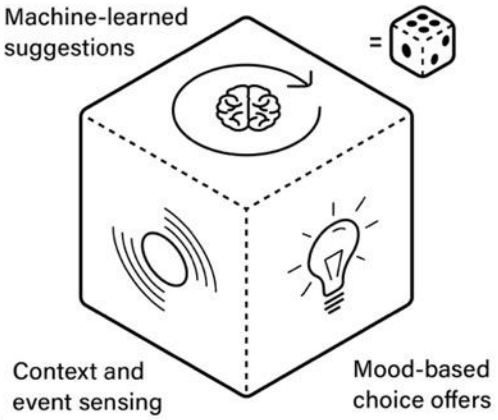



(reproduced)




| | |
| --- | --- |
| KEYWORDS | Moods & Emotions, Machine Learning, Suggestions, Contextual Recognition |

Table 5.3 - Combination process of the 1st phase artefacts of W1/P1P2 and W1/P3P4.

<table>
<tr><td>W1/P1P2</td><td>"1000-N-AZ"</td><td>W1/P3P4</td><td>"GENIUS"</td></tr>
<tr><td colspan="2">
</td><td colspan="2">
</td></tr>
<tr><td colspan="2">Emotion and context sensitivity and sensors / multisensorial interactions / playful & gestural input, sensorial enhancements</td><td colspan="2">Moods and emotion input / machine learning / suggestions / context and event recognition / gestural input / randomness</td></tr>
<tr><td>—</td><td colspan="3">Explicit and attribute-based listening experience enhancements</td></tr>
<tr><td>+</td><td colspan="3">Machine-learned discoveries / multisensory feedbacks / playful and gamified interactions / routine and occasion-based music suggestions / mood-based input</td></tr>
<tr><td>W1/P1-P4</td><td colspan="3">"THE MUSIC THINGY"</td></tr>
<tr><td colspan="2">
</td><td colspan="2">FEEDBACK ← WORKINGS ← CONTROLS<br>Active touch (haptic) and tangible interaction / Mood sensing and personal data / Movement and proximity sensors<br>↓<br>Machine learning of user actions<br>↓<br>Automatic and spontaneous<br>↓<br>Haptic feedback / Visual feedback / Music as a feedback</td></tr>
<tr><td>KEYWORDS</td><td colspan="3">Sensing, multisensorial, playful form-changing, tangible interaction, ML</td></tr>
</table>

### 5.4.2 Workshop 2: Academic Group

This group is entirely made of individuals from academia who actively partake in academic research and teaching activities (P5, P6, P7, P8).

This workshop took 2.5 hours to complete without breaks within a single morning in the weekend subsequent to the previous one. Again, all participants attended to the entire workshop session. Activities were conducted through, again, Zoom and Miro. The workshop process was video-recorded through the point-of view of the moderator (and a co-moderator to amplify the coverage) through Zoom.

The workshop began within 10 minutes of letting the participants into the Zoom conference. The participants were asked to present their cubes after a brief introduction.

#### 5.4.2.1 W2: Sharing the Dream Cubes

Interestingly, the participants had conceptualised dream cubes that possessed similar qualities unbeknownst to each other, who grasped the concept of explicitness of interactions without a full introduction to the subject thereof. In relation to this, randomness and ambiguity were common qualities of those cubes; insofar, the participants conveyed that they correlated the form of the cube to dice – a tool for enabling randomness. However, they all came up with different means for enabling the interactions per the design goals through the concepts they created, presented these concepts in the following order: P5, P7, P8, and P6.

**Cube of P5 [W2/P5].** Volunteering to be the first participant to present their cube, Participant-5 elaborately described their irregular-shaped cube by saying: “My aim in designing this cube was to bring fidgeting-like qualities into the focus. It has asynchronous geometrical indentations to enable and require playful ways of holding the artefact in a unique manner in every surface. The depth to which my fingers get into them (indentations), the tilting, or the manner I put or throw it like dice should allow a sense of playfulness. This would also be a physical signifier of the artefact's current state. All the combinations and randomness created by those factors can enable the user to control the artefact in a unique way.", then added "For example: depth of the indentations map to the depth of the music of a certain kind or a dichotomy like superficialness-depth – accentuating abstract denotations for control."

Figure 5.13 - P5 describing interaction scenario of the cube: interacting with the mock-up on-screen to demonstrate its features.

**Cube of P7 [W2/P7].** "We seem to have thought similar concepts independent of each other (referring to P5). My cube has regular controls that afford basic controls like start and stop, whereas the cube has interaction points in two opposing corners and a single cut-off edge. The reason being: the way we discover and interact with the music is boring as it is; for this end, I thought whether we could make it more intriguing. Its cut-of edge may serve as an interface placed on a surface to allow turning the cube like a spinner. On the other hand, corners may serve as functions to skip and randomise the way things are to bring novel scenarios: making the artefact go to a genre, a new track, or a new radio."

**Cube of P8 [W1/P8].** What the participant conceptualised was something akin to the other cubes in the group; in particular, P8 expressed thinking about physically actuated interactions, which they compared to Rubik's Cube, then added: "I like interactions that involve altering and manipulating an object's physical form.”. For this sense, they described three physical levels (dividing the object to three sections like a sandwich): first one corresponding to the current activity like working, driving, relaxing and such, 2nd one for distinct moods, 3rd one being random keywords that foster creativity and randomness. The user aligns a surface of each level on a designated common surface like an activity, a mood, and a random keyword. On the top of that, there is a control interface atop the artefact with default controls like play, stop, and skip. On the other hand, there are two opposing interfaces at the top and bottom faces of the artefact: one for basic controls and one for the feedbacks.

Figure 5.14 - P7 and P8 explaining their dream cubes to the other participants on-screen, the stills of which show that teleconferences of such allow every participant to see the events from the front-row seat in spite of the real distance.

**Cube of P6 [W2/P6].** Started by saying “The basic form of the cube made me feel like music is something ephemeral that is enclosed in a physical shape, which makes one think the user's movements' as affordances for manipulating the music within that space.”, P6 mapped the input scheme between emotions and user behaviours in that scenario. Examples of such included throwing, velocity of movement, pressing with intensity, or a waving movement for tamer results. In conclusion, they encapsulated their approach by saying “The translation of emotions into actions may be mapped into the artefact's capabilities: allowing control of the artefact in a unique manner.”, indicating that animate actions of human beings can serve as natural mapping of the input schemes.

#### 5.4.2.2 W2: Discussions About Explicitness of Interactions

After the sharing of the cubes, a presentation on the prototypical definition of explicitness of interactions was made to the participants: allowing the participants to reflect on their interpretations of the design requirements onto their respective dream cubes – whether the cubes they designed fit the definition or not.

In contrast to the previous workshop, the theoretical subject of the research (Explicitness of Interactions) was thoroughly discussed between the participants, who were much more intrigued by the nature of the matter. This was expected to happen owing to the fact that this group consisted of academics that possessed interest and experience in the area of Interaction Design.

Starting off the prototypical definition, the discourse steered towards playful and curious exchanges to elaborate what might explicitness and implicitness concepts may pertain to when it comes to interaction scenarios, producing a few examples in the meantime.

A participant started by saying “Shuffling between the radio stations might fall in-between implicit and explicit. After all, the playing song gives a clue about what will play next in queue in that station.” regarding the **shuffle-like experiences**, which actually is a valid point to consider regarding what is implicit and what is explicit when interacting with artefacts. Could these concepts incorporate each other in themselves? It’s a point worthy of discussion. The participant continued: “So, like teasers of a new album or a movie, it’s about making me intrigued about listening to what-is-to-come. I take action either to listen or not, depending on how I feel towards that piece of music at that time.” meaning that the actual listening experience also makes the possibility of taking action what is next in queue more explicit.

The discussion moved further through the proclamation of "It makes me think that the interaction cannot be implicit if there is no factor of randomness or indeterminacy in (the experience of) it." as said by another participant. The discussion resulted in a common realisation: it doesn't matter whether there is a factor of indeterminacy, uncertainty, or whatnot in the event itself; as far as the user is concerned, all that matters is what they experience at the moment of interaction. After all, even though radio listener doesn't exactly know the track next-in-queue, it doesn't matter whether the line-up was curated by a DJ, or not: *the exact knowledge is unattainable* for the listener in that point in time.

After the previous example, the conversations turned into enquiries about scenarios that would normally be seen as mundane.

Any **automatic door** can be considered a prime example of that in spite of not having advanced or complex features by the standards of $21^{st}$ Century. As said by P5, "Automatic doors at the malls can be implicit [laughs] because of their erratic behaviour." owing to the uncertainty of whether it'll open or not excluding cases user managed to attain immediate prior observation of its functioning. Adding to that, the door-passing user wouldn't have an exact idea about how the door will behave in case it works. It might need them to come close or extremely close, or might just decide to close in their face after the previous passer-by goes past. This brings us to the point in where whether technical uncertainties as such should be considered as perceived, false, or hidden affordances, maybe even as matters of faulty mental models, or just plain implicitness. The former seems more probable in this case as these uncertainties cannot (should not) be intentionally designed features for enhancing the user experience thereof.

The previous discussion ended with "Could every uncertainty (pertaining to an interaction) be considered as implicitness?", the answer to which needs a profound investigation as it can define the properties and bounds of the concept in question.

**Waiting-for-an-elevator experience** may constitute implicit interactions depending on the information given about variables like explicitness of its current direction, at which floor it is, and whether the (probable) passengers inside may alter what it'll do next etc. P7 went by telling even though the example of things-with-doors is kind of a fun material that was ridiculed, it opens up a discussion about whether an interaction may be considered as implicit or not. After all, if you know what the elevator will do, it won't be that much of an implicit interaction, but an explicit one. P8's addition to that proclamation was "It may depend on the experience of the user with the artefact."; in consequence, what is implicit to an inexperienced user might be much more explicit to an experienced one. Experience and educatedness might be an important factor that determines whether an interaction is implicit or explicit. In summary, as P7 said, "It's about what takes away the factor of surprise.".

P8 prompted the question that put a lid to the discussion by inquiring that "Could we say that explicitness depends on the *prediction power of the user*?". In responses to it, a common bottom line emerged as the participants concluded that it is actually more related to whether one has the means for observing the details: how much experience one has, and the quality and size of one's personal dataset. For example: in places where lots of elevator entrances are side by side, an inexperienced user would have a low prediction power about which button corresponds to which elevator. In this case, one faces with a factor they don't really understand, let's say, a non-observable factor; due to which, one experiences an implicit interaction.

#### 5.4.2.3 W2: First Phase

The participants were put into two teams as pairs of P5 and P6, and P7 and P8 after the online design board links were shared with them for them to collaborate with each other. Each pair was allocated to their respective breakout room in Zoom for them not to be affected or distracted by the other team.

**First Pair [W2/P5P6].** Initially interested in the appeal of artefact form as means of interaction, the pair carried onwards the concept of proximity and interrelation between the agents in the interaction context like users, other people, and identical (peer) artefacts. The proximity gained significance as means of input as a weighted average of the tastes between the artefact and other agents, as well as the distance a user puts between themselves and the artefact to signify their like and dislike of the current track. Lastly, the concept of 'vacuuming', an event that prompts absorption of taste profile of a peer artefact (in extension, of another user's) by the artefact (Table 5.4).

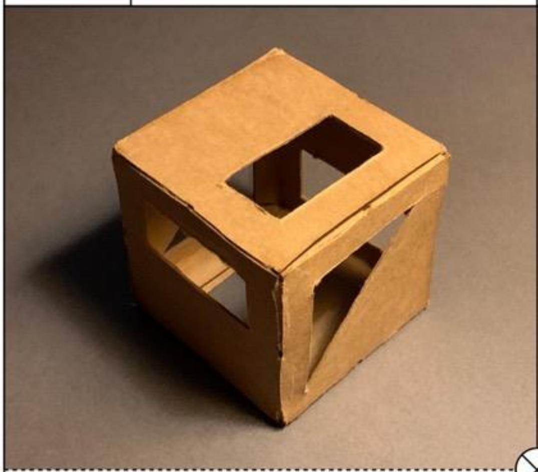
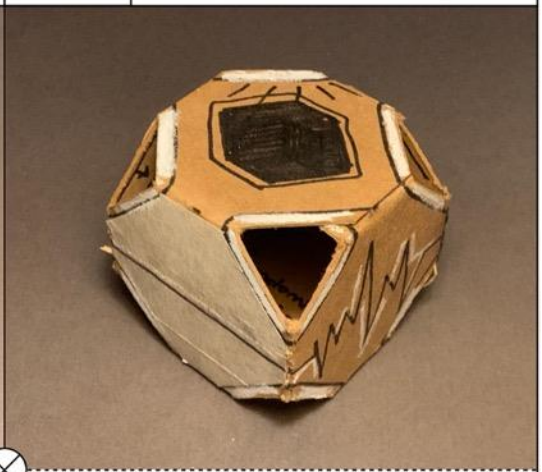
**Second Pair [W2/P7P8].** In this concept, the parallels between this artefact and the preceding cubes of P7 and P8 are clear per their visual projection to the corresponding mock-up. The rotating rectangular sandwiched dials of P8's cube and the edge cut as well as the sensor-bars on the corners of P7's cube can be attributed to its outstanding features clearly (Table 5.5).

#### 5.4.2.4 W2: Second Phase

The merged group of four started by transferring their ideas to their mash-up canvas after sharing what they did in the previous phase with each other after a causal exchange of ideas and thought processes.

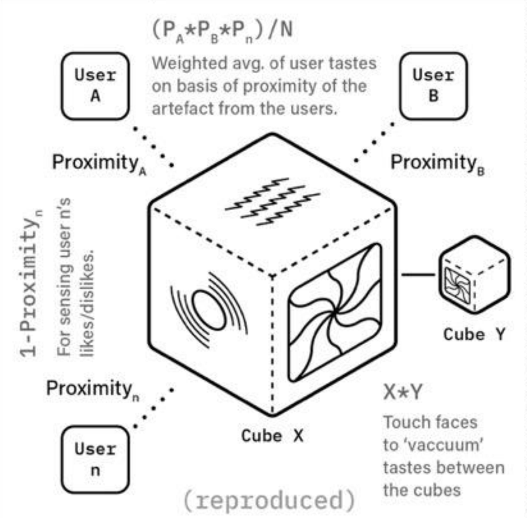
**Merged group [W3/P5-8].** It is apparent that the new artefact is a product of the compromises of and the collaboration between the pairs: bearing certain qualities of each concept while having shed the remaining ones. It sits on the middle ground between sensing-related proximity/contact features of W2/P5P6 and physical control features like the dials of W2/P7P8: it has the vacuuming feature for absorbing the taste profiles, stacking feature for mixing the tastes as per their hierarchy mapped to the way they're stacked, and mood/etcetera controls through the interlocking rectangular dials on it (Table 5.6).

Table 5.4 - Combination process of the cubes of W2/P5 and W2/P6.

| W2/P5 | P5's CUBE | W2/P6 | P6's CUBE |
|---|---|---|---|
|  | |  | |
| Volumetric properties as a source of randomness, asymmetricality / cube-to-cube interactivity / depth-speed-orientation sensor / ambiguous user-artefact interactions | | Inputting music qualities through the form: dark-bright and soft-intense tones / space-surface as a measure of like-dislike / corners for basic controls, gestural-tangible interaction for contextual-adaptive controls. | |

| | |
|---|---|
| — | Inputting the music qualities through the manipulation of form |
| + | Using the environment, context, and other artefacts as input modalities / depth-speed-orientation sensing as means of control |

| W2/P5P6 | PROXIMITY THING (UNNAMED) |
|---|---|




| CONTROLS | Interacting it with materials/surfaces to manipulate music choice | Proximity between user(s)-artefact as a mode of input |
|---|---|---|
| ↓ WORKINGS | Can interact w/ environment to produce sound (induction) | Giving the user agency for like/dislike |
| ↓ FEEDBACK | Haptic vibration feedback | Qualities of the shuffled output |

| KEYWORDS | Proximity, depth-speed-orientation sensing, social listening, sensing of material |
|---|---|

Table 5.5 - Combination process of the cubes of P7 and P8.

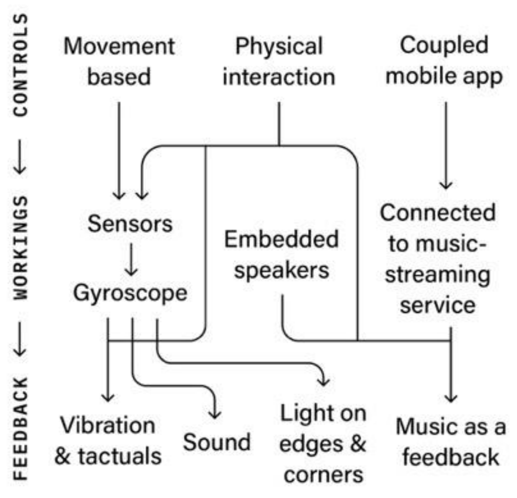
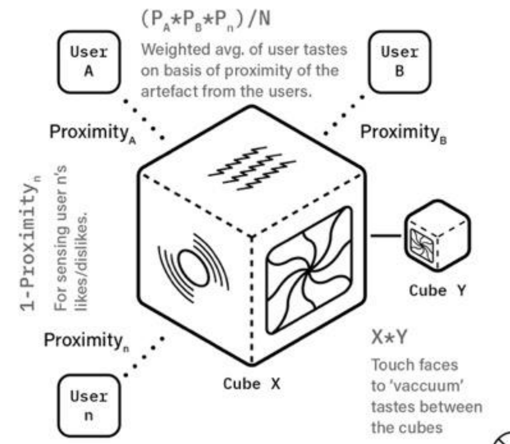
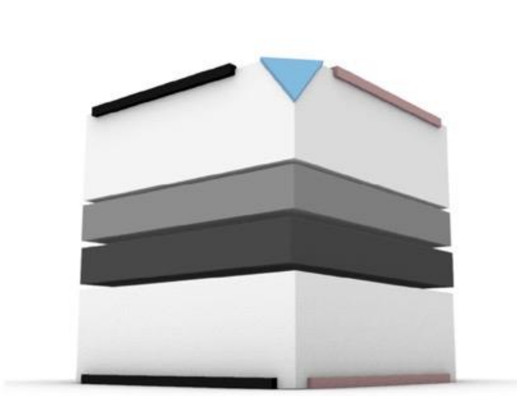
<table>
<tr><td>W2/P7</td><td>P7's CUBE</td><td>W2/P8</td><td>P8's CUBE</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Play-based, tinkering interactions, ambiguity / music discovery / mapped edges and corners / only play-stop buttons</td><td colspan="2">Mood-based, activity-based, keyword based input / play-pause, skip / rotation for mode selection at multiple levels and sides</td></tr>
<tr><td>—</td><td colspan="3">digital interface, play-pause button</td></tr>
<tr><td>+</td><td colspan="3">Rotating, rolling, spinning / skipping / dial, edge button, corner bars</td></tr>
<tr><td>W2/P7P8</td><td colspan="3">“D-ULTIMATE 1000”</td></tr>
<tr><td colspan="2"></td><td colspan="2">
</td></tr>
<tr><td>KEYWORDS</td><td colspan="3">Physical interaction, motion: mood-skip, volume / multisensorial / randomness</td></tr>
</table>

Table 5.6 - Combination process of the 1st phase artefacts of W2/P5P6 and W2/P7P8.

| W2/P5P6 | PROXIMITY THING | W2/P7P8 | "D-ULTIMATE 1000" |
|---|---|---|---|

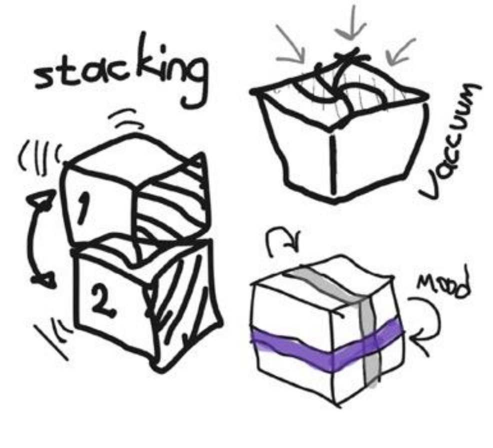


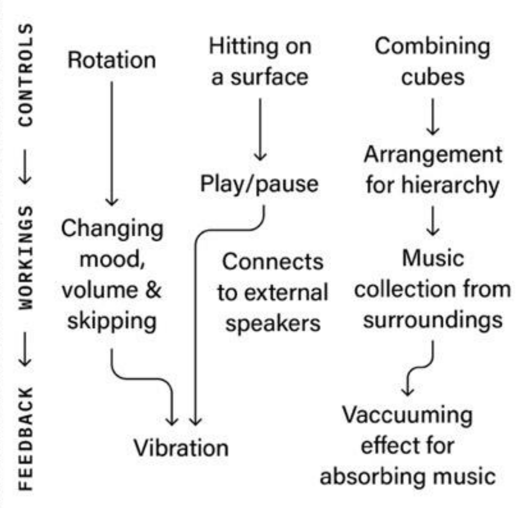



| W2/P5P6 | W2/P7P8 |
|---|---|
| User proximity for like-dislike / passing around for assigning users-styles / library sharing via contact: vaccuuming music | Rotation of dials for mood, rotation through black corner axis for skipping, rotation through the bronze one for volume / edge for randomness |

| | |
|---|---|
| — | None / (unspecified: edge) |
| + | Rotation of dials for mood, rotation through black corner axis for skipping, rotation through the bronze one for volume/ library sharing via contact: vaccuuming music / passing around for assigning users-styles / play-pause / small size |

| W2/P5-P8 | "OZ-CUBES" |
|---|---|




| KEYWORDS | 2-axis rotation, mood, basic controls / combination, hierarchy, vaccuuming |
|---|---|

### 5.4.3 Workshop 3: Professional Group

This group is comprised of individuals from practice who actively worked as a professional designer in the past years.

In contrast to the other workshops (that took place in the morning), this workshop commenced at 19:00 on a Saturday night with the full attendance of all participants: lasting 2.5 hours to conclude.

#### 5.4.3.1 W3: Sharing the Dream Cubes

**Cube of P9 [W3/P9].** Inspired by the varying tempos of their daily activities, this participant argued about making the artefact find the music by inputting a BPM, who then gave an example: "Let's say that we found and liked a music piece at 90 BPM, by anchoring to which, we can find playlists stem from either itself, genre, or album etc. of that music piece (at that BPM).". On the other hand, the BPM might be changed while the input being held as a constant or vice versa.

**Cube of P11 [W3/P11].** Due to the 'hand-sizedness' of the cube, they decided to go with *movement* as the basis of the interactions. Most of the interactions are motion-based: shaking for fortune (randomisation), waving it to indicate wanting-to-listen-to-something-else-in-spite-of-liking-what-is-being-played (quite an interesting solution to a potentially conflict-inducing situation), and spinning to find something entirely else to listen. On the other hand, there still are somewhat-explicit interaction features like playlists and mood-based music selection.

**Cube of P12 [W3/P12].** Started by saying "I think mine is quite abstract (looking at the others)", they explained the distance they put between the more explicit notions and the features they're mapped to. An example is the use of emojis instead of names of the moods. On the other hand, they mapped going back in time to an inward-oriented spiral, then expressed that timestamps don't really have a significance when time-travelling: associating them with meaningful moments and notions might more close-to-self (intrinsic). Second to last, they correlated intersecting spheres with realms of music. And lastly, they expressed that explicitly inputting BPM is boring, whereas it would be better for it to sense the tempo in context.

**Cube of P10 [W3/P10].** “I went for moods” said P10, then added “You should be able to adjust a knob for your moods”. It was followed by a set of sliders that correlate to user’s friends; by adjusting which, the user may create a weighted mixture of their listening tastes as the listening parameters. Lastly, they proposed some intelligent features that sense what the user may want to listen from their movements or the imagery around them.

#### 5.4.3.2 W3: Discussions About Explicitness of Interactions

Once again like the first workshop, participants decided to proceed with the discussions through giving examples that might solidify the more difficult concepts pertaining to the matter and discussing about them.

**iPod Shuffle** was given as the first example in this workshop, which was somewhat expected due to it being the most mainstream artefact that enabled an implicit music-listening experience with a dash of personalisation thanks to playlists put into it by users. It was discussed as a non-distracting device that didn’t afford interruptions from the occurrences around its user due to its limited interface and functions. This was particularly useful for the users for them to casually listen to music while doing activities such as studying, doing sports, or working out.

In **Tinder** (a mobile app for dating), the user generally has little to no clue about who is yet to come while swiping cards. Initial appraisal relies on the first impression about the person in the card-at-hand. If the user deems that person is attracting or intriguing enough, they can decide to get more elaborate information about them by swiping up before making a final verdict: optionally making the judgement process about that person more explicit (in terms of Ix); if else, the user may just decide to rely on that first impression. Of course, as things go both ways, the user cannot engage with the other person if both of the parties appraised the other one positively. This case bears value in the serendipity and optionality of explicitness as its interaction qualities.

Lastly, an indefinite example was given about a website that allowed **watching outside from a random person's window** with no particular means of selection was another example of implicitness. This is due to the fact that the only prior knowledge and control of the user about what-is-to-come is that they're probably going to peer out from someone's window unless they decide ceasing the activity of peering out. In consequence: the user knows more or less what they're going to get *without* exactly knowing what it'll be.

#### 5.4.3.3 W3: First Phase

**First Pair [W3/P9P10].** In contrast to the other pairs in the workshops, these participants took advantage of being located close to each other and undertook their conceptualisation activity co-spatially: utilising Zoom and Miro mainly to communicate their process with the facilitating party (Figure 5.15).

This pair, like in the cubes of its members, decided to take a maximalist route. This makes sense considering a practical industrial design approach to commercialise a product per the given brief through employing well-established conventions rather than taking an experimental or novel approach, which would have been more resource intensive. Regardless we see controls in forms like knobs, sliders, switches, button sets etc. in correspondence to rather implicit input schemes such as tempo specification or manual mixing of tastes. Another distinctive feature of this concept is its embedded speakers as a prominent feature, which could be considered as an afterthought in an interaction centric design approach (Table 5.7).

Figure 5.15 - P9 and P10 describing the features of their dream cubes co-spatially.

**Second Pair [W3/P11P12].** Again, this pair also decided to take a maximalist route as its members did with their cubes; however due to being more affiliated with academia in comparison to their counterpart pair, the pair decided to bring more experimental and abstract features to the table.

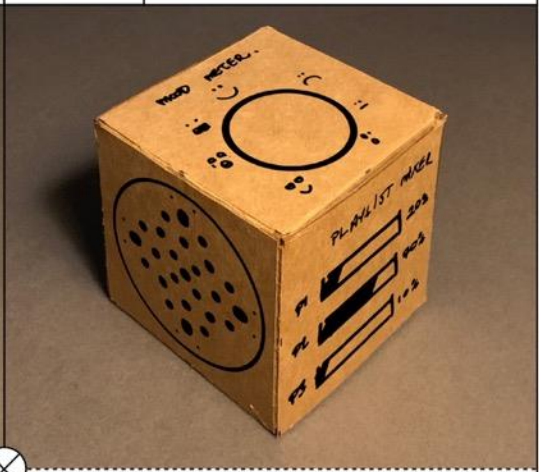
Focused on artefact-mediated gestures, their approach was to focus on motion-related qualities like speed, frequency, and directionality as variables for input mapped to how one would naturally respond to music like dancing and making beat. On the other hand, they gave multisensorial feedback in form of haptic display and lights with variable intensities, colours, and behaviours (Table 5.8).

#### 5.4.3.4 W3: Second Phase

Merged group [W3/P9-P12]. Groups incorporated their maximalist approaches in a maxi-minimalist manner, attempting to avert overlaps between its features. Features like mood knob and randomiser were merged together, whist sliders and gestural input schemes were incorporate into a tangible interaction face for enabling drawing input, yet motion-based gestures were decided to be kept for keeping beat in correspondence to natural response to music. On the other hand, the haptic display and light-based feedback were kept as is (Table 5.9).

Table 5.7 - Combination process of the cubes of W3/P9 and W3/P10.

