

Dynamix

Dynamic Music Recommendations
for Improved Group Listening

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Abstract

This report explores the development of Dynamix, a prototype music control interface aimed at enhancing the shared music listening experience in social settings. The project builds upon the existing platform Rootnote, which generates playlists based on users' streaming histories. The report highlights the limitations of current playlist creation methods and emphasizes the need for intra-context awareness, focusing on the dynamic and multifaceted nature of music preferences within a specific social context. The concept of Dynamix involves the creation of "vibe stations," which are selectable groupings of songs based on common themes such as genre, artist, era, and personal preferences. The prototype utilizes an algorithm that considers users' streaming history and incorporates a compatibility ranking to generate relevant song recommendations. Crucially, these vibe stations are based upon the songs in the queue and the recently played ones. This creates a dynamic interface that appropriately adapts to the (social) context. The report discusses future improvements, including the incorporation of collaborative filtering and additional data sources to enhance the recommendation process. Lastly, a prototype was created to explore the ideal physical manifestation of the algorithms. This prototype was carefully crafted with shared interactions in mind, emphasizing social translucence.



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Related Work

It is important to note that people's music preferences are not static. They are dependent upon a multitude of factors such as their mood, the location, or the current social situation. Juslin and Laukka (2004) highlighted the importance of considering the social context of music listening in understanding emotional responses to music. Their questionnaire study provided insights into the occurrence of various emotions in listening to music and how music is used by listeners in different life contexts. Schäfer et al. (2013) explore why people listen to music and the roles it plays in their lives. They found that people primarily listen to music to regulate their mood and arousal, achieve self-awareness, and express social relatedness.

Based upon this insight, it becomes apparent that context-awareness can play a role in improving the quality of music recommendations. Pauws and Eggen (2002) discuss a playlist generator called PATS, which creates playlists suited to specific listening situations. The paper suggests that PATS can help listeners easily and quickly select music from large personal music collections, catering to their specific preferences and listening situations. Zhou et al. (2018) developed a conversational music recommender system, MusicRoBot, which leverages a music knowledge graph to cater to users' real-time music preferences. The system captures dynamic user context, including emotion, current activities, and locations. The integration of a dialogue system allows for real-time recommendations and feedback, enhancing the user

experience. Bostandjiev, O'Donovan, and Höllerer (2012) introduced TasteWeights, an interactive hybrid recommendation system that generates item predictions from multiple social and web resources. The system's interactive interface explains the recommendation process and elicits preferences from the end user, increasing user satisfaction and the relevance of predicted content. Andjelkovic, Parra, and O'Donovan (2016) introduced MoodPlay, a hybrid recommender system that integrates content and mood-based filtering in an interactive interface. The system allows users to explore a music collection by latent affective dimensions, enhancing user experience by providing transparency and control. Tezcan, Bakker, and Eggen (2017) presented Musico, a tangible music player that combines peripheral and implicit interaction. The system uses a learning algorithm to generate and update personalized playlists based on individual preferences and different everyday contexts, optimizing user experience. Jin et al. (2019) developed ContextPlay, a context-aware music recommender that enables user control for both contextual characteristics and music preferences. Their study found that additional control for context leads to higher perceived quality without increasing cognitive load. Finally, Wang, Deng, and Xu (2018) also focused on context-awareness, specifically sequence-based context. Their approach learns the low dimensional representations of music pieces from users' music listening sequences using neural network models. Based on these representations, it infers and models users' general and contextual

preferences for music from users' historical listening records. The system then recommends music pieces in accordance with the user's preferences.

Within this design exploration, social translucence played a big role in guiding certain design decisions. Erickson and Kellogg (2000) introduced the term "social translucence" to describe the design of systems that support coherent behavior by making participants and their activities visible to one another. They argue that visibility of social cues, awareness, and accountability are the three main principles of social translucence. Ding et al. (2012) explored the idea of social context displays, which are visual representations of social information intended to facilitate social processes in online environments. They found that these displays can influence user

behavior and perceptions, reinforcing the importance of considering social cues in the design of digital systems.

In conclusion, the field of music recommendation systems has seen significant advancements, particularly in the development of context-aware and interactive systems. The dynamic nature of music preferences, influenced by factors such as mood, location, and social context, necessitates the integration of context-awareness in these systems. Numerous studies have demonstrated the effectiveness of such systems. Despite these advancements, there is still room for further research and development to optimize these systems, particularly in terms of improving their ability to capture and respond to the dynamic and multifaceted nature of music preferences on an intra-context level.

Problems & The Vision

This project was performed in the wake of a couple of other related projects. These projects range from personal business ventures to design research papers. The following section will describe some findings of these previous personal works. The problems and their hypothesized solutions are opinionated in their nature. These opinionated claims did serve as the basis of this design project, some of which were verified at a later stage through user validation.

Rootnote and its Problems

What is Rootnote?

One of the lenses through which this project can be viewed is as an improved implementation of Rootnote. <https://rootnote.io> is a website created by me. The platform grew out of the personal necessity for a straightforward way to create playlists for friend groups. Having satisfied its initial goal of playlist creation for friends, it has now found some commercial success. With 230 users as of now, there clearly is demand for tools that allow users to use their streaming histories to easily create playlists.

In its current form, Rootnote looks at the users' streaming history within a selected timeframe (e.g., weekly, monthly, yearly, etc.). An algorithm is applied to this subset of group streams to then find the most 'compatible' songs. This means that it prioritizes music that has been streamed by a larger share of group participants.

While Rootnote started out focusing on small friend groups, it has now also found its footing within music communities. These communities, such as music oriented subreddits, have a powerful desire for better insights into the groups streaming habits.

Current problems

While Rootnote is great to generate playlists that update daily, it is not in any way reactive to the social context. There is no consideration for what is happening in the moment. This is not only a shortcoming of Rootnote, but of premade playlists in general. As mentioned in the related works, some research has been done on context-dependent suggestions. These systems will give different suggestions based on the location of the device for example (e.g., kitchen or living room). While this research is valuable in its own right, it is not exactly the context-dependance we set out to achieve within this project. To clarify the difference in design goals, we will refer to these systems as inter-context. Their adaptive suggestions are based on changes in the listening environment. But what if we want to be more precise? How can we design for changing social dynamics and 'vibes' within a listening environment? We will refer to this as intra-context.

To summarize, the initial goal of this project was to use the Rootnote platform in a way that would augment its functionalities by giving it awareness of the intra-context variables.

Smartphones and Group Sessions

The advent of smartphones and streaming services being commonplace has made playing music easier than ever before. Millions of songs are only a few touches away. While this is great for efficiency and exploration, it leaves something to be desired within social settings.

Since the smartphone is a personal device, it is very closed off by its nature. It does in no way stimulate cooperation. Looking back at more traditional ways of playing music in a social setting, such as vinyl or CDs, a much more transparent process takes place. A CD needs to be picked, and everybody present can see what is happening. This in turn allows for better more effective communication about the music.

Within the smartphone paradigm, it is often hard to know if a song was even chosen to be played by anyone present, or if it automatically started playing (because of an empty queue, for example). These kinds of obfuscations are quite detrimental to social collaboration, and often lead to unwanted social situations (e.g., skipping a song somebody did add).

While speakers generally do have some playback controls, they are mostly very limited in their nature. By centralizing a bigger part of the controls, it should become easier to cooperatively curate the music that will be played during the get-together.

Data as a Conversation Starter

Streaming services such as Spotify keep detailed logs of every song you ever streamed – or even skipped. This is necessary to power

their recommendation engine. While this is a fine use case for said data, there are other opportunities currently not explored as much.

Looking at services such as Last.fm, Stats.fm, and Spotify's own yearly Spotify Wrapped, it is clear that there is a desire to share statistics about your streaming behavior. It helps users in communicating their music tastes, which in turn is used as a proxy to communicate something about their personality.

If there is clearly such interest into data-powered visualizations of personal music tastes, then why do the music interfaces not directly incorporate this within the shared music listening experience. By presenting users with relevant, interesting, statistics about their streaming habits during a moment of shared listening, we can stimulate conversations. This claim is supported by my previous research of which a summary can be found in appendix B.

Axioms

Having had quite some experience within the shared listening context, there are a few more claims made at the beginning of this project that would guide the rest of the process. The following section describes these claims. We will not further verify these axioms within this process and will accept them as true. Further research could be done to verify these claims.

Freedom to Add

While it might be tempting to create some kind of autonomous music player that algorithmically decides what music is best to play, previous experiences show that users like to have the ability to freely play music at any time. We therefore claim that the device should

only assist users in choosing which music to play, instead of taking full control. Subsequently, we claim that the phone is the preferred input device for adding (individual) songs. This project will therefore not try to replace this input method.

DJ-fatigue

Choosing which music to play can become quite tiresome. As seen in previous projects and verified by many, after a while, it becomes hard to think of what songs to play next. We therefore claim that the interface should play a supportive role in these moments of indecisiveness.

Initial Co-creation

Based upon the initial design context and axioms, a co-creation session was performed. This session was meant to further verify some of the assumptions, as well as discuss what the other real pains are for the participants with regards to shared music control. Finally, users were asked to produce potential solutions to these problems.