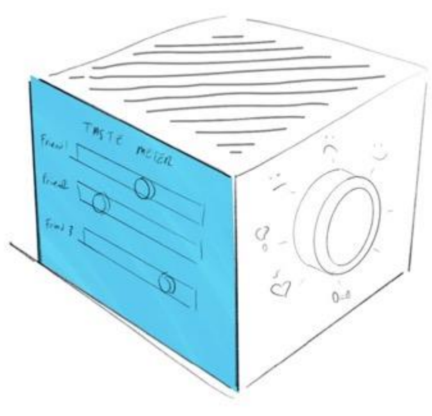
| W3/P9 | P9's CUBE | W3/P10 | P10's CUBE |
|---|---|---|---|

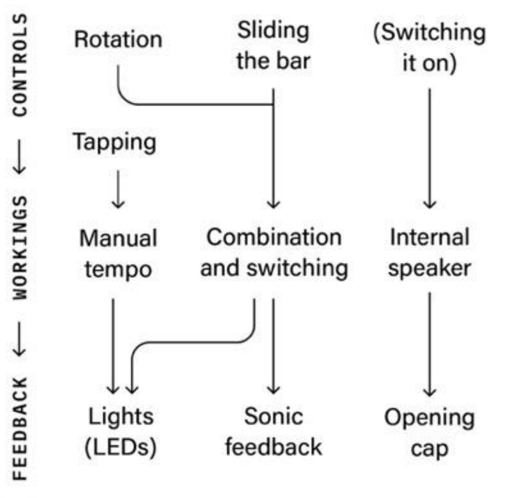




| | |
|---|---|
| Tempo (BPM) based interaction knob / shuffling through genre, album, or artist / playlist-maker, presets / internal speaker | Emotion knob / user motion sensing via camera / combining friends' tastes through sliders / play-pause / internal speaker |

| | |
|---|---|
| — | Stock photo input, presets |
| + | Mood knob, tempo (BPM) knob / close friends slider |

| W3/P9P10 | "HSM" |
|---|---|




| KEYWORDS | Rotation for selection, tapping for tempo, sliding for combination / social listening |
|---|---|

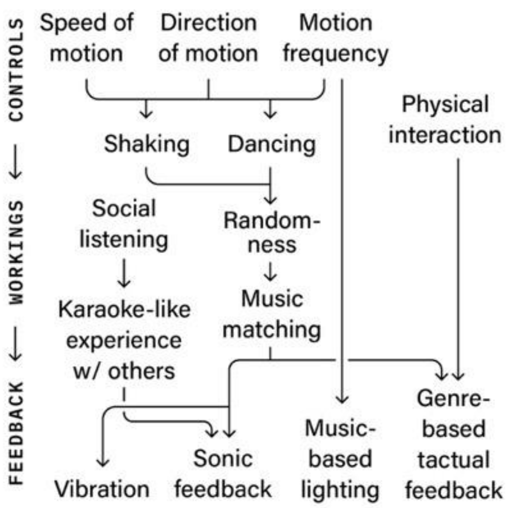
Table 5.8 - Combination process of the cubes of P11 and P12.

| W3/P11 | P11's CUBE | W3/P12 | P12's CUBE |
|---|---|---|---|
|  | |  | |
| Shake for randomness, roll to change, wave to continue / mood selection: "how are you feeling?" / playlists for liked-enjoyed music | | Tempo sensing / artist clusters / time travel: pairing memories with music / social listening and sharing / mood-based choices | |

| | |
|---|---|
| — | Mood selection: "how are you feeling?" |
| + | Shake for randomness, roll to change, wave to continue / social recommendations, someone singing randomly / rolling and dancing |

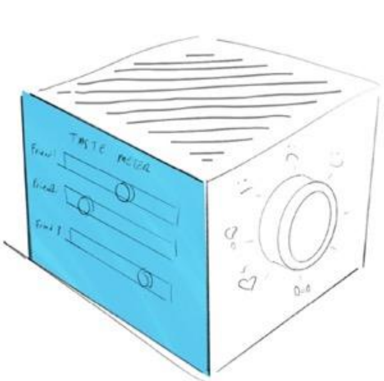
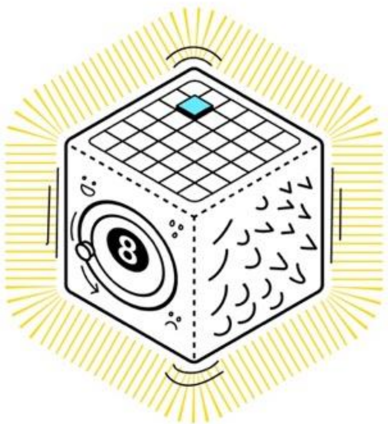
| W3/P11P12 | MOTION THING (UNNAMED) |
|---|---|

(reproduced)




| KEYWORDS | Gestural iX: shake, roll, wave / speed, direction, frequency / multisensoriality / social iX |
|---|---|

Table 5.9 - Combination process of the 1st phase artefacts of W3/P9P10 and W3/P11P112.

| W3/P9P10 | "HSM" | W3/P11P12 | MOTION THING |
|---|---|---|---|
|  | |  | |
| Mood knob, tempo knob, tempo tapper, slider for combining friends' tastes, draw to listen / rotation for selection / opening cap | | Shake for randomness / socially initiated interactions / motion-gesture induced interactions / light and tactile (texture and vibration) feedback | |
| — | None (the rest was partially integrated) | | |
| + | Tempo tapper, draw to listen, combiner of friends' playlists, tactility of the opening cap, shake for randomness, mood slider | | |
| W3/P9-P12 | HSM-MOTION THING (UNNAMED) | | |
|  (reproduced) | CONTROLS ← WORKINGS ← FEEDBACK | CONTROLS: Speed of motion / Direction of motion / Motion frequency → Gestures → Randomness → Music matching; Buttons, switches, sliders; Drawing (image recognition) → Music matching. FEEDBACK: Tactual feedback / Sonic feedback / Ambience Light feedback | |
| KEYWORDS | Motion: speed, direction, frequency / tapping for tempo / suggestions per drawings | | |

## 5.5 Analyses of the Workshops

Workshop is the paramount activity of data collection prior to the solo design phase in this research: participants were sensitised into the concepts with a longitudinal process through which they reflected on their music-listening experiences – getting prepared for the workshop. This translates to workshop findings constituting the principal source of empirical information when continuing the research. Analysis of the workshops is comprised of several data sources such as video recordings, design boards, design artefacts, and preceding information (interview and probe kit data) from the earlier phases of the research. Empirical output from the workshops is extracted by qualitatively coding the data from the aforementioned sources.

### 5.5.1 Preparation of the Data for Analysis

**For the data from the in-workshop activities.** The workshop activity and social exchange data is initially put through the same coding method (Structural Coding & Axial Coding) that was employed in the previous phase (see 4.4.1).

**For the data from the pertinent artefacts.** Coincidentally, the analysis of the design artefacts needed to be analysed through an *atomistic approach*. Through the process, a number of qualities that constitute the conceptual artefacts (the ones created by the participants) that may possess value per se emerged, many of which might be missed out and lost by solely sticking with a holistic approach, for this reason:

- A detailed inventory of physical qualities, interactive elements such as controls, afforded interactive actions, and their conceptual or impressional qualities will be made.

Inventory derived from longitudinal coding: detailing the chronological process of evolving product (albeit visually this time) over time.

The workshops are analysed under two separate the topics pertaining to theoretical discussions and design activities.

### 5.5.2 Analysing the Discussions on Explicitness of Interactions

Discussions of inquisitive and exploratory discussions commenced after the presentation of the prototypical definition of Explicitness of Interactions, when the participants were asked to talk about what might be the examples of implicit and explicit interactions per that definition: allowing explorations regarding the scope of the matter and reach to a concurrence thereof. In consequence, certain points and questions of interest came forth, which are as follows:

- User's prediction power[35] could be considered as the sum of their heuristic capabilities, past experiences with similar (or same) artefacts, and observation skills for making implicit interaction scenarios more subjective on individual basis.
- EoIX has a number of distinct characteristics similar to and different than relevant concepts like affordances, mappings, feedback and feedforwards, and interaction froggers: the relation between which need to be elaborated.
- There seems to be a number of case-specific variables acting as sources of implicitness/explicitness: affecting the EoIX with fuzzy dynamics.
- Indeterminacy seems to be positively correlated with implicitness. Thorough investigations, discussions, and thought experiments may be needed to understand whether there is causation behind those correlations.
- Lastly, nine examples were given and also discussed by the participants: constituting as cases for exploring and providing reasonings about the probable properties of EoIX.

[35] Not the same as Predictive Power term used in scientific research.

The aforementioned points, in particular, are significant enough to be discussed in their own chapter for them to be undertaken in a harmonious and logical manner; due to this reason, these matters won't be detailed under this heading to avert duplication thereof. For this end, these matters will be discussed in Chapter 7 in greater detail (page 273).

### 5.5.3 Analysis of the Design Process and Results

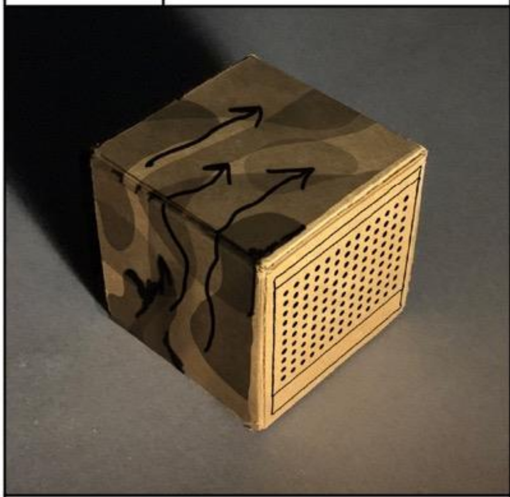
As expected, almost all cubes shared a feature for starting/stopping, whereas they were diverged to significantly different routes for fulfilling the other features.

#### 5.5.3.1 The Inventory of Workshop Artefacts

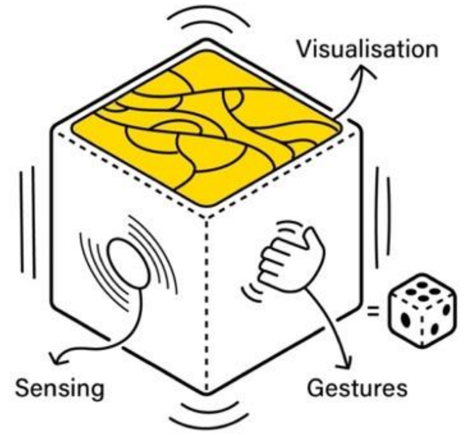
As a consequence of accumulation of artefacts starting from the dream cube activity in the probe kit study up until the conceptualisation of second-phase workshop activity yielded a total of 21 artefacts at three levels of iteration. This sum is comprised of 12 dream cubes, 6 first-phase workshop artefacts, and 3 second-phase workshop artefacts. In spite of relating to each other in sequential iterations, each artefact possessed its own properties; thus, keeping each artefact at the same level of hierarchy while taking the reasonings of the iterations allowed an objective overview of the artefacts. In addition, this inventory should serve the readers as a method for overviewing all 21 artefacts next to each other.

In a similar fashion to the previous activities and analyses, emergent qualities pertinent to the artefacts were deconstructed laterally (in contrast to relationships between sequential artefacts) as per the input sources, forms of feedback, and artefact qualities, as well as type of their interfaces for each workshop at the end of every 2$^{nd}$ page of the inventory (Table 5.10).

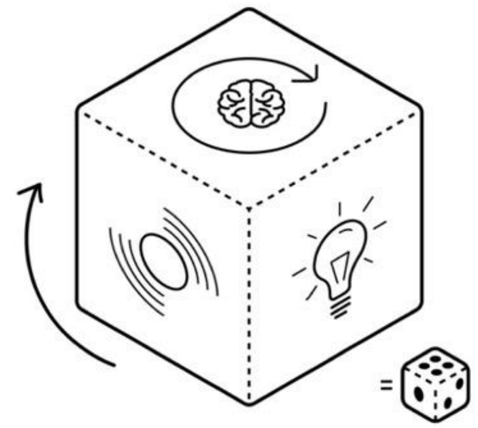
Table 5.10 - Consolidated artefact inventory incorporating all 21 items. Emergent qualities of which for each workshop were divulged at the end of every 2nd page.

<table>
<tr><td>W1/P1</td><td>P1’s CUBE</td><td>W1/P2</td><td>P2’s CUBE</td></tr>
<tr><td colspan="2"></td><td colspan="2">
</td></tr>
<tr><td colspan="2">Speak to it, shake and roll it to interact / touching them shares music / multisensorial feedback / time machine displaying past art and images for experience enhancement</td><td colspan="2">Mood-sensing features that recommend music to the user / gestural interactions / personalisation / context-sensitivity</td></tr>
<tr><td>W1/P3</td><td>P3’s CUBE</td><td>W1/P4</td><td>P4’s CUBE</td></tr>
<tr><td colspan="2">
</td><td colspan="2">
</td></tr>
<tr><td colspan="2">Lyrical overlay / mood-based playlists, mood sensing and suggestions, skipping-triggered machine learning occasion-based suprises</td><td colspan="2">Search, album cover, lyrics / scheduled releases / randomised suggestions /</td></tr>
</table>

| W1/P1P2 | “1000-N-AZ” | W1/P3P4 | “GENIUS” |
|---|---|---|---|




Emotion and context sensitivity and sensors / multisensorial interactions / playful & gestural input, sensorial enhancements




Moods and emotion input / machine learning / suggestions / context and event recognition / gestural input / randomness

| W1/P1-4 | “THE MUSIC THINGY” |
|---|---|


Sensing, multisensorial, playful form-changing, tangible interaction, machine learning

**W1 EMERGENT QUALITIES**

INTERFACE

gestural, physical, tangible, graphical

INPUT SOURCES

SENSING: mood, motion, context, event

MANUAL: waving, shaking, touching, turning, squeezing, crashing, stretching

FORMS OF FEEDBACK

HAPTIC/TACTUAL: form, texture, softness, vibration

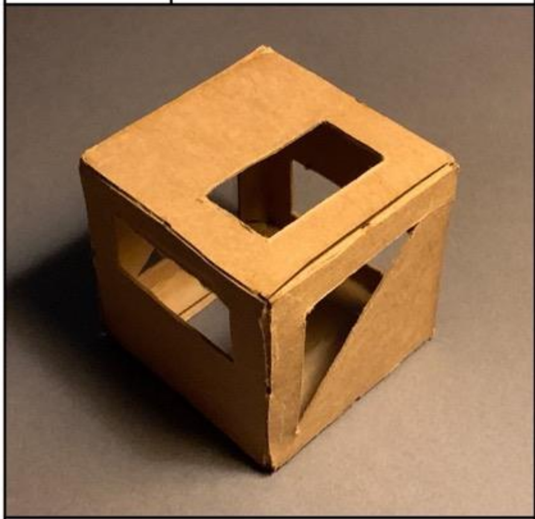
VISUAL: colours, shapes, movement

SONIC: product sounds, voice feedback

ARTEFACT QUALITIES

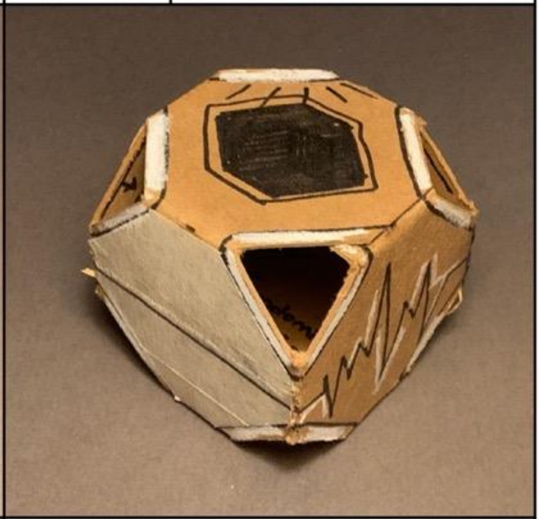
Playfulness, randomness, machine learning, multisensoriality, contextual awareness, personalisation

| W2/P5 | P5’s CUBE |
|---|---|



Volumetric properties as a source of randomness, asymmetricality / cube-to-cube interactivity / depth-speed-orientation sensor / ambiguous user-artefact interactions

| W2/P6 | P6’s CUBE |
|---|---|



Inputting music qualities through the form: dark-bright and soft-intense tones / space-surface as a measure of like-dislike / corners for basic controls, gestural-tangible interaction for contextual-adaptive controls.

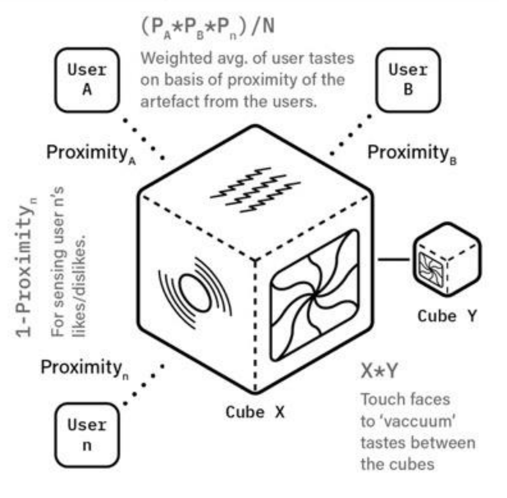
| W2/P7 | P7’s CUBE |
|---|---|

Play-based, tinkering interactions, ambiguity / music discovery / mapped edges and corners / only play-stop buttons

| W2/P8 | P8’s CUBE |
|---|---|

Mood-based, activity-based, keyword based input / play-pause, skip / rotation for mode selection at multiple levels and sides

| W2/P5P6 | PROXIMITY THING | W2/P7P8 | "D-ULTIMATE 1000" |
|---|---|---|---|




User proximity for like-dislike / passing around for assigning users-styles / library sharing via contact: vaccuuming music

Rotation of dials for mood, rotation through black corner axis for skipping, rotation through the bronze one for volume / edge for randomness

| W2/P5-8 | "OZ-CUBES" | W2 EMERGENT QUALITIES |
|---|---|---|


2-axis rotation, mood, basic controls / combination, hierarchy, vaccuuming

**INTERFACE**

Physical, tangible

**INPUT SOURCES**

**SENSING:** proximity, contact, orientation, motion, agents (user & product siblings)

**MANUAL:** rotating, spinning, moving, stacking

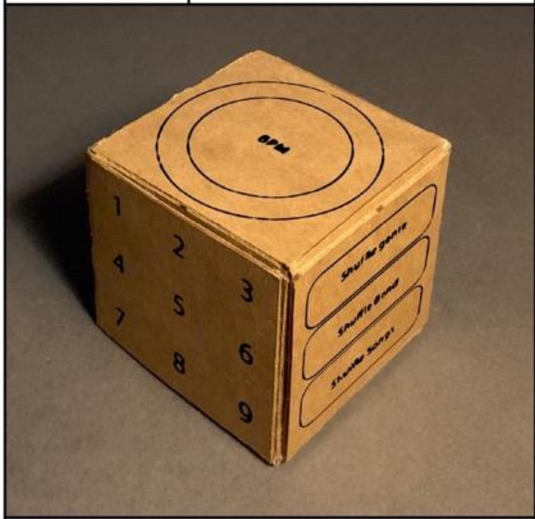
**FORMS OF FEEDBACK**

**HAPTIC:** physical state
**VISUAL:** binary lights, physical states
**SONIC:** auditory icons, product sounds

**ARTEFACT QUALITIES**

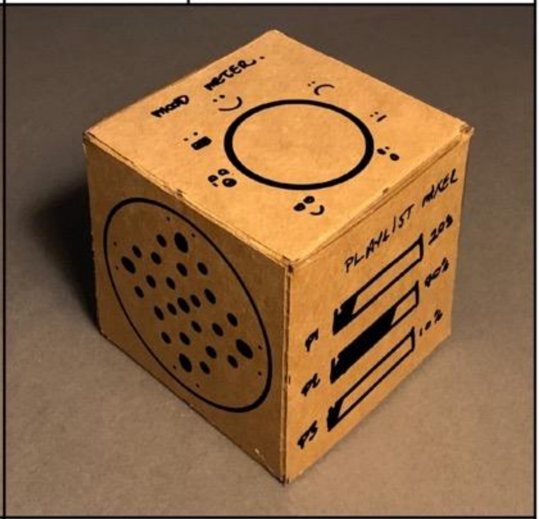
Randomness, proximity, hierarchy, absorption, combination, playfulness

| W3/P9 | P9's CUBE |
| --- | --- |




Tempo (BPM) based interaction knob / shuffling through genre, album, or artist / playlist-maker, presets / internal speaker

| W3/P10 | P10's CUBE |
| --- | --- |




Emotion knob / user motion sensing via camera / combining friends' tastes through sliders / play-pause / internal speaker

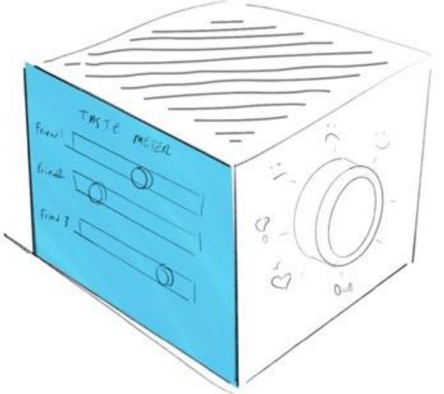
| W3/P11 | P11's CUBE |
| --- | --- |


Shake for randomness, roll to change, wave to continue / mood selection: "how are you feeling?" / playlists for liked-enjoyed music

| W3/P12 | P12's CUBE |
| --- | --- |


Tempo sensing / artist clusters / time travel: pairing memories with music / social listening and sharing / mood-based choices

| W3/P9P10 | "HSM" |
|---|---|




Mood knob, tempo knob, tempo tapper, slider for combining friends' tastes, draw to listen / rotation for selection / opening cap

| W3/P11P12 | MOTION THING |
|---|---|

Shake for randomness / socially initiated interactions / motion-gesture induced interactions / light and tactile (texture and vibration) feedback

| W3/P9-12 | HSM-MOTION THING |
|---|---|

Motion: speed, direction, frequency / tapping for tempo / suggestions per user drawings

**W3 EMERGENT QUALITIES**

INTERFACE

Physical, gesture, graphical

INPUT SOURCES

SENSING: tempo, rhythm, motion

MANUAL: shaking, rolling, waving, dialling, toggling, switching, beat tapping

FORMS OF FEEDBACK

HAPTIC/TACTUAL: haptic display, vibration, physical state

VISUAL: colors, lights (intensity, tones)

SONIC: product sounds

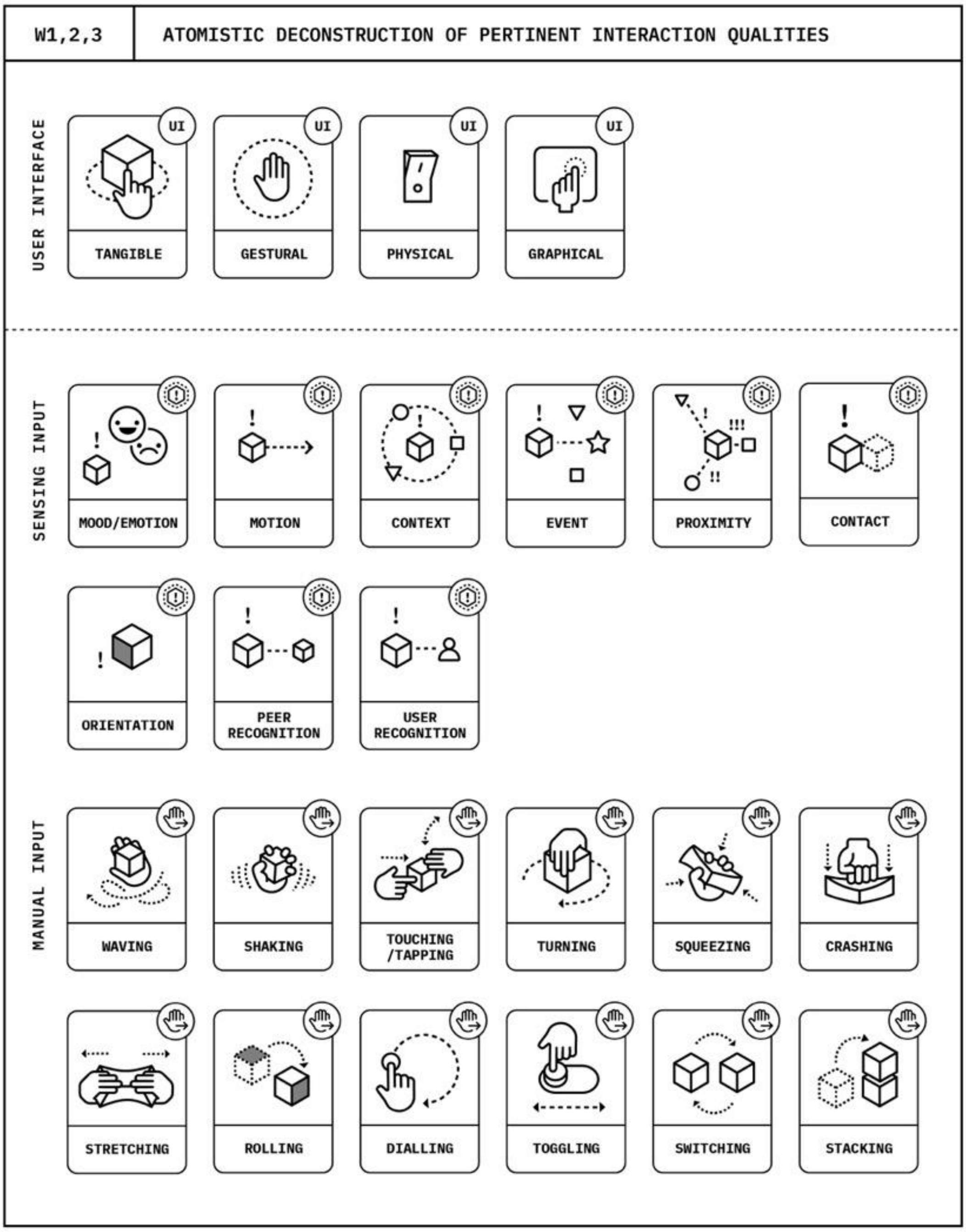
ARTEFACT QUALITIES

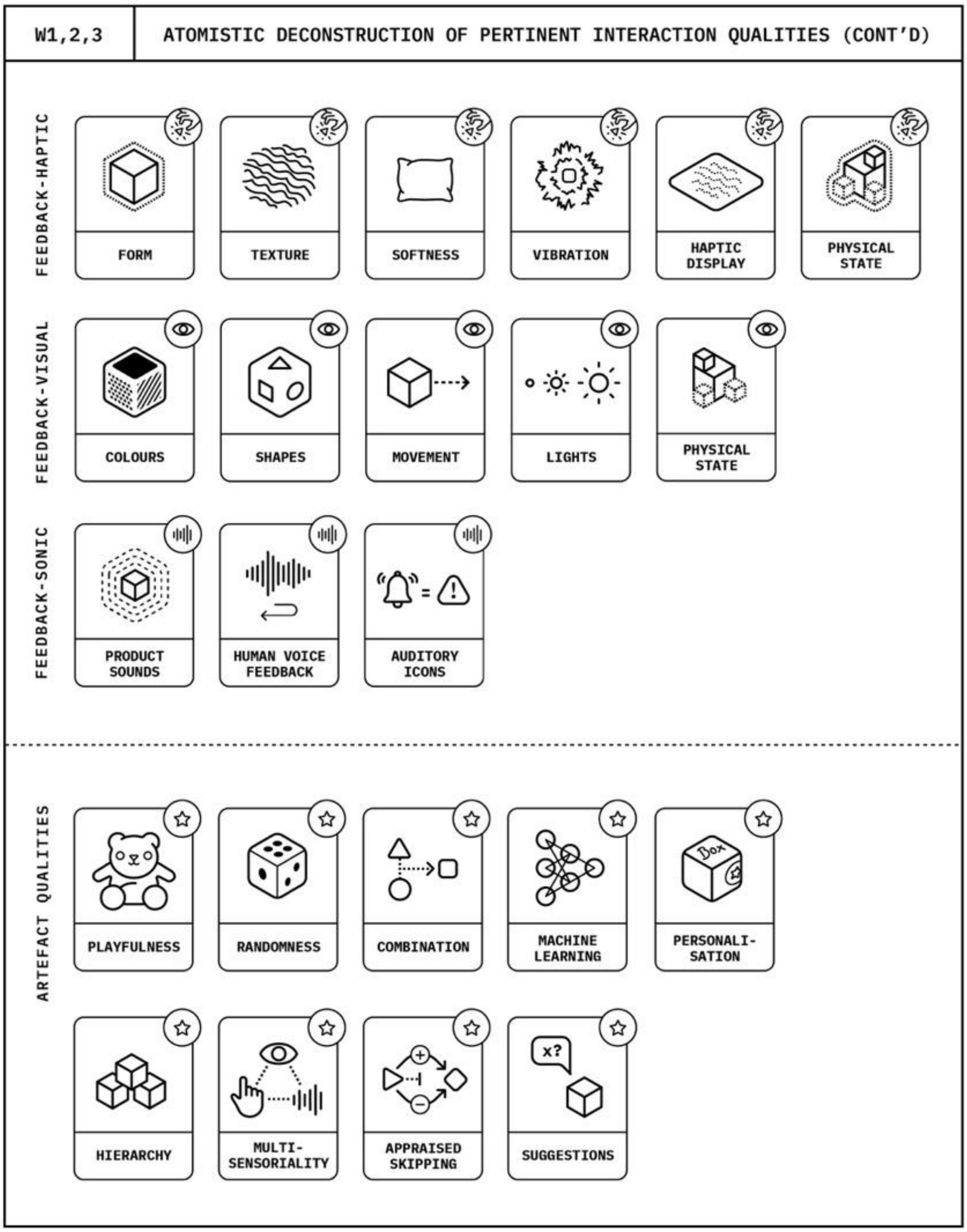
Randomness, combination, suggestions, appraised skipping

### 5.5.4 Conclusion of Analyses

The preceding phases yielded valuable knowledge for understanding about pertinent qualities of and applicable design insights for implicit interactions.

Table 5.11 - Atomistic deconstruction of pertinent qualities of in-study artefacts.






In consequence, the aforementioned qualities were filtered out for eliminating recurrences and ill-fitting elements, then the rest was illustrated onto sets of themed cards corresponding to user interface, sensing and manual input, haptic/visual/sonic feedback, and artefact qualities (Table 5.11) for the following RtD phase.

# CHAPTER 6

## RESEARCH THROUGH DESIGN PHASE III: SOLO DESIGN ACTIVITY FOR ADVANCING THE CONCEPTS

A number of concepts were introduced through sensitisation to the study participants; in consequence, an inventory of 21 conceptual artefact designs was created through the joint and distributed efforts of 12 participants. Two design goals were briefed to the participants for the design of the artefacts; however, there were inherent incompatibilities between those goals and practical coherent applications thereof. This stemmed from the conventional use cases and user habits as well as highly delicate balance of product qualities to achieve in a practical manner. Nevertheless, the produced concepts were successful in attaining heuristic knowledge from own experiences and expertise of design professionals and academicians. Furthermore, the interaction qualities of these artefacts were deconstructed down to atomic elements that will be beneficial in assisting the solo design process.

In this chapter, due to being both the researcher and the solo designer, I will be reporting my actions and thought processes including regressions throughout the solo design process. I'm going to do that as a means of accountability and a transparent trail of how I managed the information, skills, considerations, and knowledge pertinent to RtD goals and process thereof.

## 6.1 Methodology

### 6.1.1 Solo Design Activity in Research through Design

Design research (and design in general) is on a trajectory to where designing with others is more (and more) preferable to designing by oneself (Martin & Hanington, 2012; Umulu & Korkut, 2018; Visser et al., 2005). It is rightfully so due to the benefits that arise as a part of it; however, solo design activity has its merits and should be utilised when necessary. In this case, the most feasible route in this phase of the research is to proceed without actively involving the other participants. There are two major concerns for doing so. Firstly, investing and consuming months' worth of time of the participants (all of whom are primarily occupied with their own matters) that is required in the further parts of the research is not an economical way of progressing due to the diminishing returns of their time and effort. Secondly, converging of a number of ideas in adherence to the research needs can be more efficiently and effectively handled by a single person well-invested into the research (W. Gaver, 2012; Nelson & Stolterman, 2005, p. 144). For these reasons, we'll be going over existing Research through Design activities to attain the research objectives to get a greater sense of the how to proceed.

PhD dissertation of Pedgley (Pedgley, 1999) is a model example of such an activity. In this work, the researcher managed the process by intricately and openly documenting as well as discussing the issues and ongoings in, and reasonings for the decisions taken throughout the research by referring to a certain methodology. In a manner similar to the aforementioned research, this thesis went (and going) through a number of both theoretical and practical stages applicable to design; however, this being a master's thesis, its scope is more confined, and its projected outcome is an advanced product concept in comparison to a working prototype or a final product.

### 6.1.2 Relevant Concepts, Theories, and Principles

Naturally, turning the high-fidelity information resulting from the probe kit study and workshops calls for a well-reasoned systematic approach as means of self-regulation and impartiality to prevent possible biases and errors inherent in a solo design activity. The goal of this phase is to process and advance those concepts into a coherently converging design outcome with respect to the research objectives and key considerations by employing the knowledge attained from the literature and the empirical findings through a set of design principles.

**Ten Usability Heuristics (of Nielsen)** is a set of simplified heuristics that provides a general guideline for user interface designers to take certain design actions effectively without having to invent the wheel about rudimentary issues (Nielsen, 2005; Nielsen & Molich, 1990). Of course, these heuristics were made with traditional systems and web pages in mind; however, some of these heuristics illustrate universal approximate guidelines for designing human-computer interfacing artefacts. Nevertheless, these heuristics will be considered in non-rigid terms as per the design goals and other considerations of this research. The guidelines are as follows (Nielsen, 2005):

- System status must be visible to the user
- The system and the real world needs to be matching
- Users need to be given control and freedom while using the system
- The system should be consistent and up to standards
- There should be no errors in the first place; should be able to recover
- User should be able to recognise options rather than having to recall them
- The system needs to be flexible and efficient enough
- The design should be aesthetically pleasant and as minimal as possible

**Design principles of Rams.** Design of an artefact (a product), on the other hand, is whole lot of a different issue. After all, design (industrial, product, interaction) is a practical profession in itself; due to that reason, thoughts of a well-seasoned and respected designer can provide a tremendous value in form of a set of principles. Dieter Rams is one of the most influential designers (architect-turned-industrial designer) of 20th Century, who is also considered one of the forerunners of modern industrial design of such. It is also relevant to this study that his career as an industrial designer is coincidental with the design of first interactive (relevant) consumer products such as turntables, radios, and music-players (W. Gaver, 2012; Shelley, 2015). Constituent principles of Rams' design philosophy are as follows ('What is "Good" Design? A quick look at Dieter Rams' Ten Principles', n.d.):

1. Good design is innovative
2. Good design makes a product useful
3. Good design is aesthetic
4. Good design makes a product understandable
5. Good design is unobtrusive
6. Good design is honest
7. Good design is long-lasting
8. Good design is thorough down to the last detail
9. Good design is environmentally friendly
10. Good design is as little design as possible

Looking at Nielsen's Heuristics and Rams' Principles, we see certain commonalities such as aesthetics and understandability as it's safe to say that such qualities are universally accepted as tenets of good design. There are also mutually exclusive points such as Rams' long-lastingness principle for a good design in comparison to Nielsen's heuristic of error-freeness of systems: this is the reason why both of these similar-yet-different ideologies were incorporated into this process as general design guidelines.

Lastly, incorporation off all the knowledge from the literature, empirical research outcomes, and design concepts and elements need a form of hierarchy to be incorporated into each other. For this reason, MoSCoW (must, should, could, won't) will be implemented as an approach for outlaying the precedence of qualities and whatnot, and the hierarchy therein (Bittner & Spence, 2003).

## 6.2 Structure and Constituents of the Procedure

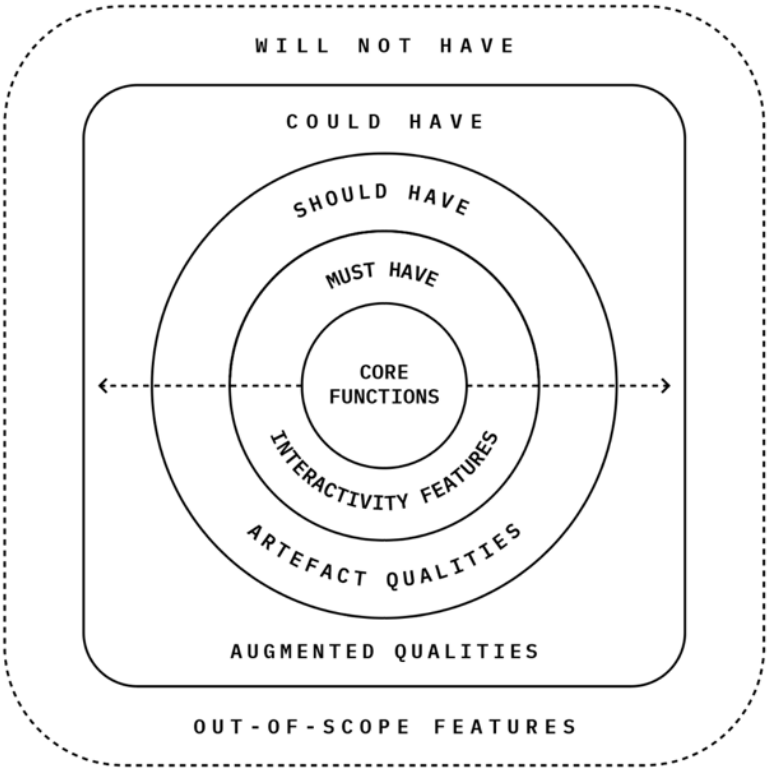



Figure 6.1 - The hierarchy of design considerations in the solo design phase of the research integral with MoSCoW approach to product development.

It gradually became apparent throughout the process that the approach for designing the artefact needed to be systematic in design procedure and hierarchical in order of concepts. Certain questions need to be inquired and answered to commence forward in this process. For example: should interaction features or the form precede in the process? Such questions need to be answered forthrightly as superseding steps should have well-reasoned precedents as it would be nonsensical to lay a less critical aspect as the foundation of a more critical one, which would end up in unnecessarily taking steps backward – especially in a design process where there is a clear goal. I could act accountably and objectively both as the researcher and solo designer throughout this phase only by proceeding in a structured and systemic manner.

For this, I will be laying out how I structured this solo design procedure and methodological considerations related to it. Following that, I will be proceeding with the design while employing a structured checks-and-balances to move forth by constituting the pertinent considerations (Figure 6.2) into this process in a systemic manner in five hierarchical levels/steps (Figure 6.1) as follows (lower numbers have precedence):

1. **Core functions.** This is the core of the product: the process will begin through the creation of a system map of artefact functions in adherence to the study considerations to achieve the design goals. Everything else will take shape around it.
2. **Interactivity features (must).** Then, the interactive features of the artefact will be designed to afford the functions and required capabilities of the system to the user.
3. **Artefact qualities (should).** Subsequently, enclosure and/or interface of the artefact will be designed accordingly to achieve aesthetical and utilitarian qualities coherent with the precedent properties thereof.
4. **Augmented qualities (could).** Lastly, augmented qualities such as brand, service, support etc. aren’t essential yet nice to have at this fidelity of product design and development.
5. **Out-of-scope features (won’t).** On the other hand, and apparently, more explicit interactive features like search and extrinsic information as well as whatever may grant direct knowledge and right-to-the-point control of media selection to the user.

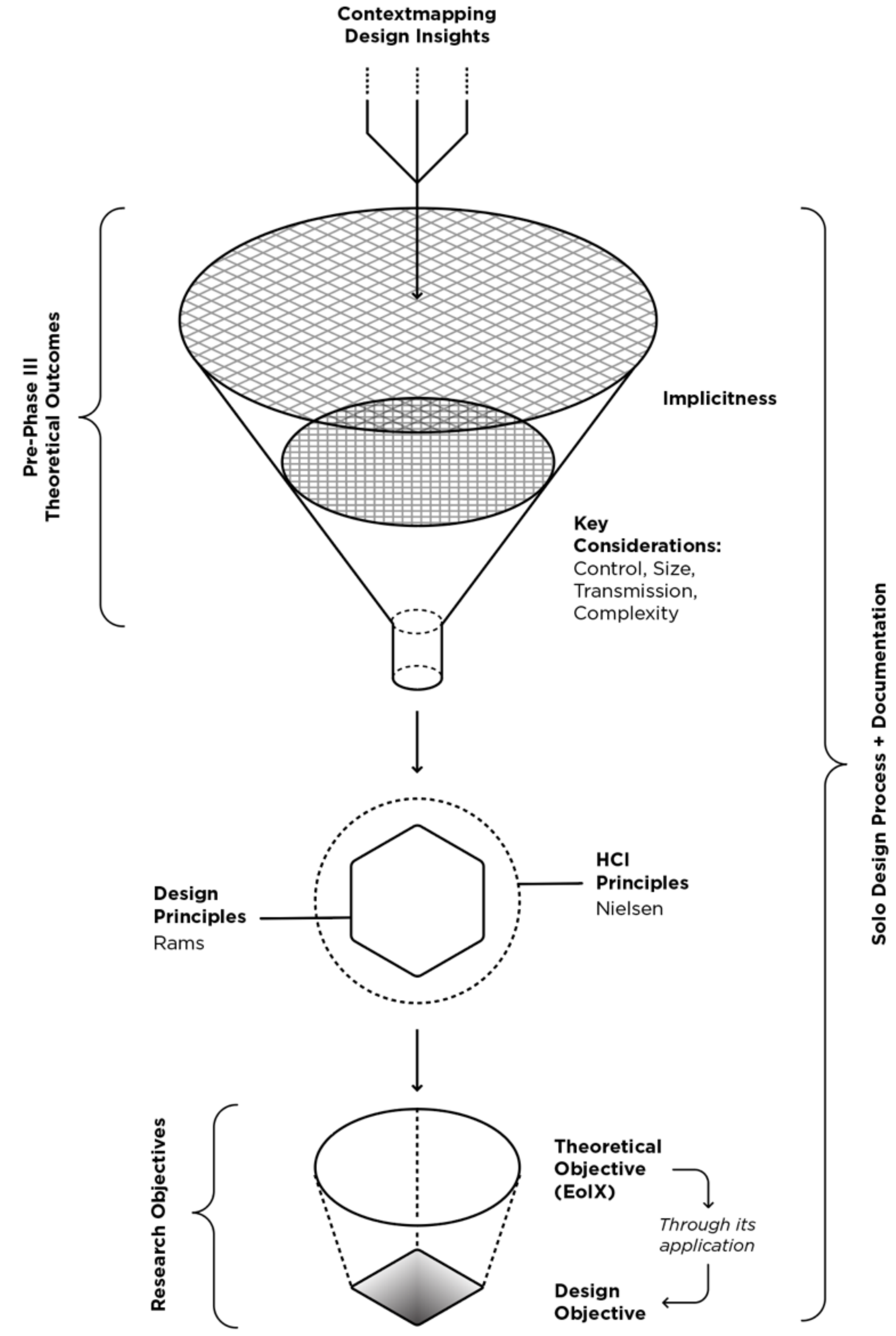



Figure 6.2 - Visualised representation of integration of concepts, information, and knowledge into the solo design procedure.

## 6.3 Preparation for the Design Activity

Considering that entirety of the earlier chapters may be considered as partial preparations for the solo design activity, the only things left to discuss are the tools I'll be employing throughout this process.

- Pen and paper for concept sketching and idea generation; stationery to create mock-ups if needed.
- Adobe Illustrator, Photoshop, and Experience Design for supplementing conceptualisation and idea generation as well as visualisation.
- Autodesk 360 for creating 3-dimensional models of the concept(s) that satisfy the design considerations and research goals.
- Trello for project management; Apple Notes for keeping notes.

## 6.4 The Solo Design Activity

### 6.4.1 Designing the Core Functions

In the beginning, two viable options emerged from the past phases of the research. *First of them* functions through sensing what the user may want to listen to by reading the data around itself and the user – these sources of data might be the user's location and context, their vitals like heartbeat or skin conductivity, or other users and peer artefacts around them. *The second one* functions by making sense of the user's responses to the music by reading their behavioural patterns, putting user input into consideration, and making forecasts. Looking at these: the main contrast between them emerges as a contrast between a more automatic (sensing input) and a more hands-on choice (manual input) (also see Table 5.11); of course, there might also be middle grounds that are hybrids of both.

#### 6.4.1.1 Sensing versus Manual Input for Implicit Interactions

I'll be appealing to the literature and empirical findings for deciding to move forward with one of them as the primary method of interacting, for the decision which a main criterion needs to be specified. Fortunately, this criterion was already stated at the beginning of the research, which is to "enable a way to experience music *as itself* in a *meaningful* way". It stands as a philosophical decision point as well as being a rational and literature-supported one; as the consequence of which, chosen method of interaction will constitute the artefact's interactive features.

**Artefact with Sensing Input.** In this case, main source of input is the artefact's sensing capabilities, which collects data from the environment automatically and passively. Its advantage, in an ideal scenario, is that there would be no interface between the user and the artefact: whatever the user may want (or need) would be at their whim without even having to lift a finger thanks to device's deductive capabilities for analysing the user's vitals and the contextual occurrences. Another advantage is the opportunity to minimise the assortment of choices to more viable ones by sensing the music-listening demands for the situation as (over)saturation of choices and information decreases the hedonic utility of the actions of a person whereas system complexity and overhead would be minimal at the user side (see 2.3.3). On a slightly lower note, and in a tame scenario, the artefact would make sufficiently successful deductions for bringing the appropriate music piece to the user overall in spite of occasionally making misses. Surely enough, it would still need some form of manual input to correct its decision for bringing ill-suited music pieces.

Taking a step to the side and looking at this route from a less ideal viewpoint, things start to seem bleak from philosophical, experiential, and human wellbeing-centred dimensions. As good as it may seem on the paper, absence of an interface of sorts might not enable a good experience for the user. An interface acts as a means to translate one's thoughts into actions, which also serves a brake or a tiny room to breathe before deciding to execute an action. Metaphorically speaking, this may be comparable to teleporting to the next junction while driving at a road as a car driver, which would have been immensely stressful as one would find themselves in the act of taking action before even deciding on an option let alone weigh on it. On the other hand, it would be annoying if there was an explicit dialogue at/close to the point of decision for asking permission or providing a notification as this form of an interaction prompt would compete with the flow of one's life, which would be interrupting.

The discussed metaphorical scenarios point out certain serious issues in spite of having a certain allure for eliminating the interface as a middleman and something that understands what the user wants as is. First issue is that the human mind does not works in a linear manner: it has an indefinite amount of reasoning and intuition processes, both of which are prone to biases and depends on correlated heuristic functions of such and may give mixed/scrambled responses to the stimuli; after all, impulse decisions do happen in spite of human mind runs with inherent checks-and-balances (Ainslie, 1975; Tversky & Kahneman, 1981). Another issue is the repercussions of hindering the self-determination of human beings (as per SDT), which actually can be detrimental to one's wellbeing and intrinsic motivations (Bandura, 2009; Desmet & Pohlmeyer, 2013; Peters et al., 2018). Lastly, frictions is actually beneficial for balancing one's reward responses and mitigating gratifications to a healthy and sustainable level: instant gratifications known to impair one's reception of experiences of hedonia while providing no benefit for enabling a sense of eudamonia (Calvo & Peters, 2014; Mekler & Hornbæk, 2016; Odom et al., 2019; Panek, 2013).

**Artefact with Manual Input.** In contrast to the former, we also have an option to afford implicit interactions primarily through manual inputs. The most apparent advantage of manual input its roots embedded to the existing user habits for interacting with interactive artefacts so that the users would have less issue recognising and using an artefact with manual inputs. Nonetheless, the defining advantage of this inputting approach is opening up possibilities for directly enabling user agency as an interactive quality of the designed artefact.

Furthermore, enabling manual interactivity is also an opportunity for affording playful, personalisable, and meaningful music-listening experiences.

In opposition, there are a number of issues with manual way of providing input. The functional toolkit for bringing appropriate or satisfying pieces of music is much more limited in comparable to its counterparts with sensing features, which indicates that there would be much lower accuracy (high variance) for bringing a music line-up to the user satisfactorily. Due to the already reduced size of the toolkit for interaction, what is at hand needs to be utilised effectively. Moreover, it's quite possible that this toolkit will have shortcomings at providing an adequate level of agency to the user, which is why slightly less implicit methods of interaction may need to be implemented.

Putting the advantages and disadvantages of this method of interaction side-by-side, it possesses significant opportunities for enabling user agency as it name (manual) suggests; although, the toolkit for doing so is quite constrained, which leads to a questionable promise of efficacy thereof. All things put aside, certain items like W1/P1, W2/P6, and W2/P5-8 in the artefact inventory (Table 5.10) and several of the deconstructed interaction qualities like machine-learning, randomness, playfulness, and combination (Table 5.11) show promise in overcoming the constraints.

As a result, *manual input as the primary means of interaction presents itself as the more rational option* among them in spite of serious constraints as per the design requirements for implementing it. This decision, as critical as it is, boiled down to going for the less ambiguous option to prevent this process to a fool's errand. It's also worth noting that as an interaction method, manual input is more in line with the research goals. Letting user make mistakes on their own volition is a more human-centric than undermining their will and taking away the experience of taking action. Let's say... if we remember Judy's train ride, it would be almost impossible to forecast how such an experience would be if a sensing artefact was in charge of bringing music to Judy: the thought of how the artefact might interpret the movement of the train, her state of emotion and thought, the immediate context, and so on would be another stimulus on Judy's mind, which means that the artefact might undermine its own purpose. Sensing input has significant number of conflicts and unknowns regarding how it might be implemented: easily pushing the RtD out-of-scope.

#### 6.4.1.2 Manual Input with Intrinsic Information

Moving forward, considering that this artefact won't be putting more explicit and conventional methods accessing recorded music pieces for playback, more indirect routes need to be utilised just like it was done by the study participants. We can emulate the idea by comparing the act of planning the travel beforehand by getting information from resources like blogs, reviews, and an online map service to the act of travelling for experiencing things on-the-go. This example also serves as a good metaphor for conversing about the way we have been experiencing and discovering music with the aid/advent of the information technologies especially since the Internet-connected era to how it is in other cases like listening to radio, going to a pub (and listening whatever is playing there), and going to a music festival and coming across music there – the latter being more implicit, albeit not wholly. Putting things into perspective: the former is more about getting more accurate and precise experience of music-listening as an end result while the latter is more in line with experiencing the music as a process rather than an end result.

In this case, rather than thinking about accessing to recorded music from something comparable an aerial vantage, we must get down to the ground to get the implicit perspective. While someone on the air has beams to overview, scan, and drop at a high speed to a location by navigating somewhat a 3D space; someone on the ground can move through vectors confined to a 2D area with a low velocity while having to pay attention to their immediate surroundings and forecast what may lie beyond by looking at the clues thereof (Figure 6.3). For this sense, for an implicit music-listening experience to happen, user's navigation process takes a number of steps: the user has to decide by facing a direction, survey it, and move towards that direction if it shows promise or feels intriguing, then repeat this chain of actions.

Figure 6.3 - Whilst taking explicit interactions, user possesses an encompassing overview and has a very little regard to affordances of the territory (left), while the user has a constrained perspective and has to regard what the territory affords profoundly as they take implicit interactions (right).

Moving forth, seeing from the past chapters that there are no precise and well-determined way to choose music without interacting with the system through explicit means as the usage of extrinsic information falls out of scope: the user will have to rely on limited information inflow, which is intrinsic information in its entirety. As per the design constraints the information available to the user relating to the state of the system will be as follows in that case:

1. Information and appraisal pertaining to the user's past music-listening experience; how the experience evolved through time
2. Experiencing of the playing music as itself
3. Intrinsic information related to the music next-in-line

#### 6.4.1.3 How to Navigate Between Pieces of Music

Choices can be made through the appraisal of the music next-in-line by listening to it or getting a sense of it about the way it relates to certain elements of the music-listening experience. In this case, several factors present themselves:

**Randomness.** There needs to be a factor of randomness with how the user navigates between pieces of music as there'll be no explicit direction or factor to specify. Even if there is a structure to what the user experiences, the music piece next-in-line cannot be a user-selected one. Randomness, on the other hand, is an interactive quality in music-listening experience which has been around here for a while now also known as shuffle (see 2.1.2).

Looking at the probe kits and the workshop artefacts, we see the presence of randomness. In conceptualisation of 19 out of 21 the artefacts, almost unanimously, it was utilised to make up for the gap created by the restriction for the implementation of explicit interactions; besides, explicit interactions were utilised in the remaining two artefacts. This indicates that the presence of randomness (at least the experience of it) is a must for the presence of implicit interactions in music-listening experience.

**Connections between pieces of music.** We now know randomness is a given, yet the ideal way of connecting the music pieces to each other is still an unknown.

In digital platforms (unless it's an amateur/personal archive of pieces), music pieces are attached/assigned with meta data and attribute information pertaining to themselves as datasets. These meta datasets *can* include or may be assigned with track name, artist name, gender(s) of the vocalist(s), instrumentality, genres, brightness, intensity etc. Those are valuable resources that can be utilised as tools for correlating the music tracks and such with each other.

Normally, it's common to see a structure in digital music-listening artefacts like music streaming services, where the music pieces are conventionally categorised and presented in accordance with genre, era, instrumentalization, novelty and so on in a manner similar to music stores. On the other hand, there are artefacts where such categorisations cannot be found such as an analogue radio, where each station is assigned with a dedicated frequency on a range with no particular order: a structure of sorts only can be found out by staying on a frequency and seeing what that particular station plays in itself. Although, there is a significant difference that is relevant to us between those two ends: modern digital artefacts can be equipped with technologies that allow personalised experience and recommendations whist analogue radio has no such function, which relies on the curative preferences of a radio DJ or a producer (see Table 2.1). In hindsight, what we're interested in are the technological capabilities of the digital music-listening artefacts that can deduce pieces that might match with the user's tastes.

According to the relevant emergent themes of music-listening experience, music-listening behaviours are unique to every single music-listener in their own way; for example, facets of the music the listeners give prominence to and the paths of the music-listening journeys don't resemble each other. In addition to that, everyone's music tastes evolve per their own personalities, characteristics, and the way they listen to music. Lastly, both intrinsic and extrinsic qualities, and the listener's knowledge of correlations between the pieces permeate the music listeners in relation to how they appraise the pieces (see 4.4.2 & 4.4.4). In sum, upon in-depth examination in this study, it was found that individual behaviour patterns and attitudes towards aspects of the music pieces are so divergent (for examples, see cases in 4.4.3) that a rigid (objective) structure isn't likely to provide benefit to the listeners; for this reason, flexible connections that allow evolution and recognition of uniqueness are more likely to be in aligned with the user's intrinsic motivations.

For the discussions made above, the user would have a richer experience in interacting with and listening to music in absence of a rigid structure between the music pieces; rather than that, the system's (the artefact) capability to draw the flexible correlations and relationships between the music pieces by giving them changing and regressive prominences to the weight of the meta data as per the user's behaviour would foster more *meaningful* experiences.

**Playfulness.** These discussions also entail the fact that there is a strong possibility that the system may intimidate and/or frustrate the users due to absence of explicit interaction affordances and the flexibility in contrast to the reliable structure conventional systems provided. For this reason, users need to be engaged with a quality that is both intrigue-inducing and able to sustain that intrigue. There are tools for doing so: storytelling, challenge and competition, aesthetic arousal, playfulness and so on. Many of these qualities are already incompatible with the more essential core functions we already decided on, for example: a relevant storytelling tool can only be an explicit one, music is already an aesthetically arousing media for the listeners, and so on. Playfulness, on the other hand, has promise for complementing the functions of this artefact for engaging the user through more subtle interactions, as the study participants also did so with their workshop artefacts.

**Machine learning for user-artefact-music interactions.** As they were discussed in the workshops and designed into some of the workshop artefacts, machine learning and artificial intelligence features provide appropriate means for music-to-music navigations in user-artefact-music interactions due to their network-like flexible structures that allow permutated combinations and shifting weights of the meta data: enabling the creation of personalised connections unique for each user. This is in contrast to conventional similarity algorithms that provide recommendations through accessing rigid data structures by matching identifiers of/between users with the meta data of the music pieces and media thereof (Schedl, 2019; Schedl, Zamani, Chen, Deldjoo, & Elahi, 2018; Zhang, Séaghdha, Quercia, & Jambor, 2012). These issues and challenges fall under the subject of computer science and engineering disciplines, which are out-of-scope for this research; therefore, we won’t be delving into deeper detail. Although, a visual simplified representation of machine learning and aforementioned flexible structures (neural networks) against the conventional rigid structures of music recommendation would convey the differences between those ideas.

#### 6.4.1.4 Enabling User Agency through Interactivity

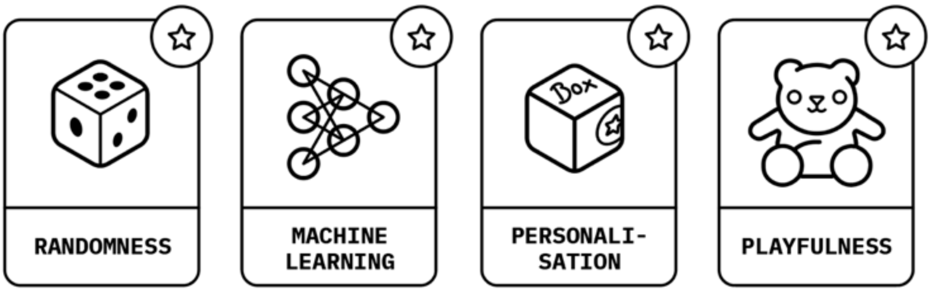



Figure 6.4 - Artefact Deck I: initial core function elements that can be utilised for enabling user agency through interactivity.

First of all, let's review the decided-on core function elements that show promise for enabling implicit interactions: randomness, machine learning, personalisation, and playfulness (Figure 6.4). However, these elements are not of any use without control elements that translate them between the user and the artefact, so we'll be looking at complementary control elements. Right now, we're looking at a wide range of possibilities where the control features might be implemented in any sort of arrangement due to the divergent disposition of the music-listening artefact in question.

**Basic music-player controls.** Let us start simple, controls for starting and stopping the music, and adjusting the sound volume are a given without question. Moving on, let us see about other ubiquitous music control features: skipping to the next and previous piece, and winding the playing music piece back and forth. So, the following controls need to be implemented as discussed below:

- Functions corresponding to **start/stop** and **volume adjustment** as the fundamental controls.
- **Skipping next** is also a feature that needs to be included as per SDT to give the users autonomy and competence through the freedom to continue at one's volition.
- **Skipping to a previous piece** might be *limited to a degree* to discourage re-listening behaviour as it would disassociate the pieces of music from the

points of lived-in moments by banalising and taking away from the uniqueness of the moments. However, complete elimination of this control would go against Nielsen's Heuristics for a good reason: it would eliminate error resolution and would greatly impair user agency. In addition, considering OLO, going back in one's listening history has its own experiential merits for reminiscence – as well as serving as points of reference.

- **Winding forth and back** has potential to be employed as a preview mechanism for the subsequent/future music as *means to enable implicit interactions*; on the other hand, it seems like they have no meaningful purpose to be utilised in currently playing and past music.

**Appraisal controls.** As modern additions to basic controls for affect responses to the system, liking and disliking are valuable mechanism akin to encouragement/discouragement for the machine to bring music pieces similar to the affectively appraised piece.

- **Liking** means encouragement for the system to bring similar pieces while **disliking** is the opposite.
- Skipping was discussed as a feedback corresponding to discouragement whereas it was also considered as a neutral function by the other participants in the workshops.
- **Positively appraised skipping** for continuing playing similar music and **negatively appraised skipping** for changing things up was another idea that can potentially complement the previous point.

**Controls for Directionality.** So far, we have been thinking by considering a linear direction; however, it is safe to say what we should look at is something with more dimensions than a line. Considering that every piece of music and media thereof has considerable number of attributes and meta data, each of such variables need to be considered as an additional dimension in the equation as it is: elevating directionality to a number much greater than a line, area, and three-dimensional space.

On the flipside, in an implicit interaction scenario, it would not be an appropriate option to present those variables even as abstract representations to the users, as those representations would still need to carry a semblance to their explicit connotations.

As per the considerations above, prominent options like steering, orienting, and combining surface, which are discussed as in below:

- **Steering** through an interactive component is a well-utilised and recognised feature for changing directions on a two-dimensional surface. We see examples of it with artefacts like vehicles, video games, and construction equipment. It corresponds to directing the vector towards one of opposing directions.
- **Orienting** can be considered as, similar to steering, changing directionality in three-dimensional spaces through combinations of directionalities in two perpendicular axes.
- **Combining**, arranging, or changing weights of elements that correlate to different locations/poles can also be utilised as means of manipulating directionality of the progression.

**Controls for Tolerance.** In a manner similar to exploration, attitudes and behaviours relating to conservativeness and openness dictate how much distance one can tolerate while exploring. For example, while more adventurous people like to delve between nooks and crannies of a sizeable vicinity, less adventurous or goal-minded people would be more likely to follow a direction without taking or taking less detours.

Users might have different and changing spans of tolerance for covering less or more space as per their personalities, moods, contexts, and motivations while listening to music pieces lined-up on a direction. For this reason, the space or area that correlates to the user's tolerance for listening to music with varied qualities needs to be adjustable. Thus, agency of the user can be amplified through means of implicit interactions. Promising concepts relating to tolerance as follows:

- **Area/space around.** Having a control to adjust the tolerance around what is being listened by the user at the present moment has a significant promise for enabling user agency through implicit interactions. Being centred on the present moment also means that possible pasts and futures are included in the space of probabilities.
- **Span in front of.** Partially similar to area/space of tolerance, a span indicates the angle encompassing an area or a space of probabilities in the future of the music piece that's being listened to at the present.

**Sequences and sequentiality.** In music-listening experience, listening order of the music pieces carries a critical significance (Brown & Krause, 2020; Schedl et al., 2018). Think about it: an abrupt change from a high tempo music piece to a low tempo one, or jumping from Death Metal to mainstream Country Music is an event that might leave a music-listener distraught. Likewise, sequentially and exhaustively listening to the music pieces that are very well-matched to the user's tastes might elevate the user to a state of euphoria; thus, increasing their threshold and gradually making them less likely to be satisfied by the subsequent pieces of music (Csikszentmihalyi, 1991; D. A. Norman, 2004, p. 107; Panek, 2013): making the experience suboptimal and unsustainable.

Relatively less satisfying, even unpleasing pieces of music have their respective places in a music-listening experience as points of references (highs and lows) and to enable an aesthetic variance to make the hedonistic utility sustainable; similar phenomena also comparably exists in product experience (Fokkinga & Desmet, 2012; Juslin, 2013; Krause & North, 2017).

**Progression.** In correlation with all the discussions above in this heading, the process of progression should be in complement to the controls for fostering a harmonious music-listening experience without jarring conflicts or poor combinations.