The key finding of this co-creation session was related to the incorporation of intra-context awareness. In trying to answer how the system could become aware of the currently desired musical vibe, the idea was put forward to use the songs that are added to the queue as a way to identify the desired vibe. This is contrary to concepts at the beginning of the brainstorm that involved a more manual form of control, such as setting sliders to input certain desired musical characteristics. This new insight to gather information from already performed user actions (e.g., adding songs to the queue; skipping songs.) became paramount in the final design.

Additionally, all participants agreed that the songs added by the system (based upon the queue) should be somewhat stylistically cohesive. Instead of just randomly playing more of the same, participants felt that they should have some control over the vibe of the automatically added music. Referring to one of the axioms, it was taken into consideration that this control should not be too involved.

Collective Brainstorm Music Interactions

Introduction

Refer to image 1. This is awful in my opinion. We are going to redesign this.



Exercise 1:

"Describe The Vibe"

Describe what kind of music you would play for the following scenarios:

A big house party with 100+ people		
A funeral wake		
A coffee place		
A get-together with 5 close friends		
A Friday afternoon drink at work		
Christmas dinner with the family (no Christmas music allowed)		
While trying to sleep on a plane		
A first date		
A first date (the 'end chill' part of the date)		

Exercise 1.5:

"Describe Your Vibe (to an alien)"

Building upon the last exercise, describe your general music taste as if you are talking to an alien who does not not what genres are. They do not know any artists, but they do understand feelings, math, musical concepts (rhythm, melodicness, etc.), instruments. Descriptions can also be related to real life events (kind of the reverse of the exercise just performed).

Exercise 2:

"Suggested Playlists"

We imagine a service that can combine two user's music tastes (like Roadster). After the users are both connected to the speaker (in this fictional scenario), three automatically generated playlists get presented to them. You are tasked with describing how these three to five playlists might look in a scenario with:

- One of your parents
- Your best friend
- [Open choice] (your favorite artist, your dog, Jeep ~~Exxx~~, etc.)

Parent

Best Friend

Custom:

Exercise 3:

"The Singular Input"



Imagine a scenario where all your music control needs to happen through the use of one singular input. This input is mapped to one musical feature.

"A slider that controls the danceability of the music"

"A knob that controls the personal connection I have with the music"

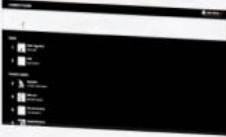
"A button that cycles through genres"

What would you choose??

Exercise 4:

"Redesigning Fallback Playlists"

With all of the previously gained insights, we are going to describe how we would want to control the 'fallback playlist'.



This handout was used during the co-creation. Users filled this in after which we collectively discussed the results.

Framing the Concept: Infinite Personal Radio Stations

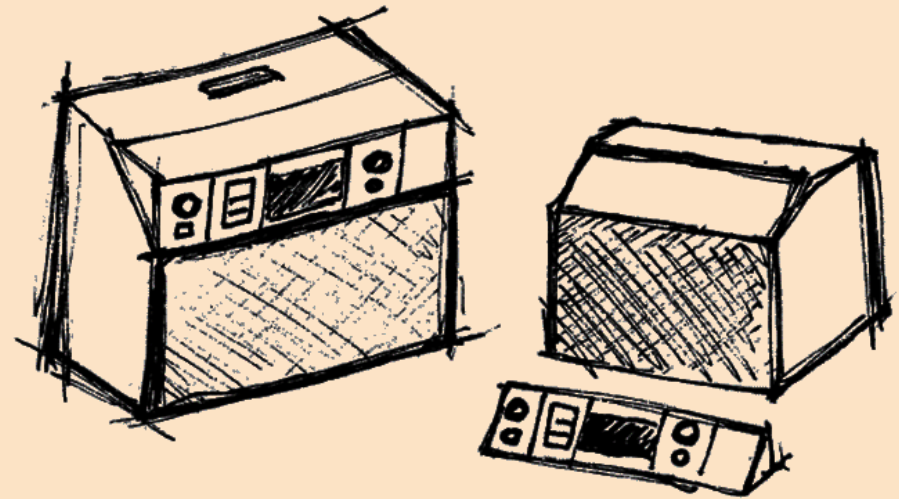
Based upon the initial assumptions and the co-creation session, the initial conceptualization was performed. This conceptualization took the angle of 'infinite personalized radio stations'. The following section will describe this angle in further detail.

Why Radio Stations

The metaphor of radio stations was chosen since they are often stylistically bound by some overarching (musical) concept. This could be genre, language, popularity, and more. Furthermore, radio stations have a 'set-and-forget' quality to them, that accurately depicts what this project set out to achieve (at this point). The term 'fallback station' was coined to describe this functionality of the product. It is a 'fallback' since it starts playing songs once the queue of manually added songs runs out.

The Form

In-line with the aforementioned radio station metaphor, the initial concepts of the Dynamix interface were heavily inspired by radios. While the radio shape ultimately came to be abandoned, we do see the first glimpse of an interface that is focused on collaboration. The front panel was conceptualized to be removable, so that users would easily be able to pass it around the table.