- There needs to be an inherently structured order of variance between the randomly prompted pieces at any state of the system that would prevent any recognisable pattern of progression by the user.
- Even though there are directionality, a linear direction is likely to lead the user to more extreme, 'fringe' pieces of music; the aim is to make user manually control the system because of their own changing needs, not because of the system's behaviour.
- In relation to the former point, anchoring the system state to the latest point of reference (a piece selected by user's direct input) should keep the space of probabilities within a threshold that is determined by the user's decision.
- Played pieces of music need to surpass a considerable albeit randomised cooldown period for them to be played once again to prevent a recursive music-listening experience[36]; furthermore, the cooldowns need be determined by an algorithm relative to each other to prevent sequential recursions en masse.

### 6.4.2 Interactivity Features

With the core functions determined, we can proceed to work on interactivity features to implement those functions into the design. So far, in addition to the deconstructed interaction qualities from the workshops that were found applicable to the design goals, a number of a priori interaction qualities emerged (Figure 6.5).

[36] An event that was often seen in earlier implementations of shuffle that led the users to be dissatisfied by the questionable randomness and well-distribution of the system's choices.

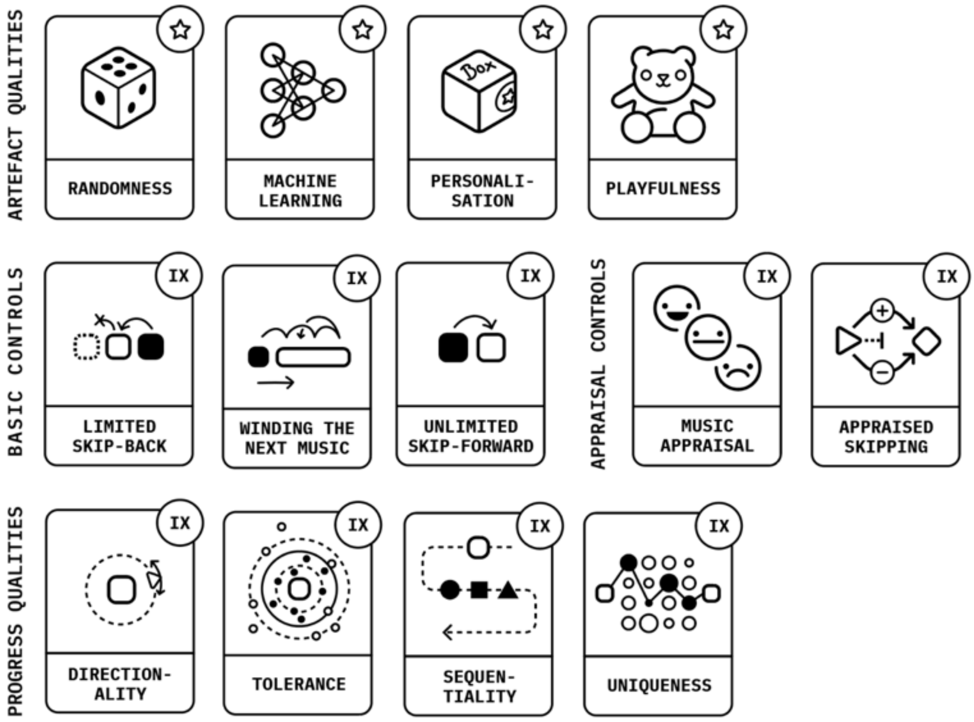



Figure 6.5 - Artefact Deck II: the current set of core functions, control features, and progressions qualities applicable to the artefact.

#### 6.4.2.1 Use Context & Primitive Artefact Qualities

Before continuing to determine the interactivity features, appropriate use contexts and form factors must be explored and evaluated to ensure a harmonious implementation of the features for having a base to work on.

**Use context.** Music-listening is an activity that is virtually done in every kind of use context possible. However, for simplicity's sake, we'll need to focus on a single context or a few complementary ones. In attribution to Judy's train commute experience at the beginning, focusing on mobile contexts could make the most sense as implicitly interacting with a music-player within the dynamism of daily life instead of focusing on just another stimulus can enable more meaningful interactions with the music one listens to. A number of contexts also seen to complement the context in question as they're embedded into it:

- Mobile context (as the primary context)
- Out-of-home sports activities
- Travelling and commute
- Working/studying at non-dwelling premises

**Physical and/or digital.** There already are smart mobile devices (smartphones, smartwatches etc.) in possession of almost everyone, which have capability to incorporate such an artefact digitally, so it means that designing an application of such makes the most practical sense. In truth, when we stop can reconsider the motivations for designing this artefact, primarily putting it into an omni-information-potent device that is also a stimuli house per se would be a paradoxical and oblivious. Therefore, the artefact needs to have its standalone physical enclosure; nevertheless, most of the decided-on capabilities such as machine-learning require digital incorporation. There indicate that the artefact is going to be a standalone physical+digital artefact.

**Size form factor.** As we're going with a mobile physical+digital artefact, it is sure to have upper and lower bounds to make it mobile enough whilst ensuring it possesses enough processing power and energy capacity to sustain it. This means that we should be looking an artefact with a diameter approximately between 40 to 100 millimetres (excluding depth and slack) and with respect to its primitive shape and implementation.

#### 6.4.2.2 Idea & Concept Development for Interactive Elements

So, back to basics: in a scenario where the user doesn't provide additional input to the system, it will continue playing music in accordance with the user's listening history in a randomised way, and the music piece thereafter will be determined after the system randomly determines the next track, which'll be the part of device's historical sample for its next decision (Figure 6.6).

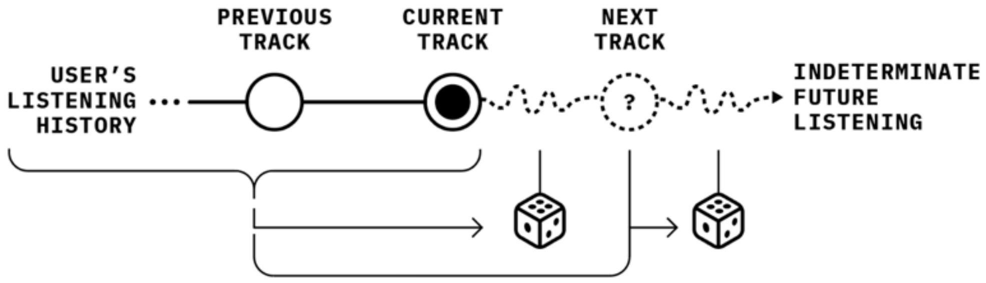



Figure 6.6 - Linear listening scenario w/o user input.

**Automatised sequential randomness.** We can assume the user to be satisfied with the music they listen to which is brought to them by the artefact, which is a valid sentiment until the user decides to take action for switching the currently playing music. Of course, certain criteria needs to be met for sustaining a satisfying listening streak. Owing to the discussions made in Chapters 4.4.2 & 4.4.4 of this research (also see Figure 4.29), we can confidently say that the sequences and interrelations of music pieces needs to be accordant with the unique, permeable, and evolving attitudes and behaviours of music-listener-users: the pieces must be weighted and *ordered* as per each user. Of course, those orderings could only be understood for being mathematical functions of many floating variables, projections of which would be some-odd distributions would only be valid up until the user decides to take action: prompting them to be reweighed; thus, *reordered* (Figure 6.7).

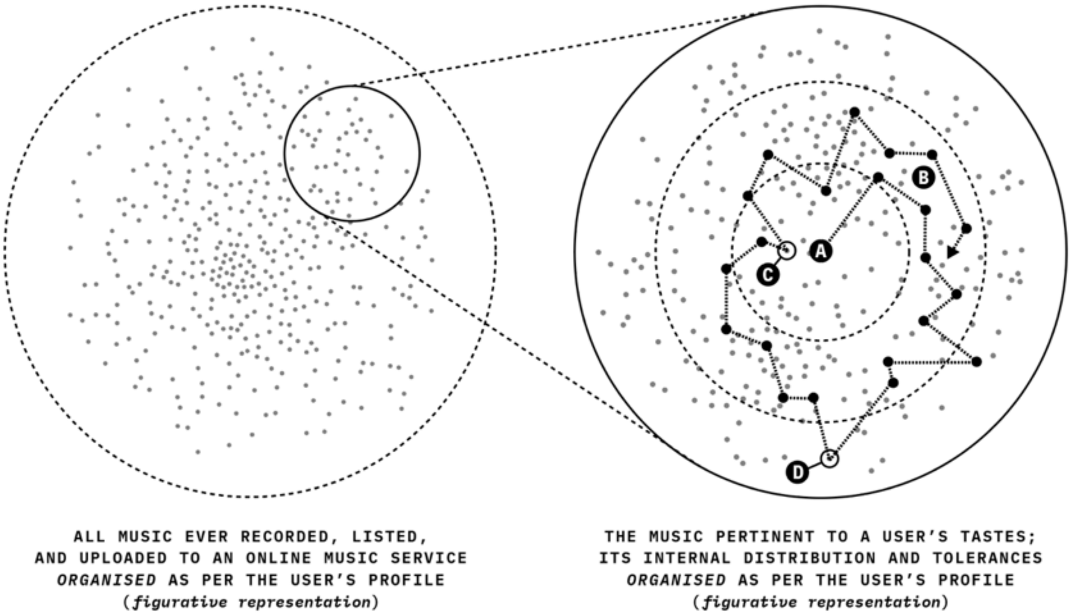



Figure 6.7 - Automatised linear music sequencing for bringing randomised pieces as per the tolerances corresponding to the user's music-listening profile. A music piece serving as starting point and centre of weight (A) where the user settled at after the most recent time when they provided an input. Most randomly selected pieces naturally lie between the inner core and outer one as the median (B). More (C) and less (D) relevant tracks are randomised for fewer time to balance hedonic satiation.

**Skipping forwards.** Venturing forth, let's say that the user wants to skip the track; for that, they'll need to skip it forward so that they'll start listening to the next track. What if user skips it for more than one time? The system should start playing a track that is sequential to the next track, right? Let us stop here and think: if we map this input action exclusively for skipping in a linear manner, we would be needing another input for changing the direction. Instead of that, thinking economically to simplify the input scheme proactively, there is an opportunity to coalesce them with each other for a clear function. As it would bring no utility to a music-listener to skip a track without even listening to it, mapping a simple skip action with direction change action(s) as sequential steps with increasing variance can provide means for affording two actions through a single input component (Figure 6.8).

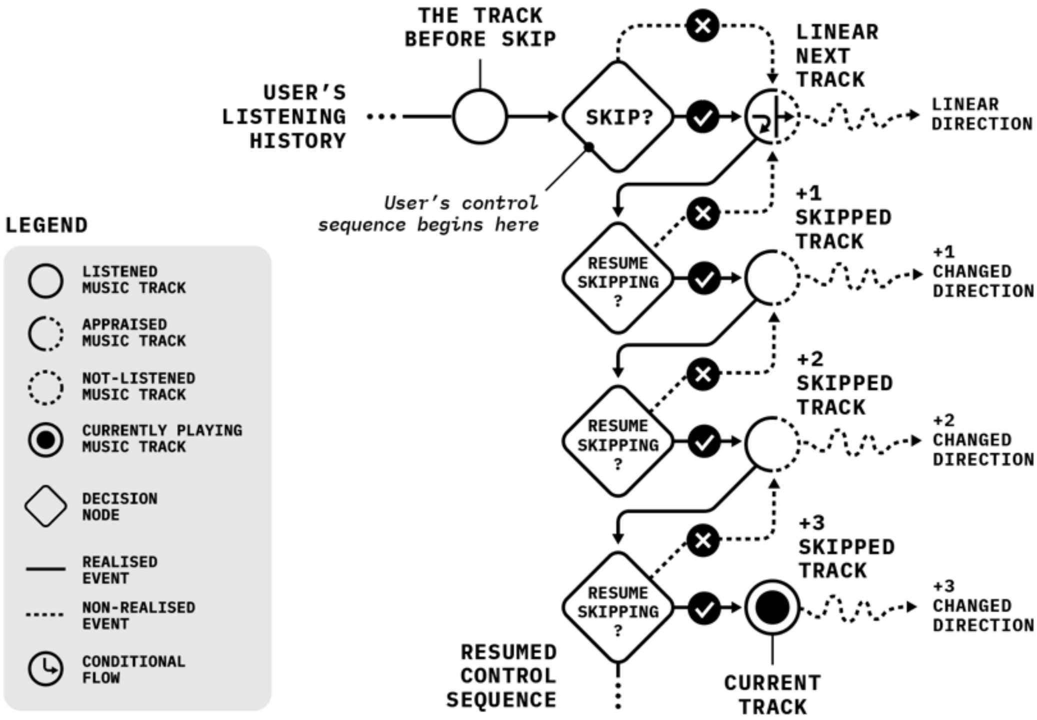



Figure 6.8 - A listening scenario where user controls the directionality, music pieces on whose direction will be randomised and selected by the artefact. In this case, the user did 4 sequential skips (diamond shape + affirmation): initial one skipped the playing tract to the next one at the same direction whereas direction was changed through other three.

The aforementioned idea indicates that the component needs to have steps in contrast to acting like a button or a toggle; it needs to possess the afford stepped input through perpetual motion (hypothetically). The input schemes that correlate to it are joystick, crank, wheel, knob, touch wheel, and also on-screen controls. As we have no need for on-screen controls currently[37], we can go with the remaining options, all of which are can be physically actuated through a circular motion (Figure 6.9). There are as discussed below:

[37] A screen would just bloat the features of the artefact unnecessarily, which is potentially more harmful than beneficial as production and integration of a screen would increase the artefact's carbon footprint per unit as per Rams' Principles. It can be integrated if it is needed at a further step.

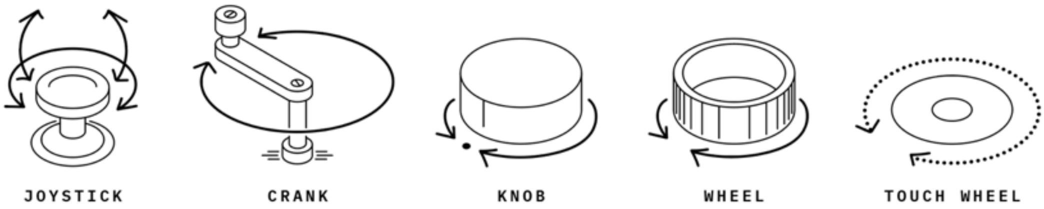



Figure 6.9 - Components appropriate for input through circular motion.

- Heuristically speaking: a touch wheel requires relatively more attentiveness and would not be suitable in outdoor sports.
- A crank, on the other hand, could be unwieldy due to the extrusions of its hands albeit requiring less force to be actuated, yet exerting force at that scale is unnecessary.
- Axes of a joystick are co-dependent, making it demand more attentiveness and cognitive resources to operate due to its lack of well-defined axial constraints.
- Lastly, a knob normally has a constraint preventing perpetuity as it functions between a closed interval, while what we envision is an open-ended control.
- Among these, a *wheel* has the most promise for being implemented efficiently for conserving the interaction real estate on the artefact. This is due to the fact that it is basically a perpetual knob that only utilises its cylindrical face (Figure 6.10).

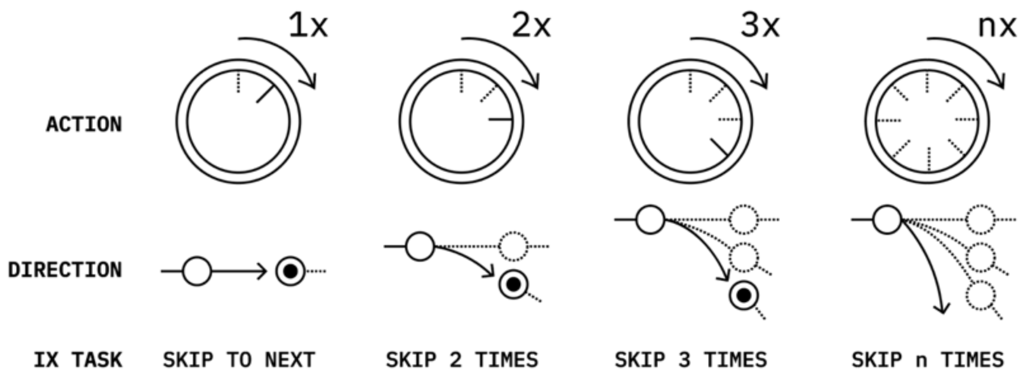



Figure 6.10 - Interaction between user and wheel can be represented like this: highlighting how action, direction, and interaction task correlates to each other.

**Skipping backwards.** As we discussed before, allowing full affordance in chronologically skipping back to the previously listened pieces of music has a number of issues; therefore, restricting it in a meaningful way would allow users to have autonomy/competence for going back. Foremostly, issues are as follows:

- Users may start utilising their listening history as a playlist, which can be considered as a means of explicit interaction due to what they'll listen to in the future by re-listening their history.
- One of the design goals was to enable meaningful music-listening experiences; thus, allowing individual pieces of music to be relistened-at-will would make them more common: detaching them from mindfully experiencing the moment.

On the other hand, reminiscence and one's wanting to go back are meaningful notions in themselves; for this reason, going back to the past needs to be less commodified and more valuable. This is comparable to going back to one's hometown, where things indeed have changed over time, yet embracing the change with the opportunity to reminisce at the same time makes that experience unique and meaningful in its own right.

For the discussions made above, two probable ways of skipping back (in a meaningful way) presented themselves:

- Enabling users to favourite or mark pieces at will: making them checkpoints to be returned back to.
- Allowing skipping back to the past decision nodes at where the user changed/skipped the playing music piece (to forwards).

Looking at all the discussions made above and the options, *second option* seems to have more promise for enabling backwards skipping as an implicit interaction. This is due to the fact that favouriting/marking, again, incentivise meaninglessly marking the pieces frequently to go back. However, decision points are meaningful points of interaction where the user takes initiative. Once again two possibilities present themselves (Figure 6.11):

- **The piece just after the skip.** Returning to the piece where the user decided to stay at and listen at a considerable portion or in full.
- **The piece just before the skip.** Going back to the piece at where the user changed the music by controlling it.

In regard to this feature, going with *the piece just after the skip* makes the most sense as the user takes off from the pre-skip piece in question and decides to settle on that certain post-skip piece of music: this *decision* should be meaningful in itself.

- On another note, *allowing skipping back to the previous piece of music for each furthest piece of music* is a quality-of-life feature that shouldn't be taken away from the users. This is due to the reason that it may correspond to a second chance for listening to a piece the user somewhat missed out of simply wanted to immerse themselves with it a second time just for the sake of experiencing it again right at that moment.

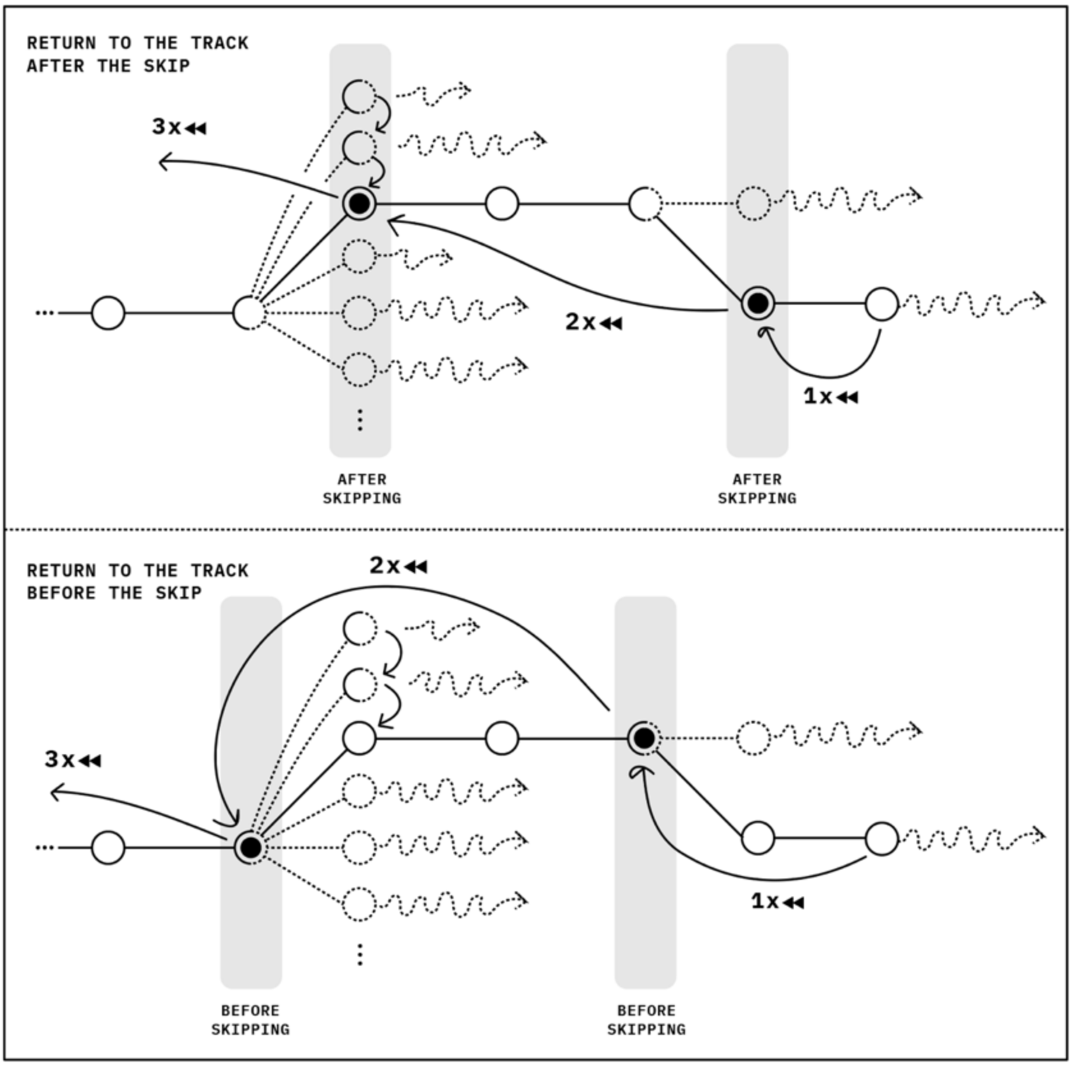



Figure 6.11 - Diagrams illustrating the scenarios where the user might land after skipping backwards: just before or just after the previous decision point.

**User-controlled navigation.** In contrast to *automatised linear sequential randomness* (at page 224), where we discussed linear listening experience without user input, user-controlled navigation needs to have a different randomisation pattern and afford a contrasting yet complementary experience.

In this case, rather than a randomisation pattern that sequences the pieces within a confined space, the matter about directionality needs to be discussed about and conveyed through a conceptual model. For this, let us examine a few fundamental vectors, curves, and sloping curves for communicating the concept in question.

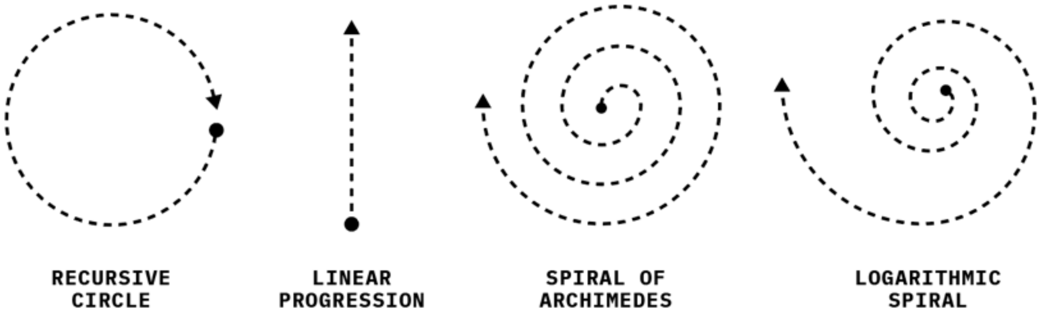



Figure 6.12 - Visualisation of the possible user-controlled navigation behaviours (or the Artefact), whose shapes indicate how the navigation behaviour may potentially change in response to each user input in a single sequence.

- When the idea of motion is entertained in projected areas or spaces, a circle is basically a recursive path that one could pass through the same spots over and over again without going off the path. This points to repetitive listening behaviour and isn't compatible with the research goals.
- Moving on a line, on the other hand, indicates going through a linear path until hitting an obstacle, indicating that one would eventually find themself at a point the variables progressed to extremes. Let's say... a Techno Music piece with discordant noises that are accompanied with a hate-romance poem written with trains in mind and synthesised with goat sounds, whose objective would be to foster a Dadaist avantgarde experience. Jokes aside, more absurd it is, more likely it is for one to end up at the presumed extreme of a linear path.
- Spiral of Archimedes is a unique type of spiral whose steps are equal to each other, which puts it somewhere between a circle and a logarithmic spiral as there is no recursion nor decay. It is a likely candidate to represent our conceptual model for more *conversative* progression patterns.
- A logarithmic spiral is a natural pattern whose spiralling shape has varying degrees of decay that puts logarithmic steps between each of its steps. This indicates its aptness for representing more *adventurous* progression patterns.

Of course, like the progression of a line, all non-recursive movement patterns would bring one to extremes at varying rates. For this exact reason, there needs to be constraints and conditions supported by conditional *slope-altering* (figuratively speaking) reinforcement algorithms[38] to make the paths attain varied paths. A great representation of such would be a spirograph, a tool/toy that allows drawing complex often circular shapes with ease by inserting a pen into it.

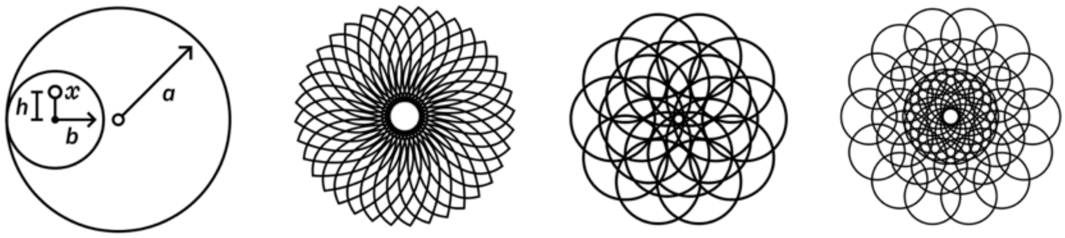



Figure 6.13 - As seen on the leftmost figure, as the smaller circle with radius b rotates through the tangents of the circle with radius of b, x pivots by the difference of h in the smaller circle: producing a shape similar to the figures at the right-hand side of it.

We can say that a spirograph is a hypotrochoid function, which correlates to continuous plots drawn by taking a certain point relative to an inner circle that also rotates through its tangents within a ring or in relation to sets of circles and rings (Figure 6.13). These mechanics behind these shapes, in truth, produces algorithms in question when the mathematical notation is translated to conventions of a programming language.

**Winding forth and back.** With respect to the previous discussion, winding back to the past is out of consideration. However, winding forward and back within and between the subsequent tracks is a potent actionable tool for enabling implicit interactions (amidst a limited array of tools) for navigating between the tracks.

It would be possible to take **glimpses** of parts of the subsequent tracks while skipping from track to track while continuing a skipping sequence. If we're to appeal the information from the interviews and the probe kit studies of this study,

[38] for machine learning programs to be *encouraged* for following that behaviour.

we see that music-listeners already utilise this action sequence while deliberately navigating between and discovering tracks (see 4.4.2 & 4.4.3).

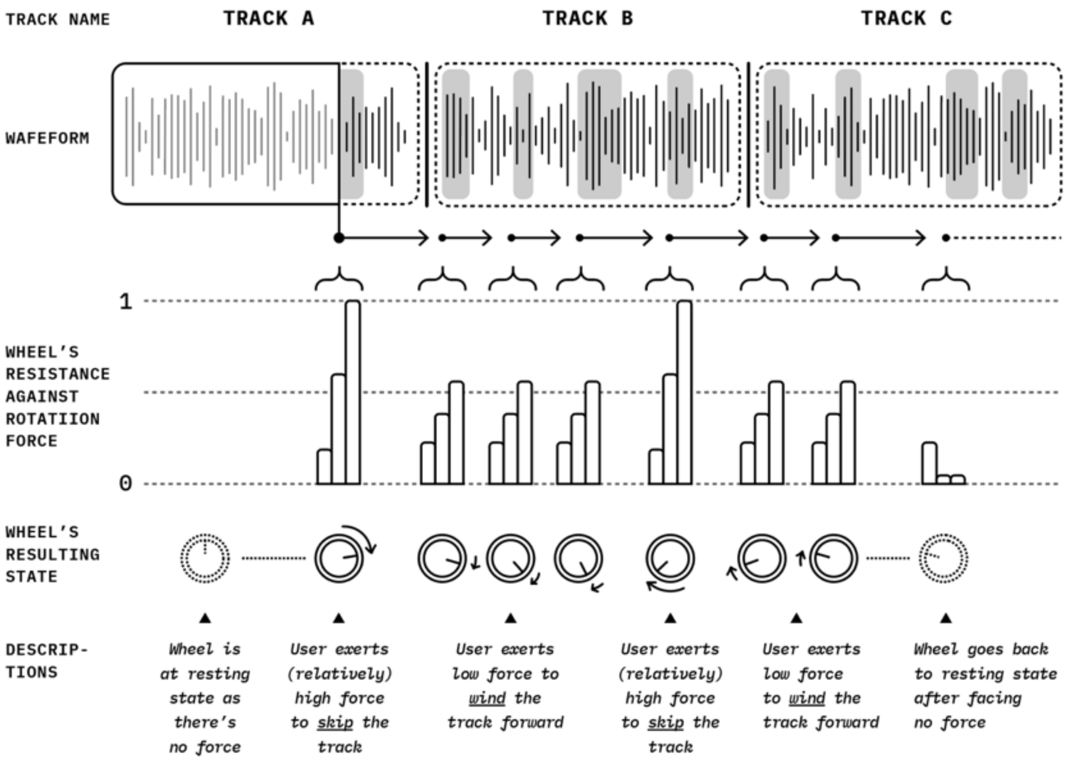
A feature of such is a significant means for appraising one's options while browsing the (subsequent) tracks in an effective manner, which is due to the fact that the intros of the pieces give very limited impression for what the music pieces are holistically.

In essence, it all boils down to the mapping and implementation of the interactivity features as controls onto the artefact. This requires a combination of haptic and sonic feedback mechanisms that convey clear messages regarding state of the system and the music piece that is being played (Table 6.1). Consequently, in summation, the interactivity feature for winding should possess the following qualities:

- Winding and skipping need to be done through the same action: rotation of the wheel, while the user needs to be able to distinguish between them.
- While winding, the act of skipping between the pieces should give a stronger feedback than winding within the parts of a track.
- The feedback in question can occur in a manner similar to stepped wheels that exert a reaction upon nearing the breaking-point of the steps.
- The button needs to have appropriate slack distance after each surpassed step for the user to readjust to reduced reaction by the wheel.
- The interaction should commence upon exerting an initial amount of force that is equal to the reaction force for skipping a track.
- Winding backwards needs to function in the same manner up until reaching the beginning point of the sequence.
- The user should be able to return to the beginning track/point of the wind-forward sequence by winding backwards; higher spontaneous force exerted by the user could correlate to returning to the beginning track instantaneously.

- The wheel should stop the sequence after the lapse of a few seconds after the user stops exerting force/motion.

Table 6.1 - A graphical table where a hypothetical wind-forward sequence was initiated in correspondence to timepoints of a piece, artefact's reaction force against the user, and the wheel's state(s).




**Two-axis wheel.** In spite of being able to progressively venture to a further-distanced music piece by changing the direction/distance with every skipped piece of music, the means to do so with step-by-step basis until reaching a satisfactory distance is neither efficient nor intuitive. For this reason, being able to change tolerances of distance would be an effective tool do alleviate this issue.

By increasing the tolerance, the range of upper thresholds increases while the rate of decay of the navigation path heightens, we can say that the distance between each step increases exponentially in case we compare it to a spiral.

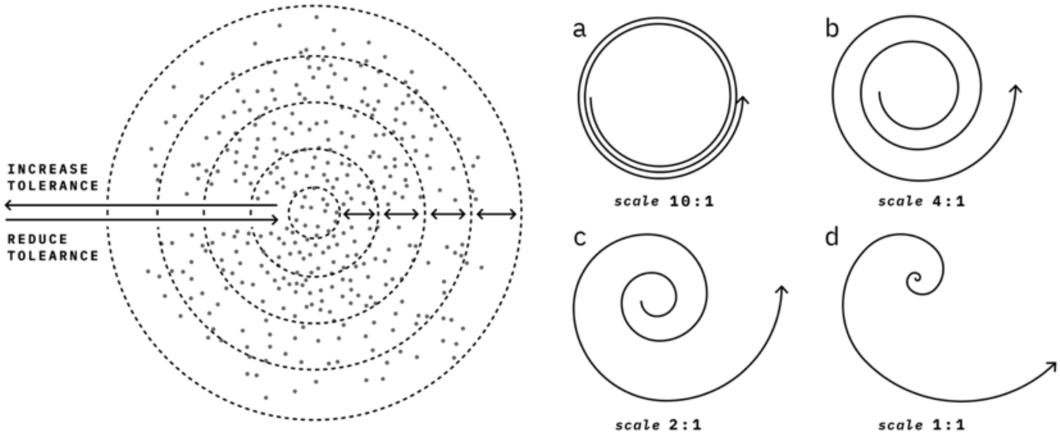



Figure 6.14 - A diagram visualising how the input for changing Artefact's tolerance affects its range and the curvature of the navigation path. The distance between each revolution step (a-b-c-d on right hand side) from a to b increases logarithmically as the tolerance increases to cover the increased range (on left hand side).

Here are the facts: currently, primary means of control or going back and forth is conceptualised as a circular motion, which is a laterally recursive full loop in itself. However, could be possible to enhance it by implementing a feature for affording perpendicular motion against the tangents of the loop: allowing bidirectional movement in two axes (lateral rotational and perpendicular). Therefore, by assigning directionality and tolerance (of area) in a perpendicular manner with respect to each other, a natural mapping and mental model thereof can be enabled (Figure 6.15).

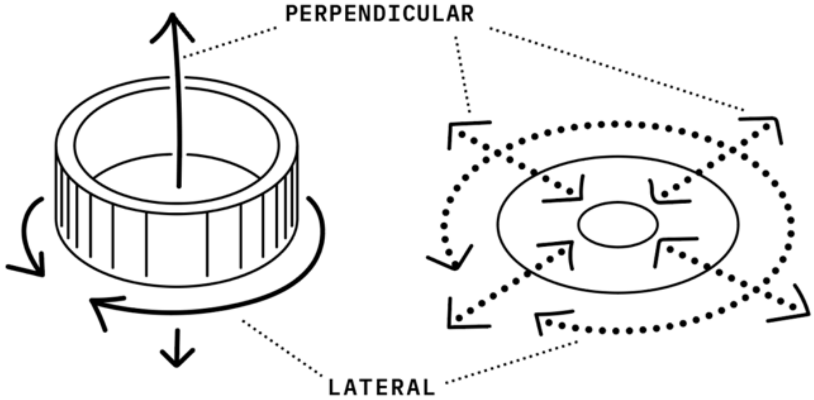



Figure 6.15 - Motion perpendicular to the lateral movement on a wheel.

Henceforth, mapping of all primary control elements to a single physical (or tangible) component has the merit of not demanding attention as it won't also be conveying any kind of explicit information.

#### 6.4.2.3 Concept Development for Exploring Form Factors

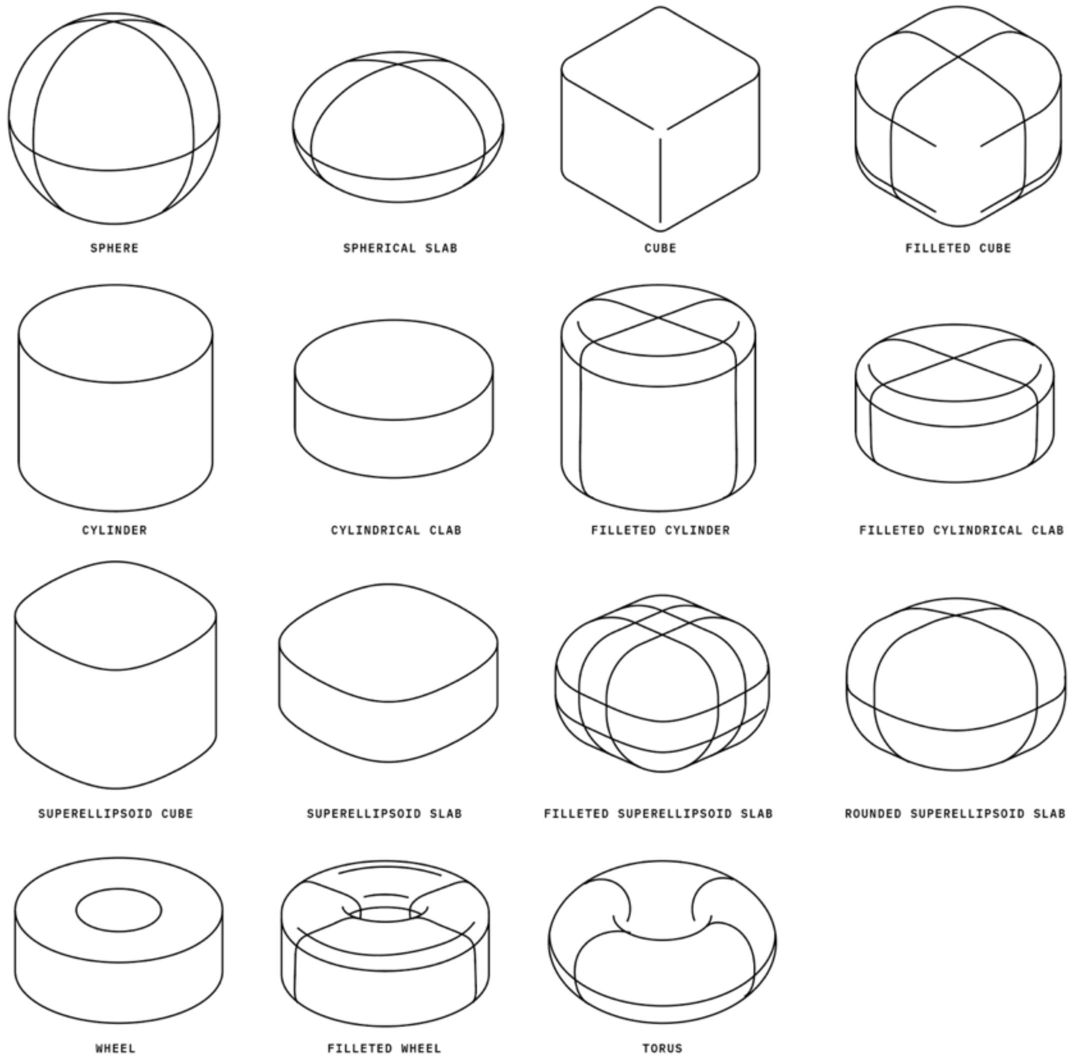



Figure 6.16 - The options for the primitive shapes to proceed with.

**Primitive shape.** The need for exploring certain shapes that may afford a wheel-like rotatable component that can rotate laterally and perpendicularly became apparent as the interactivity features were decided upon. Those are three-dimensional derivatives of circle, square, and superellipse with and without rounded/filleted corner options.

- Upon a visual inspection, we see the variants of circle can constitute a full wheel shape at varying capacities without breaking the outlines of their respective primitives, the variants of squire and superellipse may need to constitute a mechanism substitute to a wheel.
- The rotating mechanism of squire and superellipse-based forms can function in a manner akin to Rubik's Cube; alternatively, a haptic display for simulating the reaction force through haptic feedback.
- In terms of ergonomics (by considering Rams' and Nielsen's ideas), heuristically, we would prefer a shape that can sustain multiply sequential rotations that wouldn't force the users to twist their wrists significantly.
- It also should complement the use scenarios and carrying requirements of the mobile contexts of use (see 6.4.2.1).

By evaluating the shapes as per the points above, we see that the shapes in which all three dimensions are equal at the minimum specifications (40mm, see 6.4.2.1) still become exceedingly large for a number of mobile use scenarios.

- This indicates the *elimination* of full shapes like sphere, cylinder, and cube. As one couldn't comfortably carry an artefact with 40mm in their pockets or while doing sports; on the opposite side, those with large hands would face difficulty while interacting with a constrained interaction real estate.

**Size factor of the primitive shape for ergonomics.** Comparison of the specifications detailed made above with respect to Ergonomics literature regarding the hand anthropometrics of adults, and additionally, children (de la Fuente & Bix, 2010; Mathiowetz et al., 1985) suggests that the most optimal direction to go with is:

- A slab-shaped artefact with lateral dimensions between a ballpark of 64-72mm in the length width and height

- With a depth that corresponds to a point between one-thirds to two-thirds of its width and height.

#### 6.4.2.4 Access to Music, Integrations, and External Output Connections

A music-player would not be much of a use without the access to music pieces to play. Storing music pieces in a local archive is somewhat out of the question due to the gargantuan difference of size of local music archives in comparison to the archives of music-streaming services like Spotify, Apple Music, Deezer, Tidal, Soundcloud, and so on. Each of these services, albeit overlapping in varying degrees, offer values that make listening to music through a personal archive seem like an extremely constricted experience in practicality.

The technological capabilities of online music streaming services are one of the reasons why designing the artefact of this RtD is within reason and possibility. The great magnitude of the music available online makes music listening through implicit interactions possible, which would have been much more constrained otherwise.

**Access to music streaming services.** Most of the music streaming services allow integration of third-party services to their archives and systems by offering their APIs (Application Programming Interface) to the developers of those services.

By integrating APIs of music streaming services, the Artefact (and any third-party developer) would gain access to play music and attain meta data from a service of such. Of course, the user still needs to subscribe to one of those service for enabling the Artefact to play music by fetching media and data through the user’s account (Figure 6.17). Access to music through those services has significance on a few notes:

- This is the most efficient and practical route for access to music in our case in contrast to on-device storage of music (which is impossible at this scale) and creating its own services for doing so (unnecessary overdesign).

- The user would benefit from the service in itself and could play music through the Artefact by utilising the resources of that system.
- The Artefact's purpose is to enable experiences rather than competing with other means of listening to music; thus, it is both a substitute and a complementary way to listen to music for the users.

**Integrated connection-enabled features.** Having established access to the user's streaming accounts has merits of its own: the user can favourite a piece of music for it to be added their 'User's the Artefact Playlist' *after* the listening session, so that the user would have ease of access to find those pieces of music later on. Wouldn't that make the interaction explicit? The answer is no in this case as the listening session is well in the past; therefore, gaining extrinsic information about a track would have effect neither on user's listening experience at the moment of initial listening nor their appraisal while doing so.

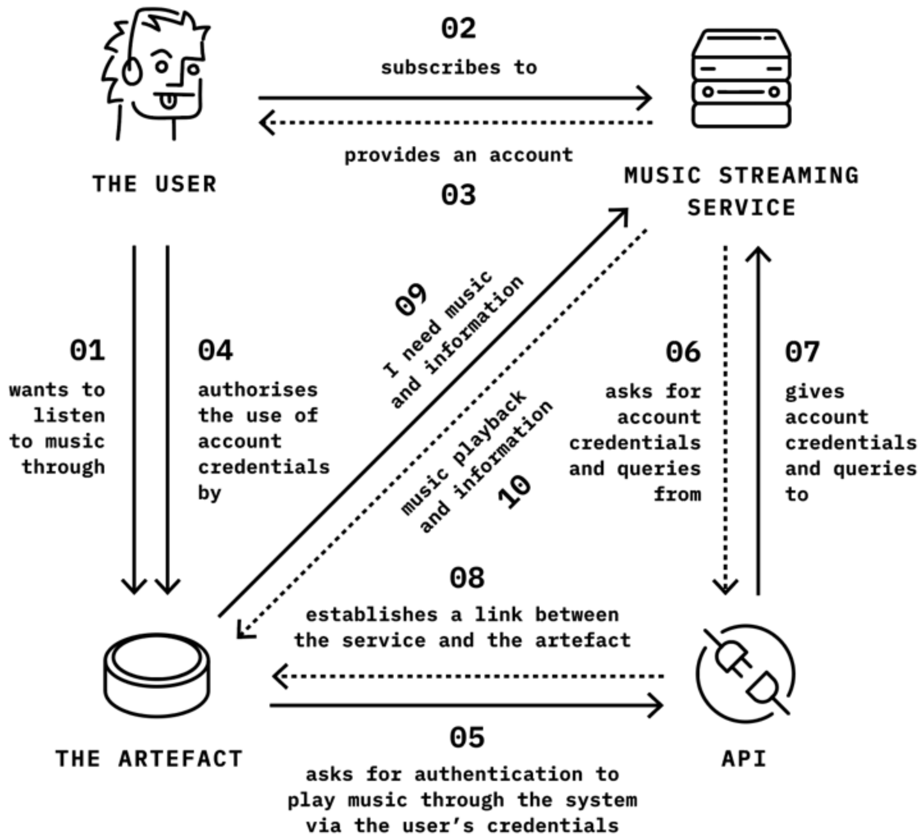



Figure 6.17 - Process of authenticating the Artefact with access to a music streaming service for music playback and meta data.

**External output connections.** As far as we're concerned with compactness due to the mobile contexts, every centimetre cube within the Artefact's enclosed space becomes much more valuable, which indicates making some sacrifices: such as (especially) including an embedded speaker.

- On one note, smartphone manufacturers embed speakers to smartphones with satisfying acoustic qualities, it's likely to take gargantuan amount resources to achieve that level of quality in constricted spaces.
- On another note, even though it is a standalone artefact per se, there is still emphasis on achieving most valuable the results through the utilisation of minimal components and attaining the rest through the complementary means.

These mean that the Artefact will be producing sound through external devices, like it fetches playback data and track meta data from the music streaming services. This is a safe decision to take at conceptualisation phase due to the fact that almost every household and every user has access to speakers or headphones that have AUX connection and/or Bluetooth connectivity (in applicable markets).

#### 6.4.2.5 Social Listening Features

One of the popular ideas while doing the workshops was the ‘vacuuming’ feature that enabled users to share music; in addition, the feature for combining the taste profiles of two or more people to play music that appeal to joint tastes for enabling social listening. Furthermore, the participants’ responses also illustrate that listening to music together is a meaningful event that brings people together in a unique way; moreover, many of the participants actually decided to give high prominence to such social listening features without receiving a prompt about it.

**Relatedness.** Sharing the music physically has a considerable impact in terms of enabling meaningful listening experiences as it constitutes a valuable opportunity to foster Relatedness[39], which is one of the three facets of self-determination. An example of which is the mixtapes[40] of the past: people used to make and give each other mixtapes, which is considered a treasure gesture due to signifying the great deal of manual effort by the person who gives them. We can say it is a gift with personal touch in terms of its contents and what it represents.

**Togetherness.** Being together co-spatially is arguably the most intimate manner to socialise with others in contrast to communicating through distances. As already mentioned, individuals cherish listening to music together: this is an opportunity to enhance and make the users feel the significance of physical aspect of music-

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[39] Sense of genuine connection and being attached with the people who surround an individual.
[40] Custom-made music cassettes that are manually arranged together.

listening artefacts for togetherness. Again, as indicated throughout the workshops and interviews, an event that happens only when two or more artefacts (and users thereof) brought together could convey the sensation of inducement through the physicality of a music-listening artefact in a sincere manner.

Owing to the discussions above, the following social listening features have merit for enhancing users' wellbeing:

- **Touching two artefacts together briefly (synchronising)** to synchronise both artefacts up until at least one of the users decide to give manual input for returning to individual listening. Although, given the overall functional decisions regarding the artefact, being able to return to the starting point of the synthesis by skipping back to that point of interest (Figure 6.19).
- **Putting plural artefacts together physically (pairing)** for initiating joint listening sessions that are determined and controlled by arranging the artefacts in hierarchical ways to induce a playful experience as the arrangements become a way to provide input to the artefacts (Figure 6.18).

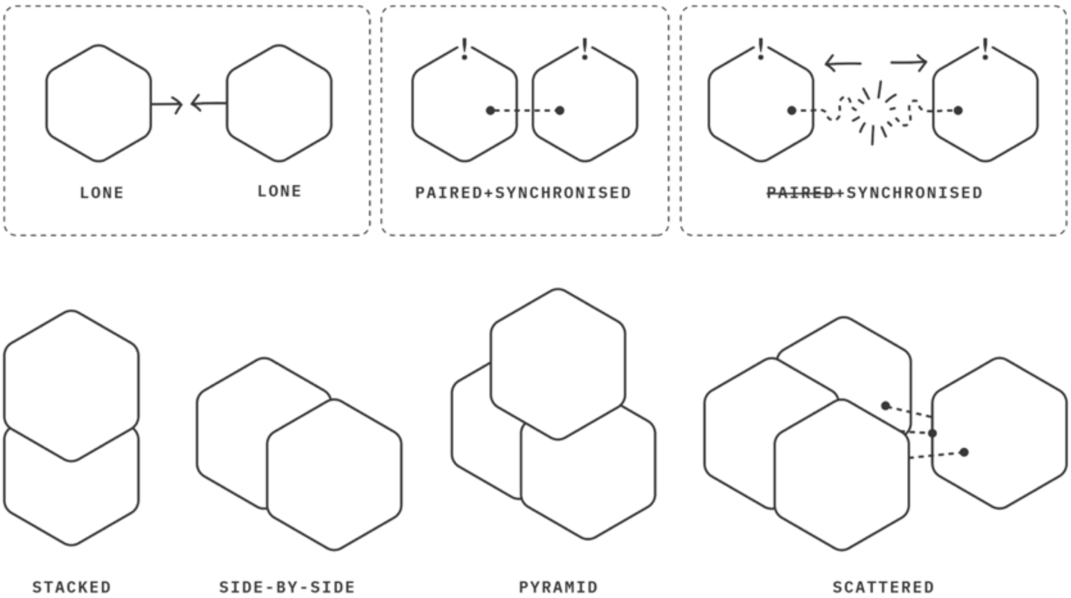



Figure 6.18 - Pairing process visualised.

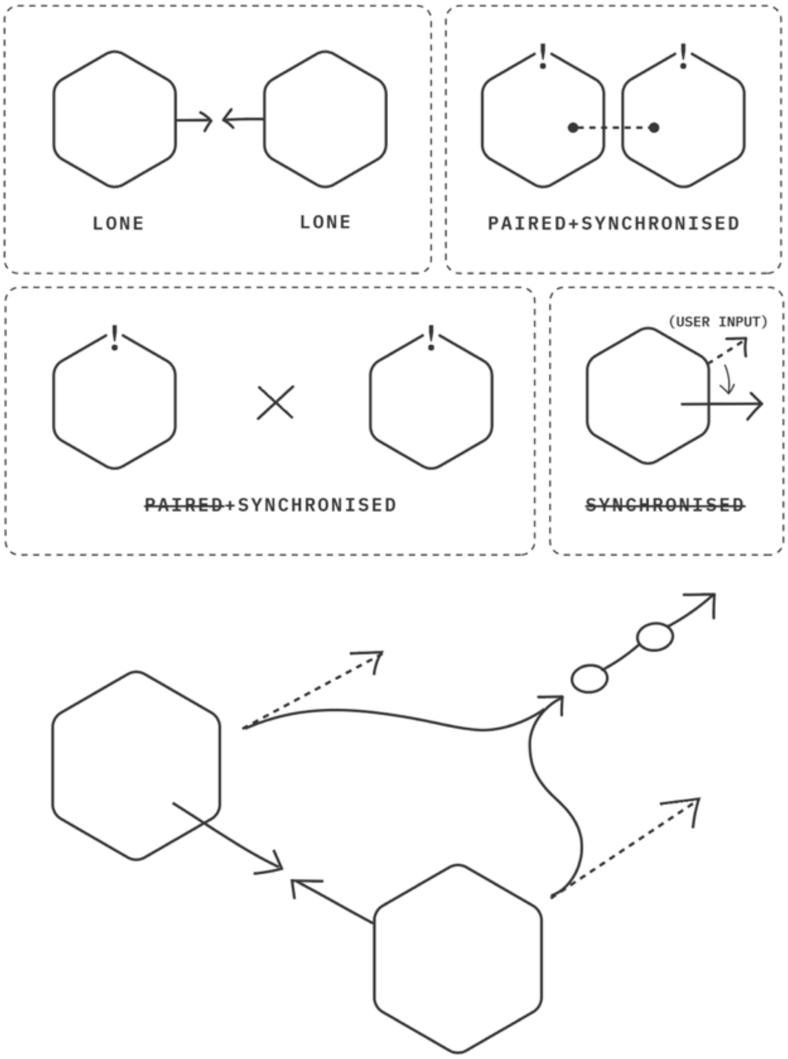



Figure 6.19 - Synchronising process visualised.

#### 6.4.2.6 Idea Development for Artefact Feedback

A pleasing-to-use interactive artefact should almost always have well-fitting feedback features and qualities (unless the decision for not to implement is intentional[41]). Those feedbacks can be given to the user through modes allow

[41] For example, ambiguity was occasionally employed to make a statement through the artefacts odd functions: absence of feedback would be intentional in those scenarios (W. W. Gaver et al., 2003).

reception by any of the human senses. As indicated by the previous chapters and discussions, the most apt modes of feedback are haptic/tactual, visual, and sonic in their respective cases that call need for implementation.

- **Haptic feedback.** The Artefact is conceptualised to be a device the user would mainly interact with through the employment of touch/contact due to absence of explicit information that puts less emphasis on the screens and vocal verbalisations.
- **Visual feedback.** On the other hand, there are tasks that require the user's direct attention and gaze; for those scenarios, a mesh of LEDs can provide the necessary feedback in simple 2d arrangements as there is no need to employ high-resolution screens.
- **Sonic feedback:** The other modes of feedback may not be sufficient or adequate in some scenarios; in those cases, sonic feedback can be given through the user's speakers or headphones.

The feedbacks/feedforwards mapped to the corresponding interactivity features as per their modalities; therefore, interactions thereof are as listed and discussed below.

**Winding and skipping.** As winding and skipping were mapped to the same interaction on the same component, they need to have coincidental complementing feedback with shared qualities that create the sensations that could be recognised from everyday events, assisting the formation of the user's mental model.

- **Haptic.** As we previously discussed the reactivity of the wheel against the force exerted by the user in accordance with the action done for skipping/winding within a track or in-between the tracks.
    - As an example, you can recognise a similar haptic feedback from bank heist movies where the safe's knob gives a rapid haptic *clicking noise*. You can also simulate the corresponding sensation to this haptic reaction (and the corresponding sound) by slowly

pushing a retractable pen’s rear button by getting a feeling of the pen’s rection.

- **Visual.** *(Any type of display would normally be appropriate for enabling visual feedback, which we’ll be exploring at a further stage)* In addition to the observable state of the physical component, simultaneously responding visual feedback would be beneficial for confirming the effect of the clicking through an additional modality and making the learning process smoother by reaffirming the user through a familiar mode.
  - Examples would be abstract progression indicators that are usually conveyed through mixtures of space use, motion, velocity, and location.
- **Sonic.** Transition between and within the tracks need to be supported by easings and cross-fade effects not to irritate the user’s ears. The effects may need to be supported with audio icons.
  - For example, the white noise that happens when transitioning between analogue radio stations or high-speed scrubbing sound may be given while winding the tracks, between the regular audio sections to create the sensation of skipping.
    In addition, for transition between the tracks, subtle bass sounds that feel similar to closing a door or mechanic sounds like inserting a cassette into a player.

**Changing tolerances.** In contrast to winding/skipping, tolerances are more correlated with spatiality, which is often associated with the sensation of spaciousness or tension. I believe that the best way to go is to map the events with how interactions between objects produce sounds with respect to their semantic qualities.

- **Haptic.** The change of spatiality may be felt through the changes of increase and reduction of physical reactive tension given by the component to the user.

    - In example, feeling the intensity of changing tension of an elongated rubber band and a compressed pillow are good examples of such; vice versa, it is also applicable for the release thereof.
- **Visual.** The foremost visual feedback, again, should the observable state of the physical component; if not, areal changes and interaction between positive and negative spaces can be applicable.
    - As an example, a shape-changing spacious object like a big balloon may correspond to higher tolerance whereas a tennis ball could create the inverse effect.
- **Sonic.** Again, the same story: some sounds feel more spacious corresponding to their material and form qualities while others don't evoke a such feeling.
    - The best example would be the stark contrast between hitting a drum (which is and feels spacious) and hitting a filled object like a concrete wall, which doesn't create such a spacious effect.

**Adjusting volume.** This is more of a self-explanatory event as the change in the sound volume is a natural feedback of the event in itself; however, and once again, assisting the creation of the user's mental models through other modalities is a good practice of IxD for preventing and resolving error while communicating the state of the system more clearly.

- **Haptic.** This haptic response may be a uniform and linear one as a more complex stimuli isn't needed; it should only affirm the user that they're providing input to the system.
    - The haptic feedback of a notched mouse wheel (not the smooth ones).
- **Visual.** Once again, a linear one is classical and sufficient like a filling bar.
    - An element denoting the ratio of positive space to negative space in a container is sufficient.
- **Sonic.** The change in sound per se is its sonic feedback.

**Liking a track.** This interaction for taking this action will be an example-at-hand that can be constituted as a precedent for other binary (non-interval) interactions like setting it up and pairing etc. This kind of an interaction needs to create a distinct, brief, and gentle feedback, whose counterparts are:

- **Haptic/sonic.** Liking is an action of positive affect and is usually mapped to positive emotion inducing objects with fluffy, bubbly, soft, pleasing-to-touch, and such semantic associations.
  - One of the most widely known pleasing objects with such interactive qualities is a packaging bubble wrap: popping it creates a pleasing multisensory sensation. The sensation is distinct as its as result of creating an explosion whilst being gentle and harmless.
- **Visual.** Going with the positive, distinct, and brief sensations: a simple animated sequence of a relevant icon does the trick in such cases.
  - Again, going with the positive and smooth characteristics, universally accepted representation of liking is a heart (unexclusively): an animation sequence in response to the user's action will give an apt feedback for confirming the action.

#### 6.4.2.7 Conceptual Design for Integrating Interactivity Features

As we decided on an artefact with puck/slab shape that should include a wheel as primary means of control, we should explore and decide on the options for the exact shape and dimensions to advance with.

**Final shape and dimensions.** Putting the updated features into measure whilst constituting the much-required visual feedback indicates dimensions that are larger than the previous minimal specifications; therefore, measurements that slightly exceed the maximum measurements will also be included to the comparisons to get a sense of shapes.

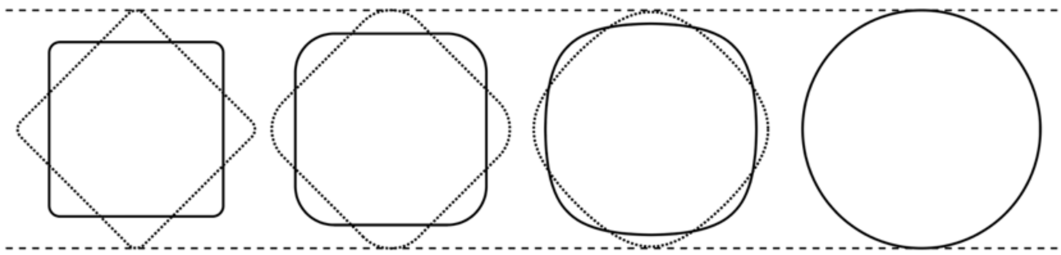


Figure 6.20 - Contrasting the short and long dimensions of the shapes to visualise the differences between the surface real estate thereof.

Anthropometric data indicates that we'll have to make a decision as per a trade-off between boxier shapes and larger circumscribed radius, meaning that it'll be either smaller and boxy, or larger and circular for enabling a circumference interval for affording a revolving circular motion.