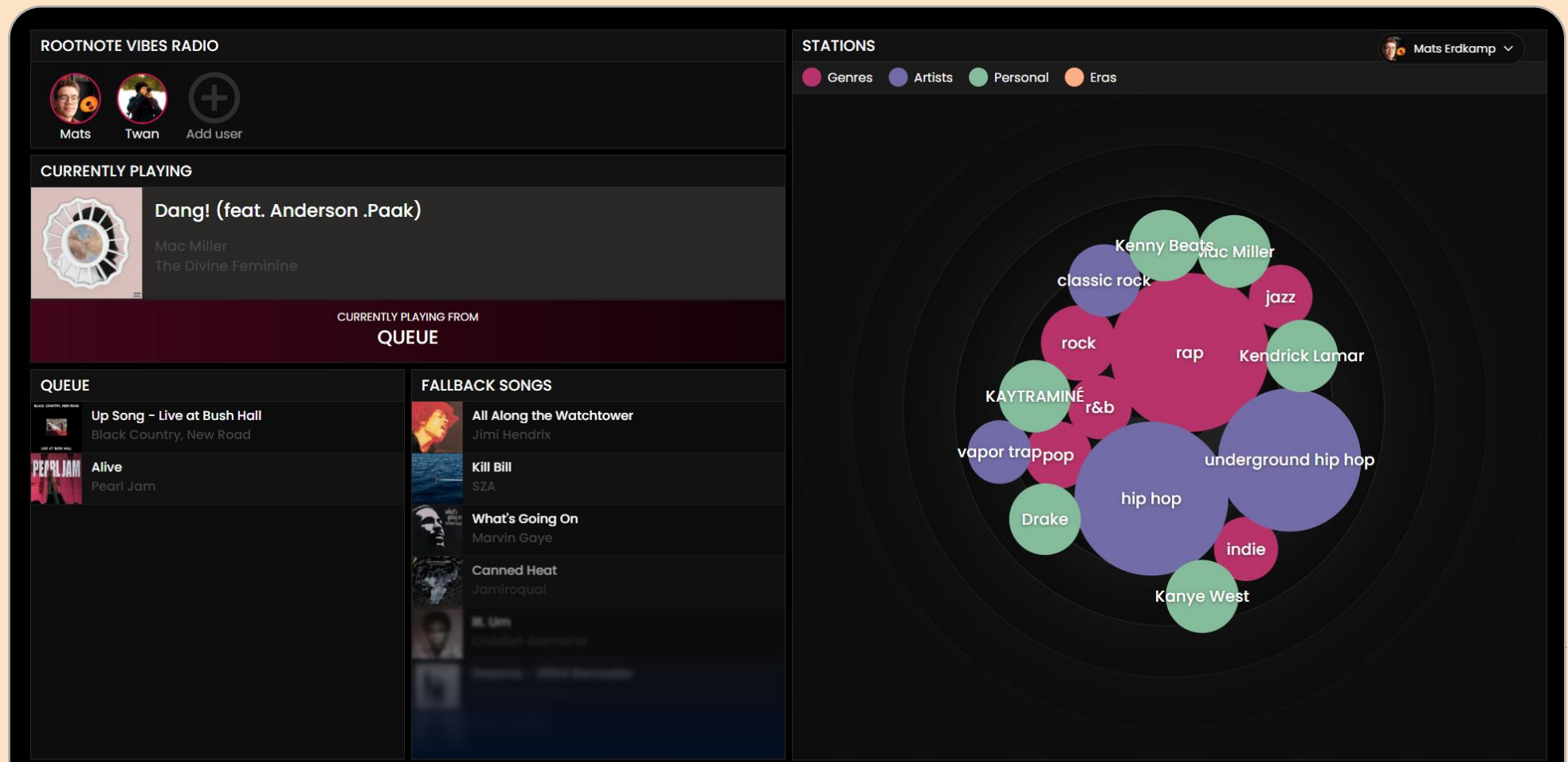


Initial Concept for the prototype.

The Algorithm

The algorithm deployed within this design prototype was created to effectively communicate the functionality of the system. It is by no means final. This section will describe the current implementation, as well as briefly discuss potential future improvements.

The website created for the initial exploration of the algorithms. Most of the functionality presented here made it into the final prototype.



Current Implementation

The Dynamix prototype is built on top Rootnote, a platform (created by me) that tracks Spotify streams for insights into you and your communities' listening habits. Rootnote thus has all the infrastructure to track the streaming history of users. This listening history is used in the prototype to feed the Dynamix recommendation algorithm.

In more technical terms, Rootnote is built on top of a Django REST Framework API. This API is itself connected to the Spotify API. The frontend of the Dynamix prototype is a web app built in Vue.