For these reasons, the relevant actions were attempted on either aptly-sides household objects or cardboard mock-ups in absence of these, resulting in the following observations and considerations:

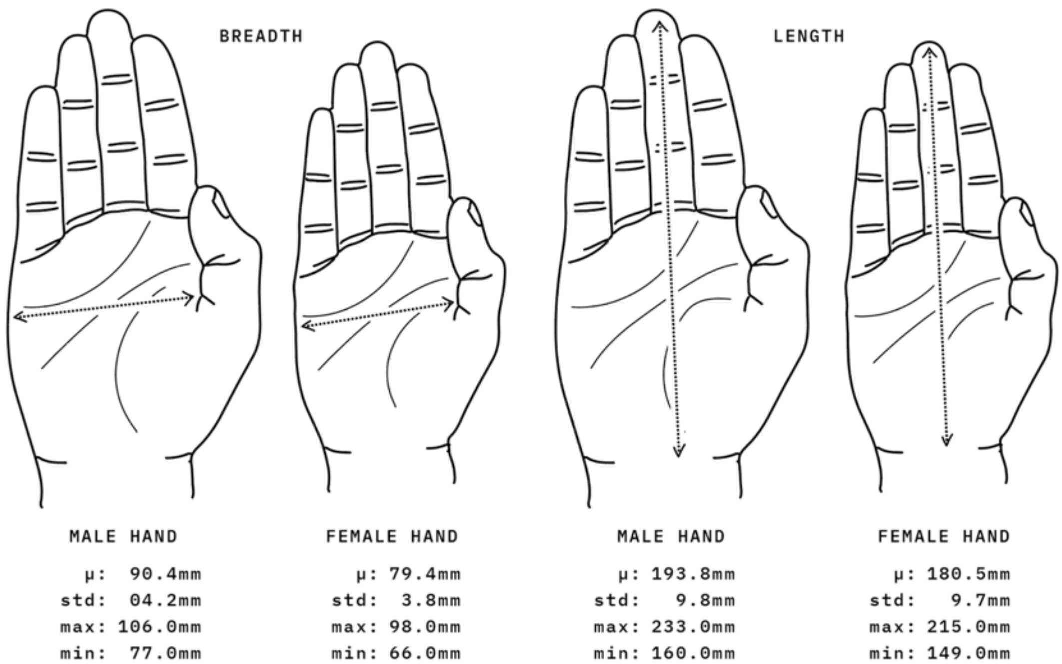



Figure 6.21 - Descriptive numbers for the distributions of the breadths and lengths of male and female population samples.

- Holding the squares even with the rounded corners became uncomfortable after a couple of seconds: the boxier and larger the form, more uncomfortable it was.
- Dual handed scenarios didn't pose any difficulty for rotating; however, it put the hand grasping the base object in an unnecessarily stretched state when the object was at bigger and smaller ends.
- In all cases of single-handed use, the thumb needed to make a circular motion between fully abducted and adducted states through a spherical grasp: making it difficult to fully stretch or withdraw the thumb while interacting with smaller and larger objects.
- In most cases, shapes like spherical slab, torus and such highly rounded objects were difficult to grasp due to the absence of discernible corners for the fingers to rest.

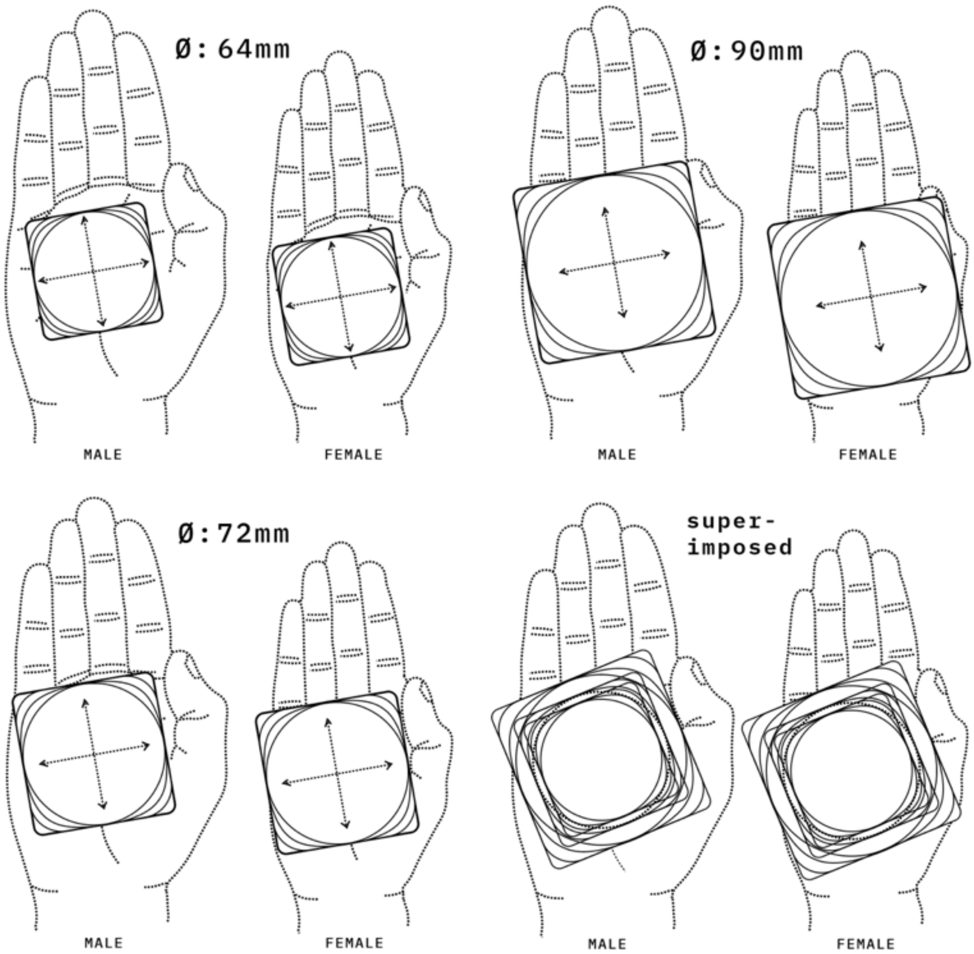



Figure 6.22 - A diagram visualising how primitive shapes between circle and square with diameters of 64, 72, and 90 millimetres compare to each other.

As per the observations above, the most comfortable form was contested between Ø72mm circle and superellipse. In consequence, to hit the right balance between mean male and female hands while considering the tails of the distributions, I concluded on choosing a *circular artefact with a diameter of 72mm*, which is neither too big nor too small – also in line with the diameters of popular consumer electronics and products of similar sizes. Moreover, *filleted cylindrical slab* (akin to a hockey puck) provided the highest level of comfort and promise to proceed.

**Implementing the primary control into the shape.** Even though we decided to proceed with a wheel-shaped control, the exact type of wheel is still indeterminate, which in turn will dictate the thickness of the Artefact. As of now, two options exist: a circumferential wheel that hugs the lateral sides of the object and a click wheel that sits on the top of the object. In accordance with which, again, two options of thickness exist: the thicker puck-like one and the thinner pancake-like one, which we'll just nickname as puck and pancake, respectively.

- **Physical wheel on puck shape.** Due to its overall girth, circumferential wheel would be more conveniently integrated with the puck shape in order to support physical interactions through a greater grasp area.
- **Click wheel on pancake shape.** On the other hand, a click wheel would be more appropriate with a pancake shape as there is no need for extra space due to the absence of physical moving parts.

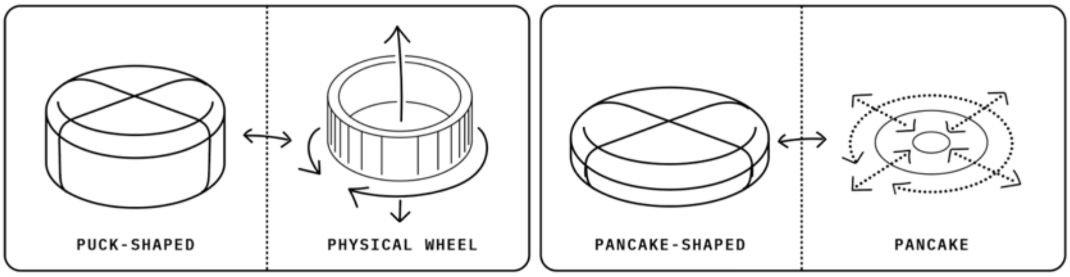



Figure 6.23 - Puck and physical wheel in comparison to pancake and click wheel.

The decision, however, is skewed towards proceeding with a *physical wheel on a puck* due to the haptic and tactile potential it has with respect to the mobile context and the lack of an advanced graphical interface with high PPI (pixels per inch), which the pancake and click wheel option are more appealing in terms of size and simplicity, that option may not be able to sufficiently simulate actual physical force reaction in a reliable manner especially on the mobile context. Moreover, as this product is on a divergent path, physical qualities that diverge from the norms would also be complementary in relation to the design goals therein.

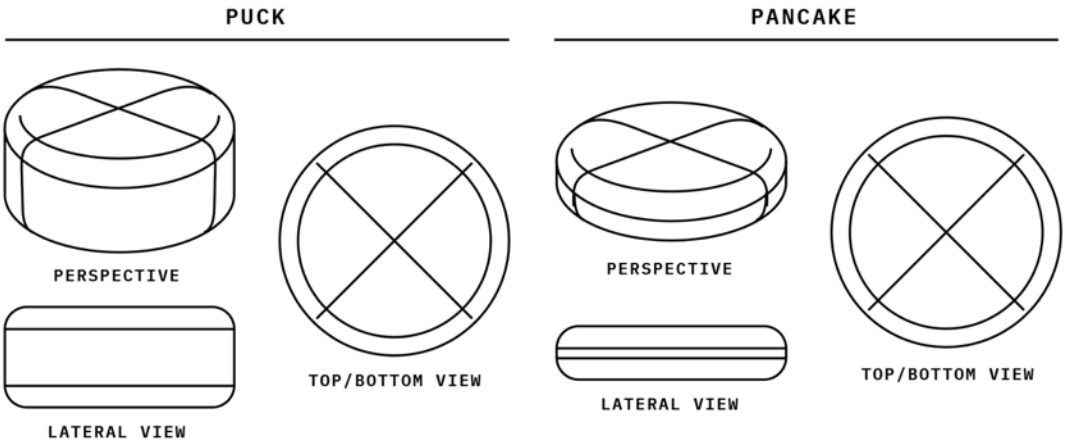



Figure 6.24 - Perspective, lateral, and top/bottom views of puck-shaped and pancake-shaped filleted cylindrical slabs.

**Wheel, base & ridges.** Moving forth, the wheel is the primary means of controlling the Artefact, which means that lots of deliberation and emphasis goes into it. As the wheel will be integrated to the circumference of the Artefact, I decided to seek inspiration and ideas from a familiar product, Lexon Fine Radio. It's a discontinued product whose means of control lie around its circumference, albeit frequency and volume control were separated to two rings that function independently (Figure 6.25).

The knurls on its rings, on the other hand, provide significant amount of leverage when rotating the wheels. However, this rotation can only be done within an interval, which is a constraint that is also a signifier indicating that the intervals are indeed limited to a frequency range and a volume range. In contrast, what we're looking for is the affordance of hypothetically perpetual sequential rotation. In this sense, it shouldn't have such a constraint in itself.

While attempting to simulate a perpetual motion through Lexon Fine Radio (Figure 6.25), I found myself attempting to continue the rotation through my index, middle, or ring fingers on separate occasions. Although, overlooking its rotational constraints, as the ring is limited to the lateral face, I found myself unable to enact that action. Enaction of such is possible on jar lids, whereas it is difficult due to the absence of ridges where one's finger may rest on. I made other people attempt to enact this perpetual rotation action, getting similar results – by failing in doing so, they switched their action sequence to wrenching (in spherical grab) to attempt to exert more force. Owing to the discussions above, I decided to design a wheel whose upper ends hug the topside of the Artefact (Figure 6.26); thus, affording the means to interact with the Artefact in such a way.

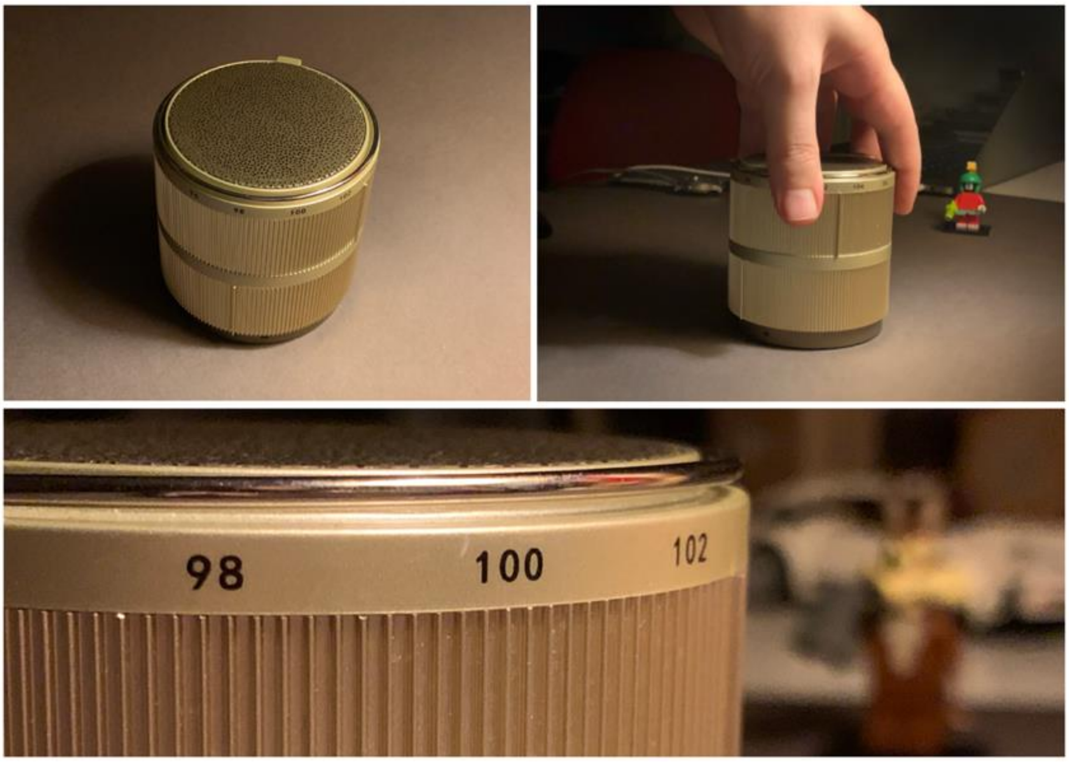



Figure 6.25 - Lexon Fine Radio from several angles, a product of interest to this research due to its overall form and controls, whose knurled wheels are used for tuning radio frequency and the volume.

Moving forward to the tolerance controls, as we already decided the means to adjust the tolerances, I looked for comparable applications of such. Closest one (also a commonly utilised one) came in the form of a watch dial that could move in three steps perpendicularly (Figure 6.27); although, it functioned in a manner similar to a switch that stays in the most recent state after ceasing contact: we wouldn’t like that. Instead, the wheels needs to spring back to its resting position in order to repeat the same action for altering the tolerances multiply sequentially (Figure 6.28).

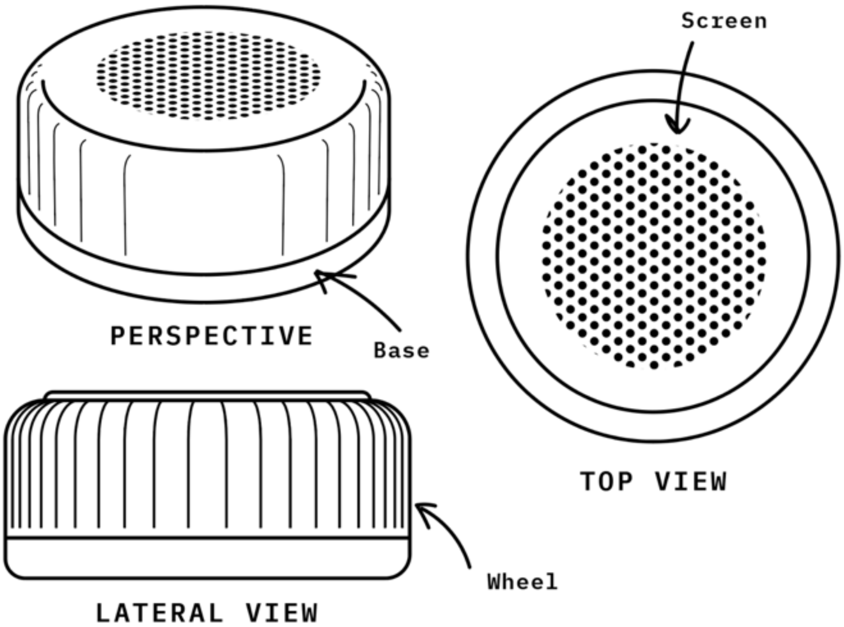



Figure 6.26 - Perspective, lateral, and top/bottom views of the Artefact with the inclusion of a base, wheel, and a placeholder display.

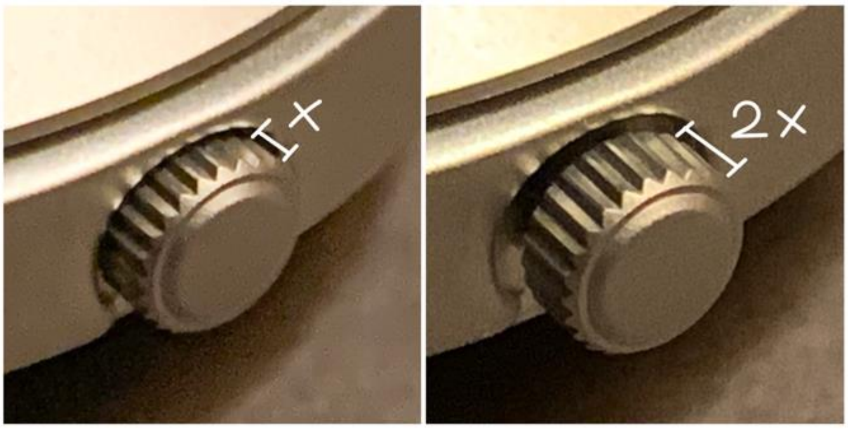



Figure 6.27 - Crown of a watch is a classic example where a moving dial is used for controlling the artefact's functional state (Seiko SNK809).

Lastly, in regard to the ridges, I found that ridges in form of knurls didn't particularly seemed to provide enough leverage for perpetual rotation (similar to surfing between TV channels), so I decided to increase the breadth of each ridge to 10° with the total of 36 ridges that should be equal to a figure between 5 to 6 millimetres, enough for a fingertip to rest on and get haptic feedback appropriately for low-effort/low-resistance rotation (Figure 6.29).

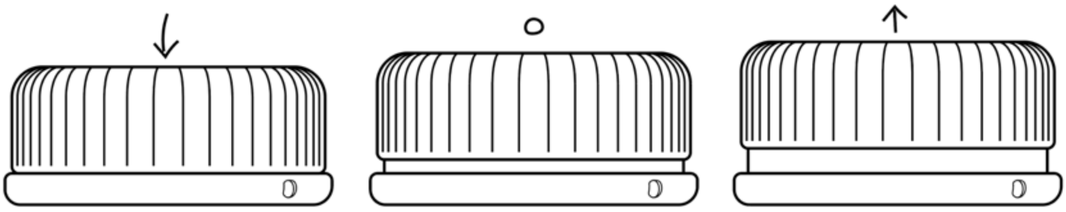



Figure 6.28 - Lateral view visualising the pushed and pulled states of the wheel, both of which spring back to the resting state for enabling repetitive input for furthering the tolerance input. In addition, a widened base for supporting the grasp of the hand that anchors the base.

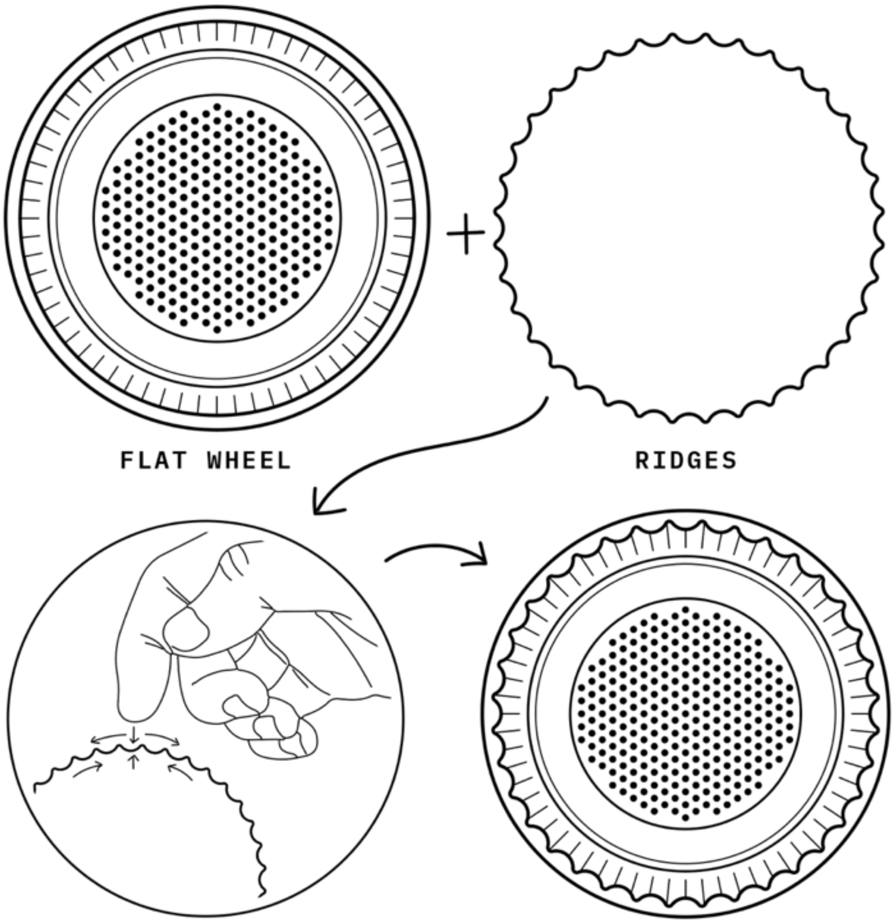



Figure 6.29 - Visualising the inclusion of ridges onto the wheel for supporting the omnidirectional rotation atop the user's fingers – *no, the ridges don't represent serrations*.

**Display.** As far as I'm concerned, the display should only assist the user for enhancing the feedbacks multisensorial manner and provide enough support for the user during the learning process by just giving enough confirmation through the already well-habituated-into visual mode.


Figure 6.30 - Representations of how it would look through the integration of three different screen types (LED, e-ink, and LED mesh).

The display choice boils down to the principles and heuristics, according to Rams "good design needs to be honest" (see 6.1.2); referring to this sole reason, I'm going to continue with a LED mesh just to outright convey that this artefact does not function as an information system when it comes to UX.

As this research not directly concerned with the explicit connection, setting, and such controls, so I decided to skip them.

**Secondary controls.** As the focus of this RtD in on the primary input methods that are used for directionality, temporality, and tolerance in an already complex and relatively novel manner, rest of the functions need to be mapped onto different controls to avoid cognitive overload and interference.

With the only remaining appropriate surface real estate being the top of the artefact, only rational decision (and only decision really) is to map controls to there. As there are no buttons or whatsoever and the secondary control scheme is not really vital, I decided to go with a click wheel through a priori approach for the sake of a consistent product language – also due to the fact that it's a component that's already explored in this research.

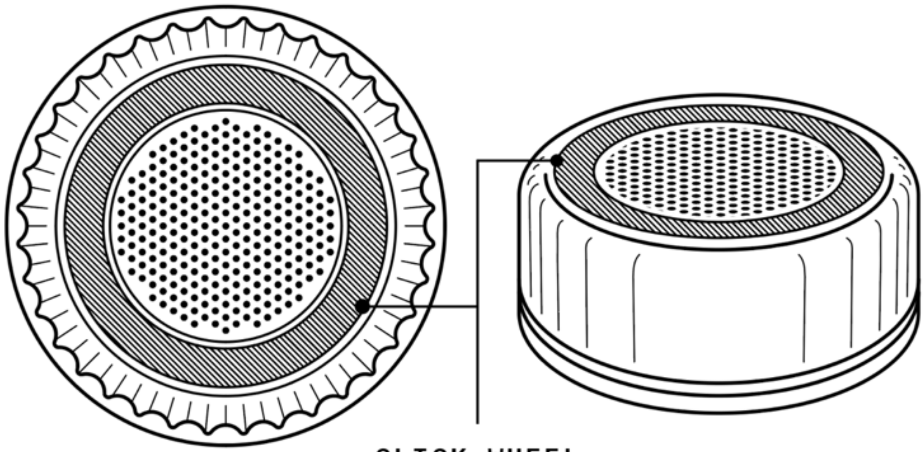



Figure 6.31 - The click wheel encircling the screen is used for adjusting secondary controls that don't have effect on directionality, temporality, and tolerance of music playback.

The secondary functions and their action mappings are as follows:

- **Dragging finger at the top half** for decreasing and increasing volume respectively.
- **Dragging finger at the bottom half** for adjusting the remaining settings for what they may be.
- **Double tapping atop the device** for liking a song and sending it to a designated playlist in the paired music streaming service and mapped in a manner similar to user habits attained on popular social media platforms.
- **Holding hand atop** it to turn it on and off: mapped similarly to force closing/resetting most digital devices like PCs and smartphones.

**Conclusive conceptual design for interactivity features.** As all of the interactivity features (and core functions) are conclusive at this point, it is safe to proceed to visualisation of the conceptual design for bringing it all together. So far, the artefact consists of (Figure 6.32):

- Circumferential control wheel
  - Sequentially initial skip forward function

- Sequential step-by-step forward skipping for exponentially increasing directionality manipulation function
- Sequentially initial skip backward function limited to going to the previous track
- Sequential step-by-step backward skipping function for returning to the past points of user actions
- Winding slowly forwards between the next and sequential tracks and their points of interest for previewing
- Winding swiftly backwards for returning to the last current track
- Increasing tolerance by pulling the wheel perpendicularly; decreasing tolerance by pushing the wheel perpendicularly

- A click wheel at the outer topside
    - Rotating from the top to increase and decrease the volume
    - Rotating from the bottom to manipulate the settings
- A LED mesh display at the inner topside
    - Simple illustrative visual feedbacks to ease tasks and enhancing the remaining feedbacks
    - Tapping atop two-times to for a piece to be added to the user's music streaming playlist after the listening session
    - Closing one's hand atop it for a few seconds to power it up or down
- An enclosure with a slightly wider circumference
    - Affords grasping without interfering with the wheel
    - Includes an AUX port for connecting headphones or speakers by an AUX cable

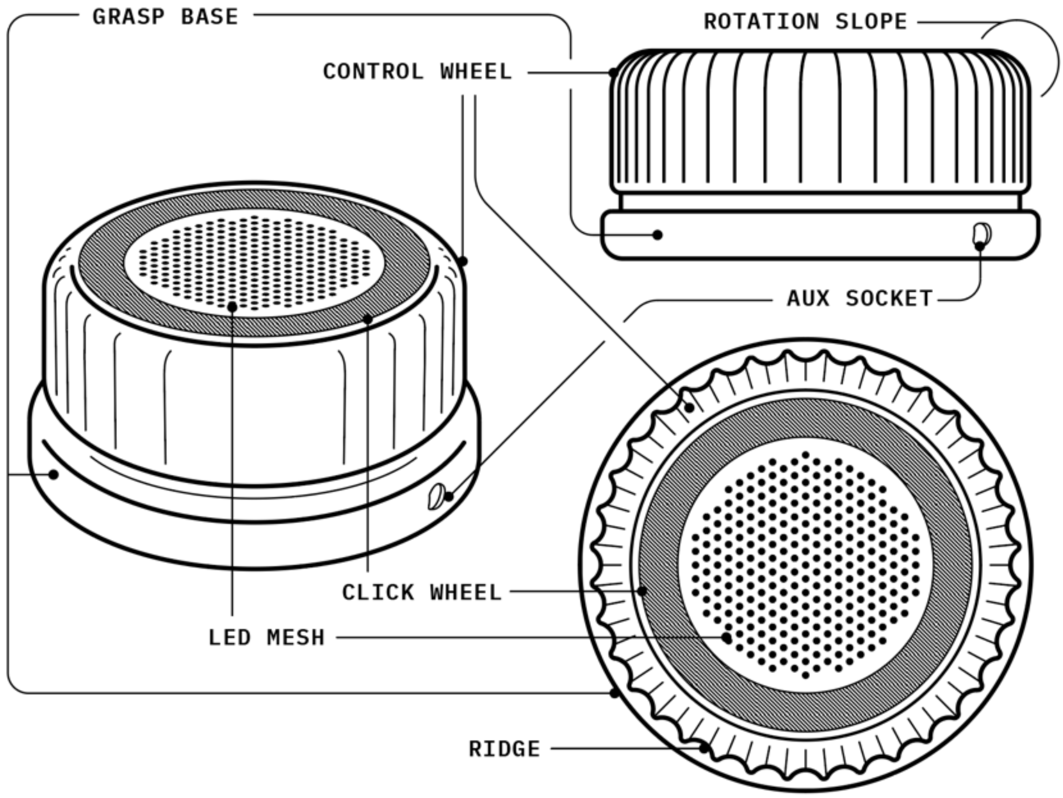



Figure 6.32 - Conclusive conceptual design for visualising how the interactivity features affect the enclosure and outer components.

### 6.4.3 Artefact Qualities

It has become a given that the artefact qualities need to be designed into the project in such a way that they may support the interactivity features of interest – without making sacrifices from the aforementioned features. This means that these qualities will be taking form as per these interactivity features.

#### 6.4.3.1 Hardware

Certain hardware components are required to be assembled together to make the functions and features in question work. An enclosure with a diameter at 72mm and a height at 34 mm needs to enclose them all to work well. These components are as follows: a circumferential wheel, an enclosure, a mesh of LED, a click wheel, a computer, a battery, Bluetooth and/or Wi-Fi module and antenna, an AUX port, and induction coil as the main ones, as well as lots of plugs and glue to waterproof it. It takes quite a lot of components make a small music-player work; whose short descriptions are as follows (Figure 6.33):

**The circumferential wheel.** A circumferential unit that can conduct internal click and clanks clearly and make the user feel the reaction force with precision is essential, so a durable material is ought to be a must – making this should be the most rigid component of the Artefact.

**Enclosure.** A water-proofed enclosure is a given for any product. In this case, it needs to convey a certain qualities of product character while keeping the components safe inside, and watertight.

**LED mesh.** Low-power LED units became more and more available while getting better in terms of performance as the demand for them increased over the years. A hexagonal mesh would complement the Artefact's character quite well due to the absence of a baseline for type characters to sit on; therefore, it would communicate that it doesn't afford explicit qualities quite well in this manner.

**Click wheel.** The likes of such were seen in the initial iPods, which then were replaced with haptic response in its successors. What we're interested is the travel distance in addition to the response to amplify the semantic qualities of its physicality.

**Computer and battery.** This device needs processing power to sort things through to give randomised music sequences to the user; if not, it should at least be able to fetch the processes made in a server as a client and make sure rest of the components (output and such) work in coherence. Of course, a battery is also a must for the mobile contexts; however, the confined enclosed space means serious limitations in terms of capacity.

**Bluetooth/Wi-Fi antenna.** The Artefact needs to communicate with a streaming service, so a form of communication unit and antenna facing an open space is a must – the stripe surrounding the click wheel allows the placement of an antenna within. In addition, to connect with Bluetooth audio output devices, if need arises.

**AUX port.** 3.5mm audio jacks are a standard for casual listening, inclusion of a jack is a must. It may change over time, yet headphone jacks are still being actively used in the time of writing this.

**Induction coil.** Making an artefact watertight means exposing as few internal components as possible; this indicates less openings. Due to Qi charging becoming the standard for the modern consumer electronics, implementation of an induction charging unit is a valuable quality-of-life addition for the users.

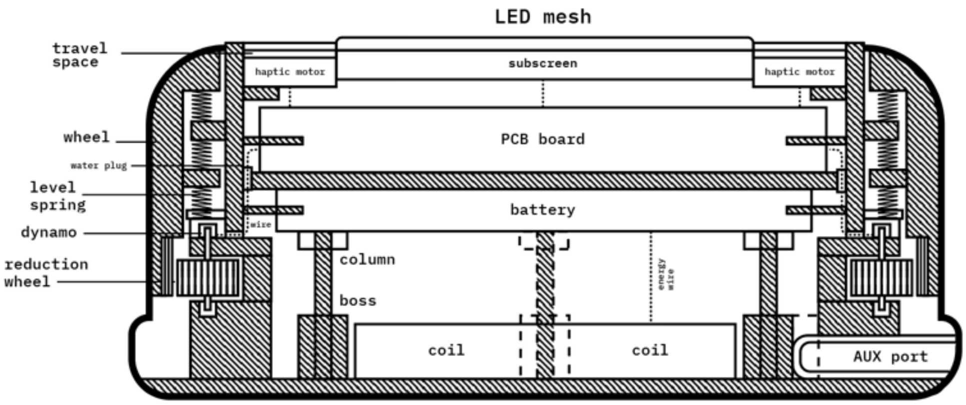



Figure 6.33 - An approximate drawing as a proof of concept that the enclosed space is adequately spacious for constituting the functions, features, and qualities in question.

#### 6.4.3.2 Enclosure Materials and Colours

These are pretty much are cornerstones of the modern consumer electronics; however, what we're interested in are the semantic qualities and durability thereof. For enclosure, modern aluminium alloys can provide the much-needed structural integrity while allowing a pleasing material experience with matte finish and colouring. However, as this product needs to convey a slightly playful character, accents need to support bright colours; for that, vivid coloured less prominent components provide the adequate means. This can be achieved through stark contrasts between complementing pastel-coloured aluminium enclosure with brightly coloured accents made of plastics or applicable coatings with visual qualities of plastics.

The internals are much more complex when compared to the encasings, but one thing is certain: the components that generate haptic reactions need to be made of durable materials as they'll be subjected to lots of punishment throughout the product's lifetime. Moreover, *in my opinion*, compared to plastics, metal components tend to age more gracefully as they take punishment, get scratched, be bruised, and become decorated with marks of the usage in a harmonious way instead of losing its initial shiny and pristine appeal.

### 6.4.3.3 Updated Conceptual Design with Artefact Qualities

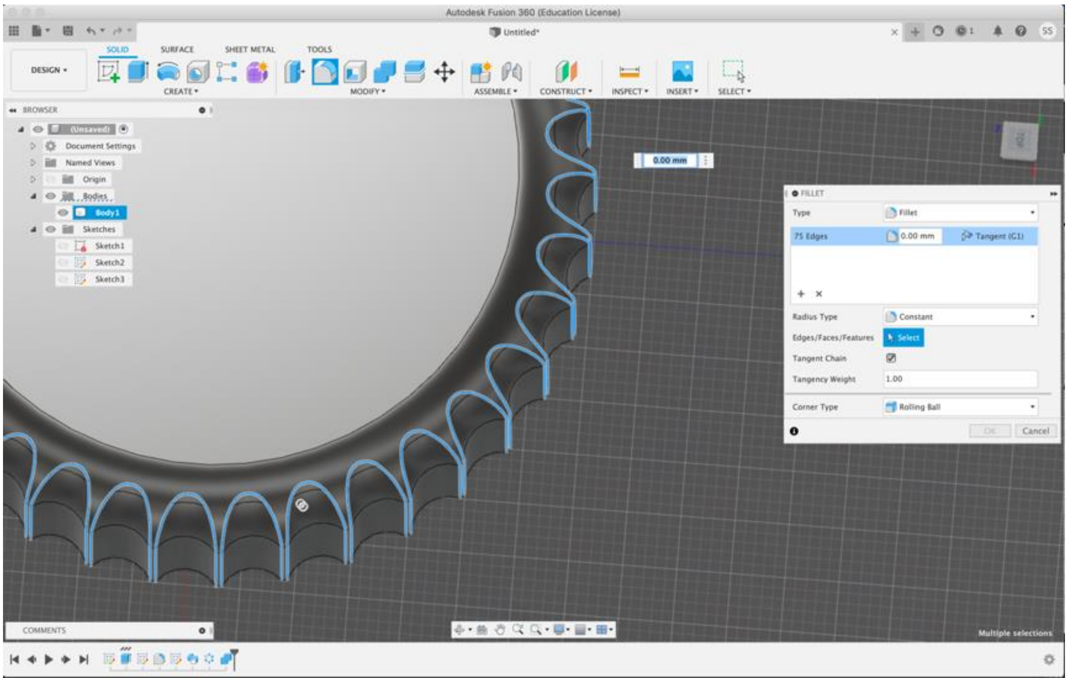



Figure 6.34 - A screenshot from the 3D modelling process of the Artefact in Fusion 360.

With the core functions, interactivity features, as well as the hardware, materials, and finishes are decided upon, I needed to translate the designs to 3D space; for this, I went with fusion 360 as discussed earlier (Figure 6.34). A number of takeaways emerged throughout this process:

- Working with a 3D model was actually much more beneficial than I anticipated as per the structure of this RtD, where the enclosure's qualities are decided the last amongst all of the artefact's integral qualities. For example, it allowed me to become aware of the conflicting constraints I inserted onto the proof-of-concept technical drawing. Even though it isn't that significant when it comes to the order of proceeding with the design process, I would have started to work on 3D models a little bit earlier.
- I was able to ideate and play around with materials in an efficient way: it quickly became apparent that the material and colour combinations I initially had in my mind didn't work well together. For example, painting the white click wheel made it apparent that it isn't really an option as per the dominant colour scheme.
- Little details either made or broke the design as the process continued: visualisation allowed me to understand and resolve issues through real-time feedback, which proved itself to be greatly beneficial and timesaving.

In the end, after finishing modelling the form, one thing made itself apparent. Materials' visual aesthetics don't like to play together in harmony, so it takes quite a while to pass an aesthetic threshold to consider a colour and material scheme applicable. As a result, the final model constituted the following qualities (Figure 6.35):

- Dark grey matte aluminium case and circumferential wheel for communicating that this is a proper music-listening device
- Turquoise-coloured acrylic accents to balance it for making it feel a little bit playful in contrast to dark matte aluminium case
- Dark grey ABS click wheel

- Hardened glass is
- White-coloured LEDs instead of matching it with the accent colours, which didn’t work well together in spite of my expectations.
- Stainless steel backplate

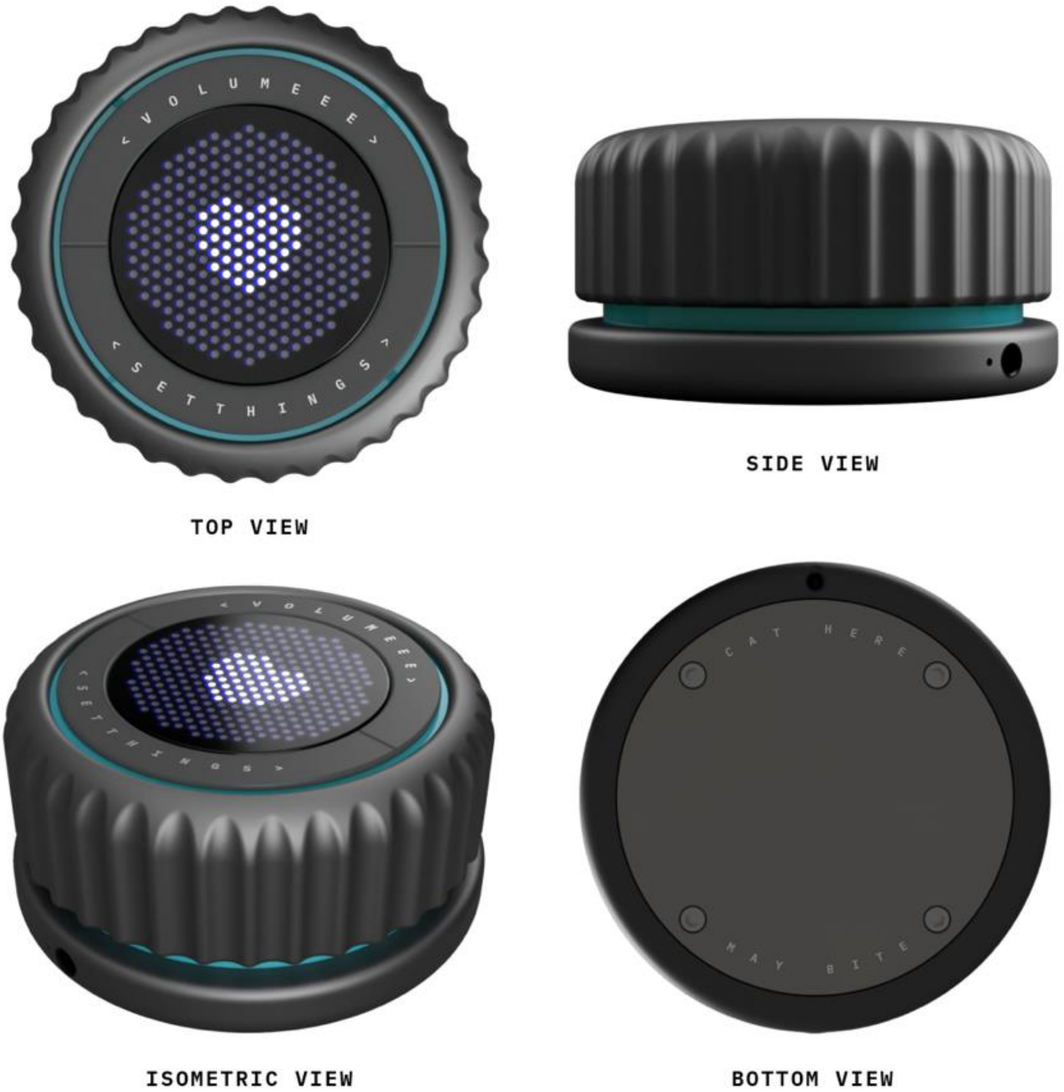



Figure 6.35 - Updated conceptual design for visualising how the artefact qualities affect the enclosure and outer components of the Artefact in 3-dimensional perspective from varying angles.

### 6.4.4 Augmented Qualities

These are the outermost qualities that aren't explicitly required within the scope of this research, the sole reason I decided to integrate them is to indicate their place at the priority between the tasks and illustrate the hierarchy between the layers of design considerations in case of this RtD (Figure 6.1).

#### 6.4.4.1 Branding & Product Image

You might have noticed that I referred to the subject of this part of the research as *the Artefact* instead of giving it even a project codename. This is a deliberate decision for putting emphasis to branding's place within the hierarchy of the constituents of the artefact in case of this research. This is due to the fact that I wanted such augmented qualities to take shape consequential with respect to the more central qualities of the Artefact; not vice versa. Therefore, I believe I was able to abstain from the extrinsic values I attributed to the subject to affect my judgements while making more centric design decisions.

**Naming the Artefact.** We're there. The Artefact can now be named at last. For that, I'll throw in some keywords and coalesce them. Sound, music, radio, wave, noise, and so on for the audial qualities. Lid, cylinder, puck, roof, dome, wheel, dial, etc. seem fine to represent the overall form of the artefact. After coalescing a number of them, I decided on 'Soundome' as the product name instead of 'Noisecylinder' and something as such, which seems to be a sound choice.

**Branding.** I want to emphasise the off-beat qualities and the bold and prominent aesthetical properties of Soundome as an artefact. Interpreting them as forms yielded the following result after playing around a bit (Figure 6.36) – quite a nice improvement for an artefact that has been nameless quite a while.

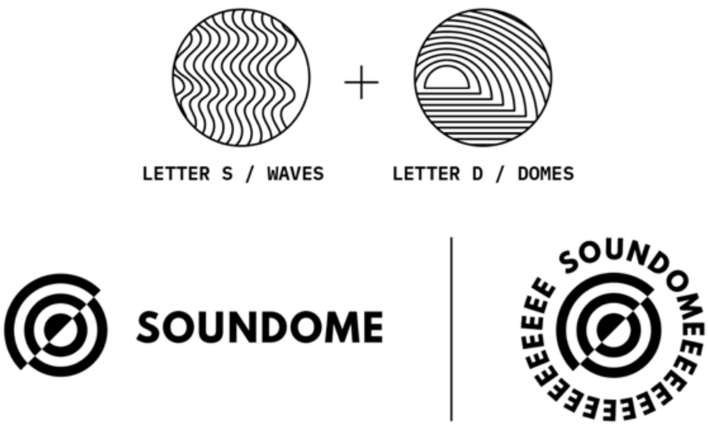



Figure 6.36 - Basic branding elements for Soundome as in two applications of its logo.

### 6.4.4.2 Packaging

A simple compact robust cardboard box with single-colour ink printed on its face is sufficient for the outer packaging, while the internal constraints that keep the artefact in place would be preferably made out of hardened paper for sustainability. In addition, to protect the artefact from exposure of the elements through its distribution, it would realistically be covered in a single plastic bag for airtightness and watertightness.

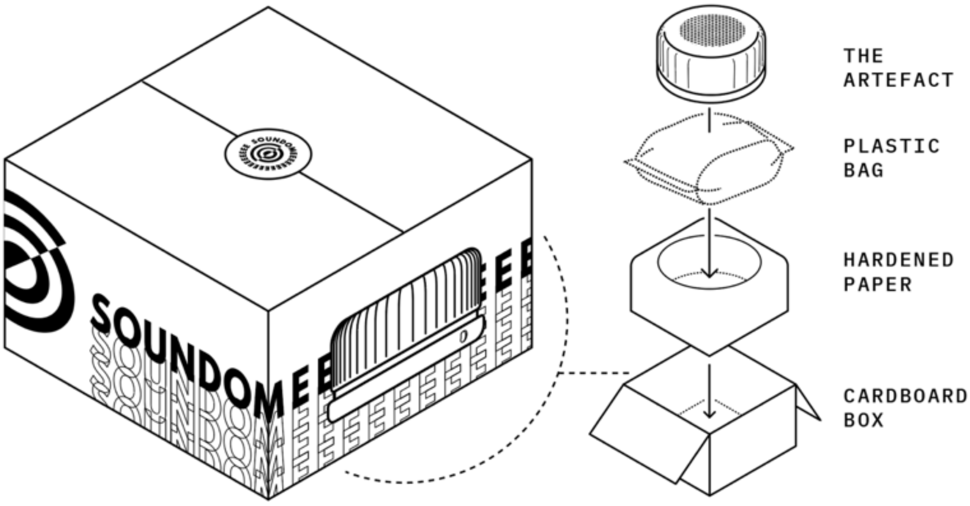



Figure 6.37 - Outer packaging element (left) and the nesting of all elements (right).

## 6.5 Finalised Conceptual Design & Conclusion

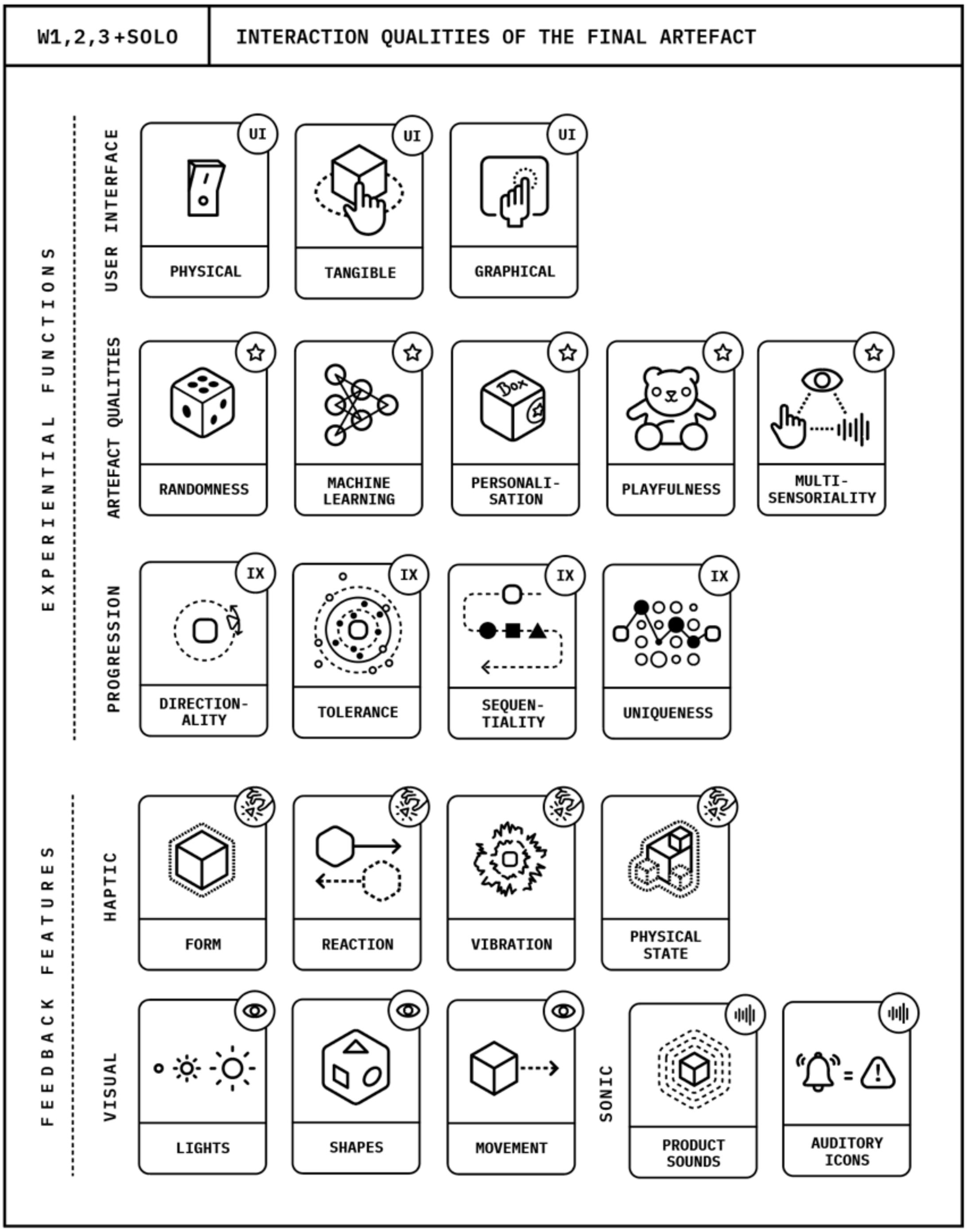
One would normally expect significant changes in the face(s) of the product as additional layers of qualities are added. As far as the structure of the design considerations (Figure 6.1) we employed goes, we should have been expecting less significant changes with each incremental progress of the structural layers with the priority of hierarchy, which is exactly what happened.

- The initial phase for designing the core functions wasn't a part of the MoSCoW methodology we employed as it dictated every design decision through abstract concepts. In spite of its abstractness and lack of significant form, a great deal of subsequent features and qualities can be safely attributed to the decisions taken in this phase.
- The second phase was when the function-related decisions were translated for the user-artefact-media interactions. This phase directly influenced the subsequent features and qualities as it constituted the first traces of translating abstract concepts to motions, which have ephemeral projections on the corresponding area/space. For example: dialling has a circular projection, which calls for an appropriately shaped component.
- The third phase was about adding the factor of substance to the designed two-dimensional projections, transferring them to 3-dimensional space as an artefact that occupies a volume and has volumetric shapes, materials, colours – making it possible to prototype by its shape.
- Last phase, on the other hand, has very little to do with the actual product, rather is occupied with the factors surrounding it such as branding, marketing, distribution, and so on – making its effect superficial, somewhat limited to the surface of the artefact at best. To demonstrate which, I designed an arbitrary logo and applied onto the artefact – being the solo designer of the final phase, I just decided to conceal it to the backplate as a personal preference as branding has no outcomes in scope of this RtD process besides of making this point (Figure 6.38).


Figure 6.38 - Final renderings of Soundome, whose only difference from the previous iteration is the laser engraved product logo at the backplate.

In the end, the artefact resulting from the process is an artefact called *Soundome*, an artefact with a diameter of 72 millimetres and a thickness of 34 millimetres: making average adult to be able to hold it within their palm like the bottom of an average water glass (Figure 6.39). Nevertheless, from the point at where the Dream Cubes were conceived by the participant-designers, a number of qualities were deconstructed down to atoms to translate for this phase of the design. Some of them were deliberately selected as per the research needs, some of them were reintroduced, some were even repurposed, and even new ones were introduced throughout the last phase: amounting to its own set of harmonious atomistic elements, divided and shown as per their features (Table 6.2).

Table 6.2 - Interaction qualities of the final artefact



| W1,2,3+SOLO | INTERACTION QUALITIES OF THE FINAL ARTEFACT (CONT'D) |
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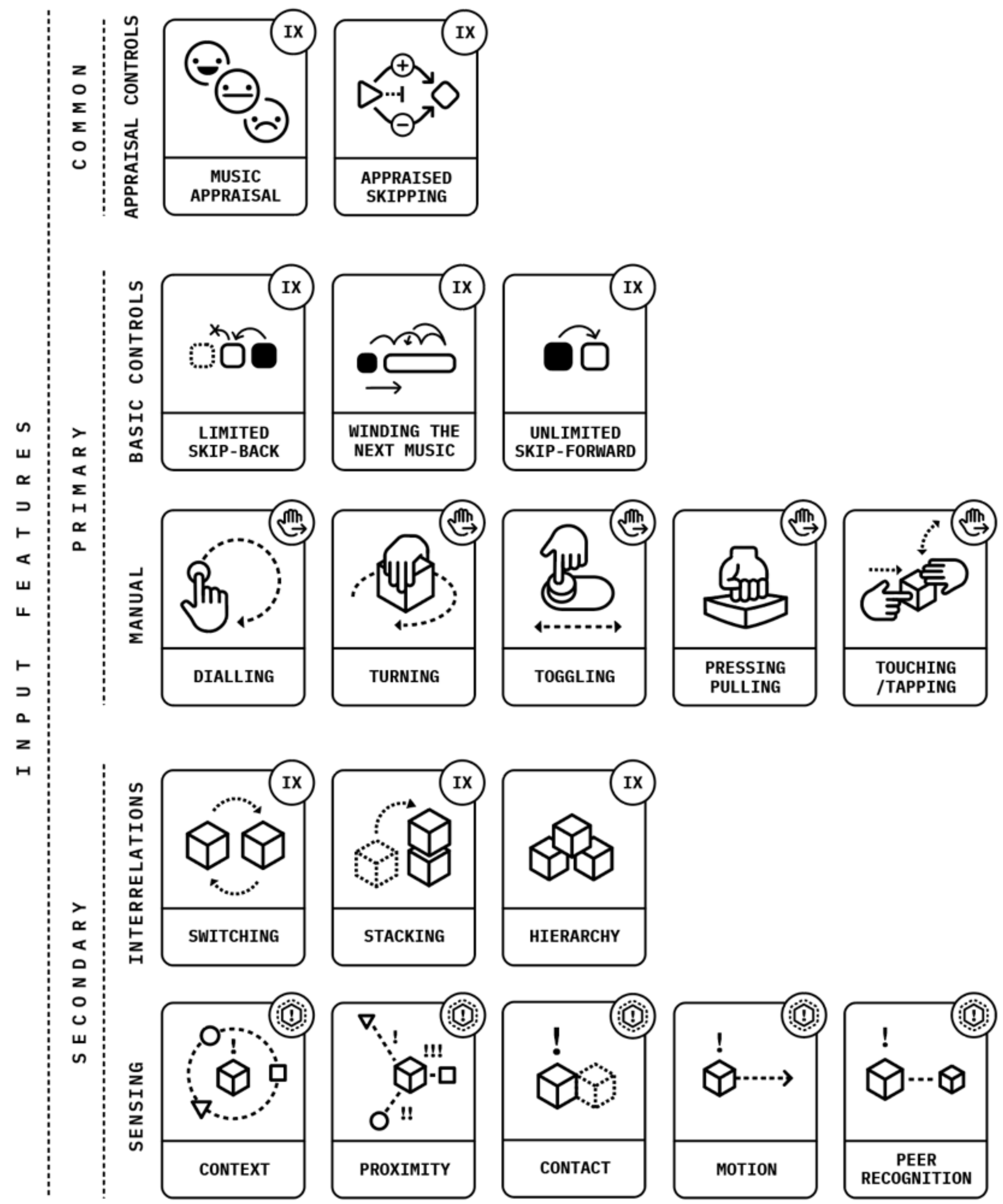

Figure 6.39 - Form and size of Soundome relative to an average adult male hand.

# CHAPTER 7

## CONTINUUM BETWEEN EXPLICIT AND IMPLICIT INTERACTIONS

As people, we tend to associate the notion of *betterness* with conceptions like effectiveness and efficiency when it comes to our interactions with artefacts; the reason of which is simple: achieving the results with relative ease in comparison to the competitors. When we look at it, we see that concepts like efficiency and effectiveness are the metrics of outcome rather than the process, so it’s only natural for people to seek what gives superior outcomes. This perfectly reflects the underlying behaviours in the nature due to the fact that organisms and natural events normally take the optimal route. Human nature is on the other hand, is complex, even complicated: *the better* is subject to differ as the human needs rise from the context and occasion; therefore, it cannot be solely reduced to the outcome. The process, rather than the goal, is what we experience as human beings; because of that, what is better for human experience depends on the experiential substance of the present time.

In some of the scenarios in life, it can be actually better to know less about the outcomes of what we’re doing at the present moment. The thrill of reading a captivating novel, playing a game with your friends, watching the game of your team on TV, rolling some dice, and not knowing what’ll play the next in the radio. On the other hand, especially in cases relating to operations, the more an individual is informed about the future outcomes the better, especially in cases where utility is sought rather than hedonic experiences. While it is OK for a person not to know what’s to come next in the former scenario, it might just not be an option for the latter. However, oftentimes, you can observe that we’re treating every single occurrence around ourselves like the latter in today’s information and choice-saturated society as one would expect. So, to what extent we can gain value from knowing less about the outcome of certain things we do?

## 7.1 Background

Designers are conventionally expected to reduce uncertainty and number of choices within a product to a minimum (Janlert & Stolterman, 2018; D. Norman, 2011); however, this convention may not be universally adequate when it comes to designing for interaction in the case of an array of artefacts and information systems, the arguments for which we discussed earlier within the literature review chapter of this research (section 2.3.3). Interfaces nowadays can change a multitude of states and offer an easily scalable number of choices to users (section 2.1.2), which comes into the territory of users' decision-making: this is especially relevant in cases where the user lacks an explicit goal or significantly strong preferences (Tversky & Kahneman, 1981). Upon looking at the case of music choice through recorded music-playing artefacts, we see that decision-making can become a critical facet of an interactive artefact due to the existence of irreducible number of choices (section 2.1). In current trajectory, like the current predominant method of music listening through music streaming services (Marshall, 2015), it has also become a norm to include as much as information and choices, and connections between both into the artefacts (Janlert & Stolterman, 2018). This is done to enhance user agency through affording everything at once maximally; however, it is safe to say that there is merit in not-affording every information and choice on-demand at once in favour of fostering subtler and more elusive experientially positive qualities like serendipity, surprise, curiosity, and letting things flow.

## 7.2 Relevant Discussions in the Literature

**In the literature stemming from Ecological Psychology.** As we mentioned a couple of times in earlier sections, as a refresher: Gibson initially came up with the

Concept of Affordances (1986), which is about what a human or some animate being can do by interacting with a certain thing and the cues they get for interacting. Norman (2013) built upon it and adapted it to the relevant literature. In addition to that, supplied that concept with practical concepts like signifiers, and perceived and hidden affordances whilst also counting in feedbacks and feedforwards. In relation to that, interaction frogger was later introduced to the literature, which recounted and mapped the flow of information between objects and subjects in interactions into a robust framework (Wensveen, Djajadiningrat, & Overbeeke, 2004).

**Other discussions about implicit interactions in related fields.** Concepts similar to Explicitness of Interactions exist in the related literature. In spite of carrying the similar names, the aforementioned researches seemed to give different definitions when compared to this research's definition of EoIX: the similarities more or less end there.

In those cases, all of which being HCI researches, we see that implicitness isn't thought to be a part of a dichotomy between implicit and explicit. It is rather thought either as case-specific implications for responding to the actions of the other actors in the system (Ju & Leifer, 2008). In other case, implicit interactions were considered as objects or occurrences that remind or prompt the user to take a certain task while they weren't explicitly going for that task, rather going for another task (Serim & Jacucci, 2019). There are interesting parallels between each of them (including this research's take), yet the definitions and understandings thereof diverge significantly in each case.

However, a mention pertinent to this research's understanding could be seen in latter of the aforementioned researches. This mention was found in their explorations about the meanings of the word 'implicitness'.

**Faceless Interactions as a similar concept.** As a parallel or even an antecedent that significantly influenced this research, there are similarities between the motivations and starting points of this research and faceless interactions (Janlert &

Stolterman, 2018). It is somewhat a critical approach to the stimuli-saturated on-screen interactions that make heavy use of information to afford successful undertaking and completion of even the menial tasks with modern digital devices.

Faceless interactions, in essence, are interaction cases where a screen isn't utilised either as means of input or output, or even both. This is because of the fact that a screen simply affords the transmission of more stimuli and information at the same time due to making them simultaneously available, which becomes more intense as the screen size, pixel density, and processing power increases.

As an example, primary interactions in our case of our RtD outcome, Soundome, fits the definition of faceless interactions on many levels due to not necessarily making the user either need or utilise the screen to successfully proceed.