Vibe Stations

When users join, they get added to the Dynamix session. Based upon the **weekly streams** of the connected users, an initial set of 'vibe stations' is created. Vibe stations are individually selectable groupings of songs based on a common theme. Within this first implementation, the themes are **artist, genre, era, and personal**. The next section ('Future Improvements') discusses these vibe stations in detail and how they might be improved upon in the future.

Once the session has started, the vibe station algorithm starts to look at the songs that have been played, and the ones added to the queue. After a while, the influence of said songs outweighs the influence of the previously listened songs.

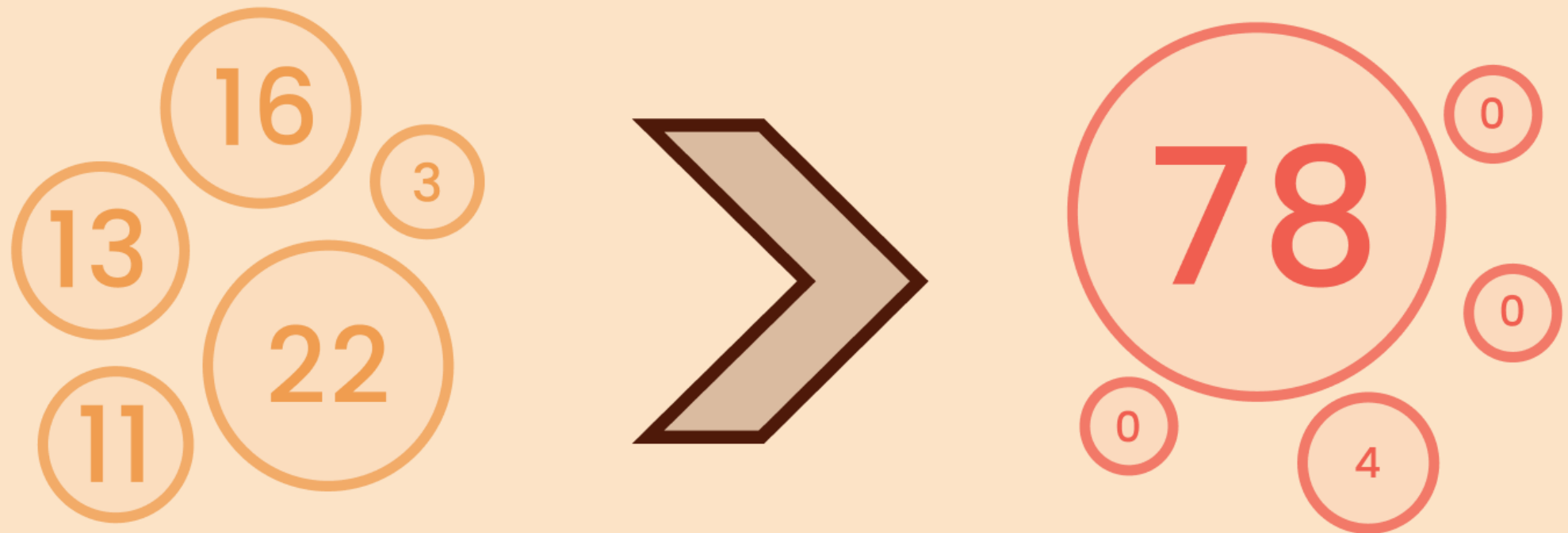


An example of a collection of 'Vibe Stations'.

What's Inside a Vibe Station?

Once a vibe station has been selected, the system will have to find songs that fit the required criterium. Songs within the 'rock' vibe station need to be rock songs, and songs within the '80s' vibe station need to be from the 80s. But, after this categorical filtering, the remaining songs need to be ranked by some metric. To achieve this, Rootnote's compatibility ranking was used.

This compatibility algorithm creates a scoring metric from the summation of logarithms of individual users' streams of a song. In practice, this means that it is beneficial for a song's score to be streamed by more people, instead of just by one person. The songs inside a vibe station are ordered by this metric, ranked from high to low.



Yellow and red both represent a song, and the circles show individuals' streams of that song. Even though red has more streams in total, yellow would have a much greater compatibility score because of its more even distribution of streams amongst users.

Future Improvements

Vibe Types

Within the prototype, four categories of selectable 'vibe stations' were present. The categories can be described as follows:

- **Genre:** songs which are part of a certain genre (e.g., Hip-hop)
- **Artist:** songs from a certain artist (e.g., Tame Impala)
- **Era:** songs released in a certain year or decade (e.g., 80s)
- **Personal:** songs that are one connected user's favorites of the last week.

The 'Event' category was conceptualized but not implemented. This category could, for example, be based upon a festival. If enough artists from a festival line-up are listened to, this station would present itself.

Genre and Artist are based upon nominal data, with Era being an ordinal classification. Due to the relative ease of implementation, it was chosen to focus on these qualitative descriptors. Moreover, the nominal and ordinal nature of the categories was thought to make it easily understandable for the user to identify what a category would entail. There are, other ways to group the music by that were not present within the Dynamix prototype. To better understand this, we will first shortly summarize the distinct kinds of widely available recommendation engine methodologies.

Collaborative filtering is based on the idea that users who agreed in the past will agree in the future. It uses the behavior of numerous users to recommend items. **Content-Based Filtering** uses item features to recommend other items similar to what the user likes,

based on their previous actions or explicit feedback. For example, if a user listens to a lot of rock music, the system will recommend other rock songs or artists. While content-based filtering can be performed upon nominal data, continuous data can also be used. These continuous descriptors are often derived directly from the audio (e.g., energy level, danceability).

Within the Dynamix prototype, categorizations are mostly based upon nominal content-based filtering. The inclusion of various available continuous parameters needs to be further explored. This could include parameters such as energy, danceability, tempo, key, and more. Collaborative Filtering is also absent within the current prototype. The songs within a 'vibe station' are entirely based upon the connected users' streaming histories. This means that the songs are by definition listened to by (at least of the) group members. To allow for more serendipitous recommendations, one might consider implementing collaborative filtering. That being said, it seems that in practice users like to have songs played that they know in social contexts. Most of the time, small social gatherings are not the place to discover new music. Adding an explorative element to the recommendations therefore needs to be done with care. Collaborative filtering can play a role in biasing the algorithm towards 'party' songs in a social context. As an example, users might stream a spoken word interlude in the context of the full album. This does not necessarily mean that said song is desired in a social context. By looking at how many users are connected to speaker while playing/skipping a song, we gain insight into when a song performs best. Some songs might shine in a personal context, while others might be listened to most with 10+ people.

Queue

Additional Information

The Dynamix recommendations are based upon the recently played songs and songs in the queue. While it is obvious that we can use these songs to power the recommendations directly, there is some more subtle information hidden within this data. The following section describes some questions that one could ask about the aforementioned songs.

User Bias

- Are the songs being played evenly popular amongst all users?
- Are the songs being played biased towards a certain user?
- Who is adding the songs to the queue?

Exploration

- Are the users adding songs that they know very well?
- Are the users adding songs from categories of music that they know very well?

Negative Feedback

- Are users skipping songs?
- Are users removing songs from the queue?

Users

- How many users are currently listening?

All of these additional pieces of information can be used to strengthen the dynamic recommendations at the core of the Dynamix project. Further research needs to be done on how to effectively incorporate this additional data.



purely from the songs on the queue and their metadata?

The Design

With the algorithm now created, a second exploration of the form factor was done. This second iteration prioritizes collaboration over the metaphorical resemblance to a radio. Additionally, this new iteration was heavily inspired by interior design since the interface would need to have a prominent placement within the listening space.

The sources for the images used within this mood board can be found in appendix E.