**In other fields.** Upon looking at other disciplines, we come across mentions to the dichotomy between the utilisation of implicit and explicit knowledge/information with discipline-specific names. This owes to the fact that many of those disciplines inquire about the natures of certain notions (which usually isn't a main goal of design research) and occurrences (Dienes & Scott, 2005; Moors & De Houwer, 2006; Poulin-Dubois & Rakison, 1999); in other scenarios, some disciplines have to work with mixtures of knowns/unknowns and certainties/uncertainties; consequently, have to come up with ways to deal with them head-on over time (Meyer, 2002). This; on the other hand, is different for designers: I attribute this to the differences of approaches and skillsets between designers and other disciplines. Designers normally either find ways for resolving and minimising unknowns and uncertainties in functionalities of the products they design, which is a sensible route really; however, uncertainties and unknowns as designed features instead of malfunctions have merit (that are being utilised for practical needs) in many applications (Archer, 1999; Odom et al., 2019; Stolterman, 2008).

## 7.3 In relation to Discussions Made in the Workshops

There wasn’t any noticeable or apparent contests against the prototypical definitions of EoIX throughout the workshops. However, the definitions proven themselves to be difficult to decipher and understand due to their complicatedness, where the supplemented TLDR definitions have been helpful in conveying the meanings. On another note, the discussions rather focused on the boundaries and qualities of explicit and implicit interactions (see Chapter 5.4).

## 7.4 Refined Definition of Explicitness of Interactions

Owing to the discussions made at the workshops and the examples given by the participants, the prototypical definitions were refined into more grounded ones after a number of iterations as follows.

**Explicitness of Interactions.** It represents the sum of factors determining user's prediction power for discerning the outcomes of their interaction with an artefact.

**Range of EoIX.** A range indicating the properties of a certain locus where a user falls to as per the amount of prediction power they have as sum of their knowledge in and control of the situation.

**Implicit interaction.** A case where a user has low prediction power for knowing what the outcome of their interaction will be as they don't have means to attain knowledge of or control the end result.

**Explicit interaction.** A case where a user has high prediction power for knowing what the outcome of their interaction will be either through having means to attaining knowledge of or controlling the end result.

Furthermore, there are two parameters affecting the explicitness of interaction in pertinence to these descriptions:

- **Knowledge:** Sum of factors that amount to the user's knowledgeability in a given scenario.
- **Control:** Sum of factors that amount to the user's extent of agency in a given scenario [42].

### 7.4.1 Properties of Implicit and Explicit Interactions

By refining the relationships between which interactivity properties/attributes may pertain to and influence explicitness of interactions afforded by artefact features, and also what cannot be constituted as such were written up and itemised separately.

**Properties that pertain to EoIX:**

- The EoIX may vary in correspondence to a user's past experiences that relate to or similar to that interaction in relation to the user's prediction power.
- The interactive function of the artefact needs to be well-defined: user should be knowing why, how, and what they're interacting with regardless of the explicitness.
- Explicitness of an IX must have an experiential purpose or value.

**What cannot be constituted as EoIX:**

- Malfunctions or poor mappings can't be considered as properties that pertain to EoIX.
- Scenarios where the functions of an artefact are ambiguous aren't a property of EoIX.
- Faulty induction of mental maps aren't an indicator of explicitness.

[42] Concepts like knowledge and control can take varying denotations depending on the context, therefore, the definitions above only pertain to the extent of this chapter.

- Features and qualities that don't affect the user's predictive power are irrelated to EoIX.

### 7.4.2 Experiential Qualities of EoIX in the Continuum

Trade-offs between the experiential qualities between implicit and explicit interactions arise as we move along the continuum thereof. Even though there are congruent qualities that emerge regardless of the affordances of interactivity without a doubt, we cannot disregard there can be clashing or even mutually exclusive antecedents of certain experiential qualities. Of course, changing variables of particular occurrences and contextualities does not allow generalisations or principles to be valid across varying cases; however, certain heuristics and examples can be highlighted to convey the underlying idea.

**Examples in music-listening scenarios.** Users' listening experience of recorded music is probably the most relevant example to discuss in terms of explicitness at this point of the thesis. Already having discussed the qualities and backgrounds of a wide array of such artefacts, it's appropriate to place Soundome at the end of the continuum in a practical sense as opposed to modern music-listening artefact like music-streaming services like Spotify and Apple Music. Of course, taking a more extreme approach that may more appropriately oppose qualities of the aforementioned explicit music-players would end up in designing a glorified dice that randomly plays music. Instead, with respect to users' self-determination, Soundome allows employing a degree of control and knowledge in an implicit manner by referring to intrinsic appraisals.

#### 7.4.2.1 Edge Cases Pertaining to EoIX

The discussions made throughout the study indicates that fully implicitly interacted artefacts very unlikely to exist whereas fully explicitly interacted artefacts are quite common and not quite as intriguing as the former. It can be argued that this is due to the capabilities and limitations of human nature and the technology, either of which can be attributed to an end of the spectrum.

When it comes to **implicitness**, an ultimate implicitly interacted artefact is not likely to exist, we can go as far as to say that it cannot exist. When talking about an ultimate artefact of implicit interactions, we would need to look for the extremes; in this case, we should have means to interact with the artefact in the slightest manner yet possess no knowledge of what the interaction may yield. This means that this artefact must be able to achieve anything in the realm of possibility in the universe as one interacts with it. As there is no comparable real-world example, we can go into the realm of fiction:

- A metaphorical ultimate example may be a big red button in the middle of a street that emits the information that it's interactable; however, it doesn't exactly tell the user what it may yield as an output whilst being able to do *anything*. Let's say the user interacts with it: any outcome now becomes possible. A meteor shower, summoning of a plush rabbit to that location or anywhere in the universe, transformation of the universe into Middle Earth, or simply nothing (which is still in the realm of possibility. We know that neither humankind may ever possess such means to achieve it or that there's enough resource in the universe for achieving it.
- A comparatively tamer example does exist in an established fictional universe: there is a magical staff called 'Wabbajack' in the universe of Elder Scrolls, which causes odd events around the player that they cannot predict when they interact with it for the first couple of times until the player experiences its limitations, yet the idea is similar to the previous example. It may do nothing, summon a demon, transform thing into different things, conjure a fireball, and so on.

When we look at the possibilities of ultimate **explicitness**, we can easily argue that it is infinitely more possible as the artefact affords both the knowledge and control for interacting and predicting the outcome. In fact, most artefacts we interact with in our daily lives are examples thereof.

- An example is a simple brush, which conveys what it affords through its physical properties and the basic human knowledge regarding the nature: it brushes, can be thrown, handled, not be interacted, burned down. Just add the use instructions to it, it can arguably become as explicit as it can get.

#### 7.4.2.2 Experiencing Implicitness/Explicitness

Experiencing EoIX, on the other hand, is a whole different-yet-interconnected concept in relation to the capabilities of the artefacts. In contrast to whether it is possible for a certain artefact to exist, it is easily possible to experience the artefact in a manner different than what it is. For example, the big red button we just discussed as the ultimate implicit artefact, may be experienced; that is, until all of its actual affordances are exhausted through use. In that sense, the example of Wabbajack becomes a good example due to the fact that it may simulate that sensation within a game up to a point where the user explores entirety of its outputs. If we move away from edge cases, we can see the experience of interacting with most artefact is similar, which was well-explored in Gibson's Concept of Affordances.

#### 7.4.2.3 Role of User's Past Experiences in Experiencing EoIX

The discussion under the previous heading also indicates that implicitness/explicitness is also bound by a user's past experiences with a relevant artefact and transferable past experiences of such.

For example, we can illustrate this effect by reminiscing the example of waiting-for-an-elevator that was discussed during the workshops. Let's imagine a particular elevator, a person without any past experience with elevators, a person who is accustomed to elevators in the past but that elevator, and someone who uses that elevator on daily basis. Attitudes, behaviours, and thus the interactions of each of these users would naturally significantly differ per their experiences. While the prospective user without any past experience would resort to using the stairs, observing other people, or experimenting with the interactable elements, the somewhat experienced user would apply their relevant experiences for using the elevator; on the other hand, the experienced user would just go for the most optimal or preferred course of action without giving any thought. It would be unfair to say the explicitness/implicitness of the artefact (the elevator) is experienced the same way by each of these users.

It should be expected that the interactions should become more explicit as the applicability of the users' past experiences increases. Of course, properties of an artefact would determine the minimum and maximum point of explicitness of these interactions per the varying levels of expertise (with respect to users' past experiences).

For the sake of simplicity and generalisability, it would be most appropriate to regard prominent user habits, attitudes, and behaviours with respect to time and place the EoIX of an artefact is considered. For example: the most rational assumption about EoIX of Soundome would be to consider that the user wouldn't know what to do with it in case it is handed out to the most average person in a prospective user group it was released right now. In contrast, if the most popular electronic device at the time (let's say... an iPhone) was handed to that user, they're more-or-less likely to know how to interact with it.

### 7.4.3 Visualising the EoIX Continuum

Having discussed an array of artefacts throughout the workshops to highlight dichotomies between what constitutes as an explicit or an implicit interaction, we can heuristically put them on a linear continuum in a manner similar to what was done in the workshops (see 5.3).

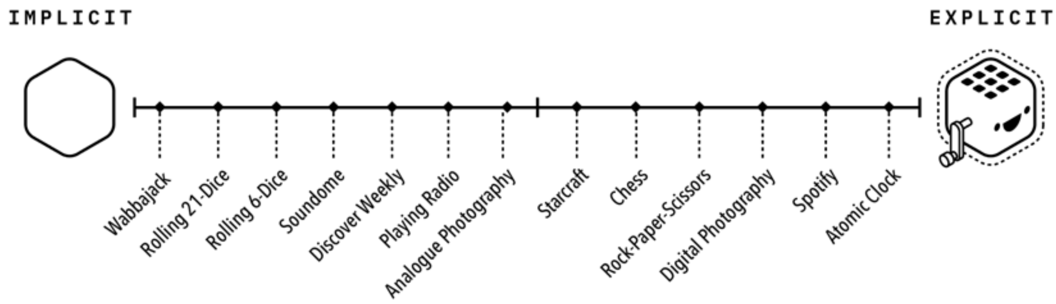


Figure 7.1 - An approximated visualisation of EoIX continuum, artefacts on which were placed as per a combination of control and knowledge afforded to user.

**Explicitness Continuum.** Looking at the one-dimensional continuum above, one can say that "*Spotify* should actually be on the left of *Digital Photography*" and such, and rightfully so. This is because of the fact that the diagram above only reflects a combination of *knowledge* and *control* parameters of the continuum that puts it into two dimensions – it can be said that Figure 7.1 is a projection of EoIX continuum from a perpendicular angle. For this reason, we need to move forward with a two-dimensional area that conveys the relationship and combinations between control and knowledge parameters of EoIX.

**Control and Knowledge Dimensions in Explicitness.** By plotting the corresponding artefacts onto their locations relative to each other, we can discern where each of them fall approximately on a plane defined through control and knowledge axes. Of course, this plane is hypothetical and serves as a proof of concept to convey the relationship of artefacts with respect to their control and knowledge qualities in relation to EoIX. We can discern four areas that correspond to certain qualities, these are:

*High-Control & Low-Knowledge.* In this area, even though the users possess the means to specify their actions with significant level of self-determination, their actions aren't entirely definitive of the outcome so that they lack knowledge thereof.

*High-Control & High-Knowledge.* When it comes to this area, we can safely say users have significant level of self-determination and also means to predict the direct effects of their actions on the outcome.

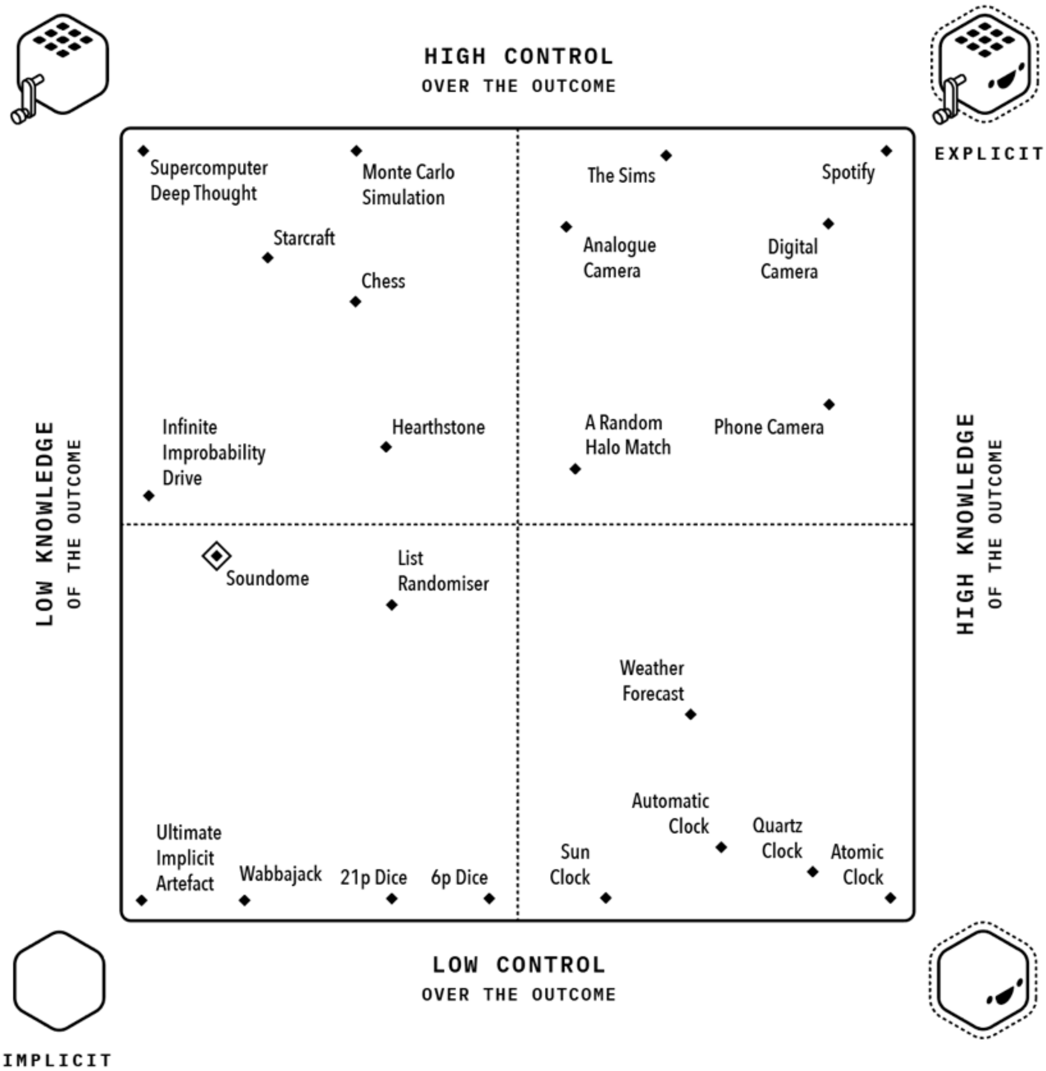


Figure 7.2 – A planar graphic showing the points where the artefacts can be placed with respect to their qualities corresponding to control & knowledge dimensions of EoIX.

*Low-Control & Low-Knowledge.* In this scenario, users have relatively low level of self-determination for affecting the interaction outcome and limited means to attain knowledge for predicting and correlating the effects of their actions to outcomes in precision.

*Low-Control & High-Knowledge.* Users in this scenario have no to insignificant level of self-determination for affecting the actual outcome, yet they have means to affect their prediction power about the outcome through their actions; furthermore, the variables affecting the outcome are likely to be related to natural events.

# CHAPTER 8

# CONCLUSION

## 8.1 Discussion

Nearing the end of the research, I'll be wrapping up the past chapters and discuss what was done and the communicate extent in which the research aim, and objectives were achieved.

### 8.1.1 Fulfilment of the Research Aim

The research aim was/is as written as follows: "The aim of this research is to discover design strategies to design music-player artefacts for navigation between, and experience with, the pieces of music independent of their extrinsic attributes, for the purpose of fostering an open-ended experience focusing on the appraisal of the music played at the moment."

This research was constructed with this aim in mind, around three sequential Research through Design phases where the progression towards the fulfilment of this aim was furthered and eventually completed through execution of the 2nd and 3rd research objectives. This was done through an array of knowledge and resources, with the valuable participation and inputs of 12 design specialists, and putting all together through a structured consequential solo design process.

Furthermore, it needs to be emphasised that the aim of this research has never been the exploration or discovery of what happens in the end, rather generating an empirically derived approach to enable means to that particular end. 'The ends' in this case entailed a theoretical music-listening artefact that enabled implicit interactions and experiences. On the other hand, 'The means', the aim we pursued, was and is about finding out a certain functional configuration of an artefact that satisfied the ends. In the meantime, a befitting definition for the pertinent concept in question that had no existing correspondence, Explicitness of Interactions, was derived synchronously in the process.

### 8.1.2 Fulfilment of the Research Objectives

There are five research objectives I pointed out at the beginning of and then attempted to tackle throughout progressing parts of this thesis. Each of these points pertain to and addressed through varying chapter(s) in the research.

***1st Objective.*** *Establishment of a theoretical background by reviewing normative and conceptual music-listening artefacts, relevant facets of music-listening experience, and pertinent design for wellbeing literature.*

The fulfilment of this objective was mainly pursued throughout the literature review chapter of the research (Chapter 2).

Initially, a comprehensive array of the past and existing music-listening artefacts, and also a span of conceptual and experimental were compiled together and were exhaustively evaluated in accordance with what extent they afford users' access to music.

Following up, facets of music-listening experience in the literature were examined in relation to how music-listening users choose, judge, and listen to pieces of music. These spanned from why an individual listens to music, the cognitive processes that affect the choice and judgement of music, and theories pertaining to that mental relationships that influence this choice and judgement process. Then, intrinsic and extrinsic factors that affect the choice and judgement of music were evaluated in three orientations: user-centric, system-related, and contextual. As a consequence, a model of how users choose recorded music through music-listening artefacts was derived, and then the issue of free will and the role of intrinsic and extrinsic motivations, and their interplay with the intrinsic and extrinsic factors was discussed.

Lastly, literature related to designing interactive music-listening artefacts was reviewed and discussed on. These were divided to three parts that point to their respective areas in the literature: designing for interaction, designing for wellbeing, and key considerations for designing for the aforementioned concepts. Additionally, relevant approaches and resources for doing so were briefly reviewed and mentioned.

All of which then were discussed about in a consequential general discussion: fulfilling this objective.

***2nd Objective.*** *Elicitation of design strategies for conceptualising music-players that afford interactions excluding extrinsic attributes and the conceptual outputs thereof through a participatory design activity.*

The fulfilment of this objective was predominantly pursued through first two chapters of the Research through Design (Chapters 4 & 5). A longitudinal empirical research was employed for understanding the attitudes of the participants towards listening to music as a music-listener, a user, and as a designer.

Relevant concepts derived from the literature was delivered to the participants throughout the cultural probe study to introduce them to those concepts and prepare them to design for the relevant considerations in the following workshop chapter, whereas the actionable part of the workshop was stated well into the cultural probe study through the introduction of the dream cubes.

In return, the participants came together in the workshops as groups of design academics, design professionals, and design academic-professionals. The members of those groups paired up twice, eventually coalescing into a group of four. The process and strategies discussed in their entirety, whereas the concepts produced through the entire process were comprehensively evaluated through a deconstructive analysis. Fulfilling the second research objective.

***3rd* Objective.** *Execution of a solo design process for conceptualising a music-playing artefact as per the considerations from the literature review, the participatory design outcomes, and design heuristics.*

All the knowledge, information, and input were taken from the preceding chapters and applied throughout the solo design process by extensively reporting the process thereof whilst constituting all the incoming elements in a structured manner through an actionable sequentially executed hierarchy of their research aim centric prominences: producing a final conceptual design that is pertinent to the objective (Chapter 6).

In the end, a handheld physical/digital artefact that allows implicit interactions for accessing and playing recorded music in mobile contexts was conceptualised through a systematic and exhaustive design process. The purpose of implicit interactions was to benefit user's wellbeing by creating an *alternative* way of listening to music. Thus, designing a music-player for meaning and wellbeing was achieved by empowering mindful listening experiences in opposition to ubiquitous modern music players that overflow with information and provide means for near-absolute control (isolating it from all the stimuli therein), which is a solution for an intimately mindful experience of eudaimonia, serendipity, surprise, and a sense of journey into unknowns whilst maintaining an adequate level of self-determination. It can be further argued that existing artefacts can benefit one's wellbeing and provide meaning as they are, and they can, indeed; however, we can also say that they are limited by their own natures – inhibiting the experience of music-listening in the absence of their maximalist features.

Of course, it is imperative to discuss why a particular design solution for a certain context and use case[44] was selected; therefore, it all boiled down to a single artefact. Collection of all the conceptual artefacts that emerged during the 1st and

[44] Mobile use contexts where users may do out-of-home activities like sports, commute, and day-to-day affairs like working or studying in their respective premises.

$2^{nd}$ phases of RtD with the contribution of the participants enabled the creation of an inventory of those artefacts. This allowed atomistic deconstruction of the interaction-centric qualities of those artefacts that can be easily adapted and transferred across changing use cases and contexts for the requirements thereof. For example: Soundome, the artefact, can be adapted into a smartphone or a smartwatch application (which aren't physical artefacts per se), a device for the in-home contexts, or some other scenario of such through the employment of the atomised qualities with respect to the needs of those contexts. Consequently, designing a single well-documented proof of concept adequately fulfilled the solo design objective.

***$4^{th}$ Objective.*** *Definition and exploration of the explicitness facet of interactions: discussing and evaluating what pertains to their properties. Doing so throughout a process of designing a music-listening artefact that may only be interacted through implicit interactions for intrinsic motivations.*

The fulfilment of this objective was pursued through the entirety of the empirical part of this research, the pertaining information and outcomes were then brought together in the Explicitness of Interactions chapter (Chapter 7), in where refined definitions and properties of EoIX were derived. More so, the definition evolved throughout the span of the Research through Design from an idea to a prototypical definition, which gave way to a refined definition.

Resulting from the design process, a music-listening artefact that may only be interacted through implicit interactions was designed: deliberate isolation of music-listening experience from the extrinsic attributes limited the appraisal of music pieces to user's impression from listening to them. In consequence, the final research objective was also fulfilled.

## 8.2 Personal Motivations & Reflections

From the conception of the idea for this research, the process of researching, writing, and designing also affected my take on things on many levels. Most prominently, while my initial idea was to modernise the radio, the process transformed itself and directed me in a different direction while investigating who killed the radio star; eventually, instead of modernising (and reviving) the radio as it was and could be.

Returning to self-reflections from the process, it changed how I think about music-listening experience, the products themselves, the ways we interact with products more critically, and lastly, handling a project that becomes consuming in every manner.

For example, talking about music, I started researching this thesis while listening to Foo Fighters (most conveniently described as Post-Grunge) and Arctic Moneys (Alternative Rock) predominantly; I started to listen to much more diverse music throughout the process; and at the time of writing this, I'm listening to Bülent Ortaçgil, a Turkish composer whose music may best be described as Contemporary Folk Pop. For measure, I listened to Tom Waits (Varied, Experimental), Refused (Swedish Post-Hardcore), The Amazons (Alternative Indie Rock), Christone "Kingfish" Ingram (Blues), and Bishop Briggs (Electropop) just before him. In hindsight (and interestingly), I can safely say that my behaviour and attitude towards listening to music has changed throughout the process of this research, which has been an eudaimonic experience unironically.

When it comes to design, I realised its value for drawing alterative futures for bettering human wellbeing for flourishing instead of solely focusing on commercial success as the mainstream route and resolving pathologies for making positive impact.

## 8.3 Limitations and Future Work

### 8.3.1 Limitations

The aim in this research has always been the creation of an interactive artefact that would provide meaning from a unique angle while providing the design literature with the theoretical quality of that angle. In my opinion as the researcher, my attempt to keep up with ambitious goals of this research have been inherently self-limiting for the pace of progression thereof: imposing the need to appeal to a number of scientific fields, making in-depth and longitudinal empirical research, and pursuing intricate and well-documented tasks to accomplish it. This is due to the nonconformist ideas of and approaches in this research that usually put it at odds with conventions; resulting from that, extensive amount of justification, analysis, research, and reporting was produced to support it. That was further accentuated by the aforementioned effort to provide literature with a case of designing a nonconventional artefact while producing a theory pertinent to it.

However, the greatest limitation was the coincidence of the COVID-19 outbreak at the beginning of the user research phases that involved a significant amount of physical material and person-to-person contact. The inherent incompatibility of this research to norms of the pandemic crisis elongated the duration of the research by halting it for a significant amount of time – leaving no chance for progression for several months. Consequently, adapting to these norms and interpreting the entire procedure for it made it possible to progress. Nevertheless, the pandemic conditions have been significantly detrimental in logistics of the research, causing lapses in transferring the physical proponents thereof.

Last limitation was the lack of means to produce any kind of functional prototype. Making up for the lack of user testing and user feedback demanded painstaking amount of a priori primary and secondary research to attain a concrete command over the topic as the phases progressed by.

### 8.3.2 Future Work

The very limitations of this research also produced opportunities to pursue and expand upon the ideas and artefacts thereof. As comprehensive and intricately detailed as it is, this research was limited in sample size and characteristics as well as being focal to the use cases of one type of task (listening to recorded music from artefacts); the discussions and cases need to be widened and investigated appropriately.

When we look at the research opportunities, as a concept, Explicitness of Interactions deserves its own research in terms of artefact appraisals and in-field user researches. What we did was to approach this notion from designers' perspective, which leaves lots of questions unanswered.

Moreover, it became apparent that constituents of indeterminacy (like randomness) from the user's perspective is the main source of what makes an interaction implicit. Moreover, it stands as an underexplored notion through a structural approach when it comes to D4I, and in product design in general. In spite of seeing related work in literature pertaining to D4I here and there, there has been no holistic attempt in understanding the qualities of indeterminacy.

In terms of opportunities for designing artefacts with implicit interaction qualities, it can be seen that enabling interactions of such qualities in a harmonious and well-mapped manner requires immense amount of detail-oriented work due to the difficulty in translating their highly case-specific design requirements.

Furthermore, I will be continuing working on Soundome as a standalone project to create and manufacture it as a functional artefact; consequently, apply and report on the much-needed post-prototype user research thereof.

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Just as I was writing the final words of this thesis, I heard the following lines being sung by a somewhat familiar but unknown voice accompanied by a rather discordant yet powerful tune at the crack of dawn of a temperate Summer day:

*Fat bassoon*
*Clears the room*
*But nothing now can take away my gloom*
*Triangle*
*Fiddle Stradivarius*
*I'd like to cause a fuss* [45]

[45] As brought by Spotify somewhere amidst in my newly refreshed Discover Weekly playlist: “The Secret of Music” by Morrissey.

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# APPENDICES

## A. Voluntary Participation Consent Form

### Voluntary Participation Consent Form

This study is a part of MSc thesis research conducted by Ömür Sarper Seydioglu and advised by Prof. Dr Owain Francis Pedgley at the Industrial Design Department of METU. This form was made to inform you about the scope of this research.

#### Its Purpose and Scope

The purpose of this research is about eliciting strategies for designing music-listening products that afford informationally implicit interactions for fostering meaningful listening experiences.

#### What do we ask you to contribute?

If you accept participating to this study, we'll be doing a preliminary interview with you to understand your stance and disposition about music listening. Then, we'll be providing you a cultural probe kit that will be sensitising you to music-listening concepts for 30 days in relation to the scope of this study. You'll find a music-listening diary, inquiry cards, music-listening activities and challenges, a letter, and a concept-generation activity. Even though we encourage you to complete some of the probes, you are neither required nor obligated to complete them. Consequently; upon the completion of the probe kits, we'll be inviting you as a part of a group of four to a single workshop event, where you'll be participating to a two-staged design activity within that day. We'll be analysing and processing your designs in addition to two other groups' to design them further. Participation to this study is on voluntary basis: you may withdraw from it if you would like to do so. Identity and sensitive information of all the participants will remain hidden in and after the study in a way that it won't be possible to identify them. All the raw data (including photos, sound recordings, and videos) and information gathered for the purposes of analysis can only be accessible by the researchers of this study. Outcomes of this study may be published or utilised for educational purposes whilst the identities will be kept hidden.

#### More Information About the Study

Thank you for participating to this research. If you would like to get more information, you may contact METU Industrial Design student Sarper Seydioglu (sarper.seydioglu@metu.edu.tr) and/or faculty member of the same department, Prof. Dr Owain Pedgley (pedgley@metu.edu.tr).

*I, the participant, have read the information above and I participate this study voluntarily.*

| Participant | Researcher |
|---|---|
| Name-Surname/Signature/date | Name-Surname/Signature/Date |

## B. Semi-Structured Preliminary Interview Questions

Purpose of this part of the study is to understand the personal attributes and dispositions of those who participate this study.

Part 1: Warm-Up Questions

- What kind of music do you like? Can you talk about them?
- Who is your favourite artist? Least favourite? Why?
- Is there a favourite song of yours? Is there any specific reason for that?

Part 2: Self-perception Questions

- Do you adopt novel technologies early upon release or after they mature?
- What matters to you in relation to music?
- What is the effect of music in your identity?
- Why do you listen to music?

Part 3: Habits and Context Questions

- (Self-perception) Do you think you listen to enough music? Why?
- How do you listen? Where? Through what?

Which music-listening devices have you ever owned?

Part 4: Tastes and Discovery Questions

- What music did you discover recently? How?
- How do you usually discover music?
- What do you do to find and choose new music?
- How did your listening tastes change over time? Why?
- What music you don’t listen to anymore? Why?
- Is there anything music-related you wish you discovered sooner?

## C. Ethics Commission Approval (in Turkish)

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20 Şubat 2020

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi: İnsan Araştırmaları Etik Kurulu Başvurusu

**Sayın Prof.Dr. Owain Francis PEDGLEY**

Danışmanlığını yaptığınız **Ömür Sarper SEYDİOĞLU'nun "Olağandışı bir Radyo ile İmalı Etkileşimler: Anlamlı Müzik Dinleme Deneyimlerini Besleyen Bir Ürün Tasarlamak"** başlıklı araştırması İnsan Araştırmaları Etik Kurulu tarafından uygun görülmüş ve **043-ODTU-2020** protokol numarası ile onaylanmıştır.

Saygılarımızla bilgilerinize sunarız.

Prof.Dr. Mine MISIRLISOY

Başkan

Prof. Dr. Tolga CAN

Üye

Doç.Dr. Pınar KAYGAN

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Dr. Öğr. Üyesi Süreyya Özcan KABASAKAL

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