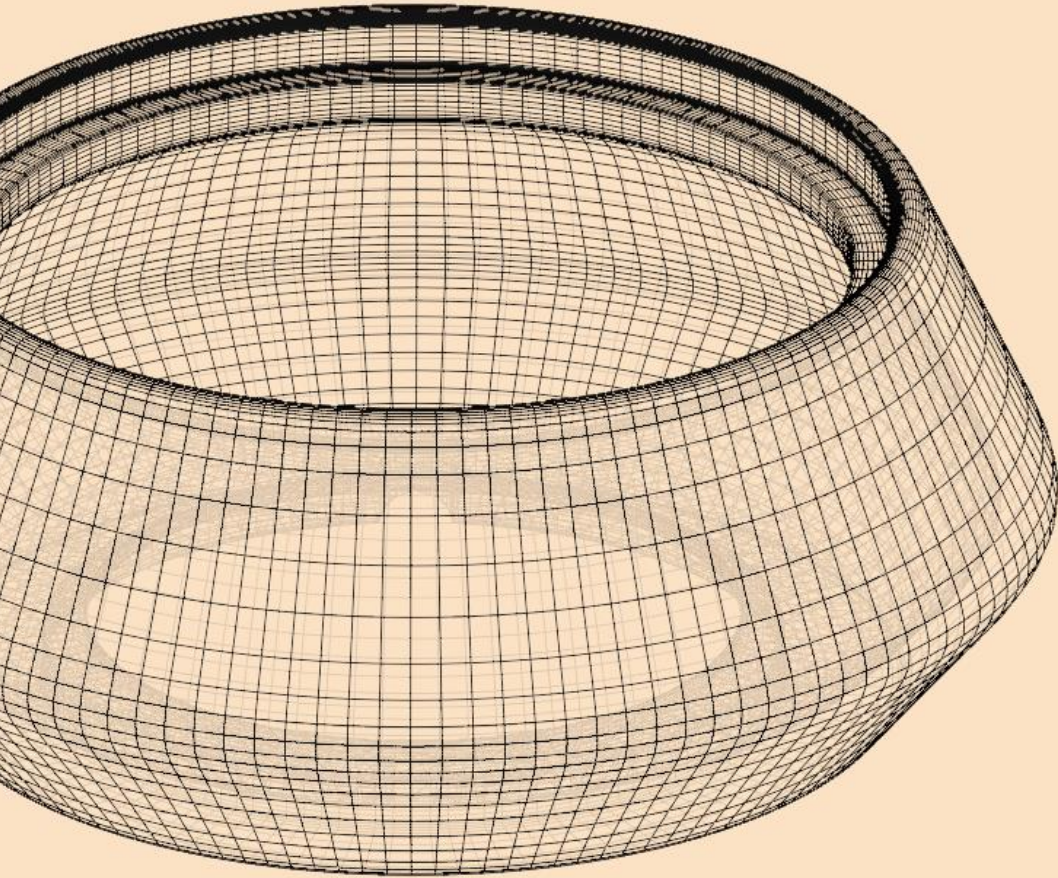
Shape Explorations



Concept Renders



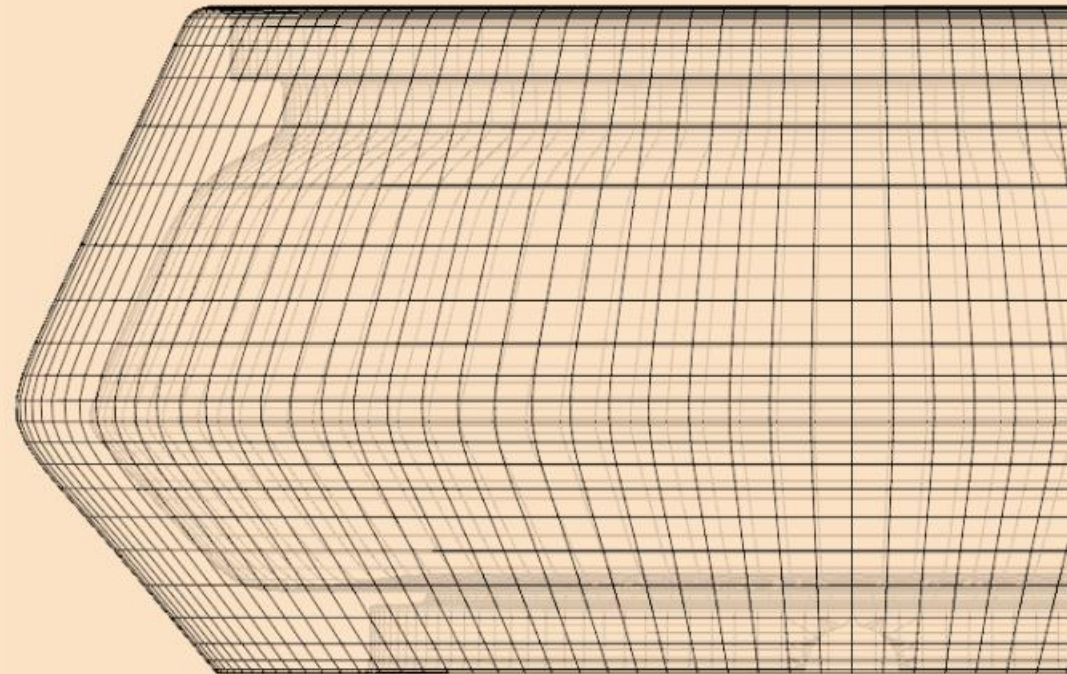
Schematics



Out of the shape candidates, this one was deemed the best for its aesthetical, practical, and perceptual merits. People generally found this one to look best, it is easy to pick up, and it slims down the screen.

The precise dimensions were redone at this stage, so that it would fit the required electronics.

Certain features of the updated design draw inspiration from the golden ratio. This applies to the proportion between the screen's diameter and the broadest segment of the form. Similarly, the vertical position of the protrusion is also determined using the same principle.



Final Render #1



Final Render #2



Final Render #3



Prototype Creation



Final Prototype

Based upon the digital explorations, the final prototype was created. A 3d print was sanded and painted, giving the final prototype a finish similar to an injection molded part.

The color gradient on the body of the device present in the renders is absent from the prototype due to feasibility concerns. Future explorations will explore the body color more.

While the final prototype is just an interface, one could imagine how this device could be turned into a speaker. The speakers could be mounted into the vertical walls of the device. Since the device is meant to be put in the middle of a table, this would hypothetically mean that the speakers project towards ear-level. More research will need to be done to validate the acoustics of the device, and if it can serve as a (good) speaker.



The Display

The Dynamix interface consists of a round display as its main feature. This shape was chosen to highlight the fact that everyone is welcome to engage with the interface; there is no preferred orientation. The content of the display consists of a few key areas. The following section will shortly describe them.

The ‘Rotation Ring’

To further support multidirectional usage of the prototype, a ring was added around the outer edge of the display. When tapped, the entire user interface rotates towards the touch point. This makes it easy to read text present in other parts of the interface, no matter where you are sitting. The ring is colored in accordance with the currently playing song’s album art.

The Vibe Stations

The screen on the right shows the Vibe Stations menu. As discussed previously, this menu presents the users with various categories of music. The ones selected will dictate which types of songs play once the queue runs out of songs. Crucially, the vibe stations are dynamic, and change based upon the recently played songs, as well as the ones currently in the queue.



Basic Functionalities

The Dynamix interface has all the 'basic' functionalities of a music interface. You can see information about the currently playing song, play/pause, skip/rewind, and set the volume.



Queue View

A separate view was made to allow users to collectively see the queue and the subsequent fallback songs. This way, it is easier to collectively reason about the music that is about to play.



Social Prompts

In line with the findings of the previously performed research (appendix B), the Dynamix prototype includes some 'social prompts' to serve as conversation starters. Within this previous research, users were presented with an abstract visualization of the streaming behavior. The Dynamix prototype takes a more direct approach, by communicating streaming behavior through text popups. This change was made due to the fact that the conversation starters are not the main focus of the Dynamix prototype. Abstract visualizations were thought to take too much time to grasp and overload this UI.

Soft-skipping

Previous research discusses the potential benefits of soft-skipping. It is thought to allow for better negotiation about the music being played, since users can swap the current song for one of the same artist or album, as opposed to skipping it entirely. Due to a technical limitation with how the Spotify Web API works, it was not feasible to include these inputs within the Dynamix prototype. Appendix A discusses the soft-skipping intervention and its potential benefits in more detail.

Demo Day

The Dynamix Prototype was presented at the TU/e Industrial Demo Day. Public reception of the Dynamix prototype was incredibly positive. The majority of visitors deeply understood the issue this project was designed to solve.

Interest was not only limited to the desire to own the product. One group of researchers was eager to use the prototype as a part of a larger user study that aims to promote more conscious media consumption. On the commercial side, one person was interested in becoming a co-founder and bringing the product to market. Another tried to get me in contact with investors. Moreover, the university invited me to submit my project to Design Intelligence Award, claiming it made a "remarkable impression" during demo day.

This positive feedback confirms that the Dynamix project solves a problem that users identify with quite strongly. It is important to highlight however that this does not necessarily mean that the product will do well commercially. Further commercial research needs to be done to validate consumer interest in a more scientific manner.



Conclusion

Within this project, we described the creation process of Dynamix. Based upon research literature on (context-aware) music recommendations, as well as social translucence, a design prototype was created to make recommendations more aware of the social situation.

An initial conceptualization for the software was created. This software uses the recent streams and queued songs to give dynamic suggestions to the users. This in turn creates an interface that can adapt to the social situation at hand.

This software was then carefully adapted to ensure a symbiotic relationship between it and the hardware. The hardware was purposefully crafted so that it would look right at home in the middle of a table during a get-together. Moreover, it was made to stimulate collaboration and social translucence between users.

With user validation of the concept during the final demo day, the Dynamix project shows a promising start in solving current frustrations around shared music listening. Further steps will need to be taken to verify the commercial opportunities of the design. Next semester provides the perfect opportunity to further explore the market potential.



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Appendices

Appendix A: Soft Skipping

In this report we refer to ‘soft-skipping’ multiple times. This appendix gives a brief summary of what it entails and highlights the various iterations of the same idea as of now. Lastly, we explain the technical reasoning why it could not be included in the Dynamix prototype.

Soft-skipping (coined by me) is a way to change the currently playing music without outright skipping to the next song. Instead, the currently playing song is swapped out for a song from the same album, or same artist, depending on which of the buttons is pressed. The soft-skipping intervention started as a research project to improve shared co-located controls. The idea being that soft-skipping a song would be more socially acceptable, since some aspect of the previous song remains intact (the same album or artist). This way, when users do not like a song, they can negotiate with the person who chose to play the previous song in a non-destructive manner. We envisioned conversations such as “Hey can we play another song from this album? I have heard this one way too much.” taking place.

While the results (within the lab environment) were mixed, I personally still saw potential in its usage. This led to the second iteration of the soft-skipping prototype, one designed to be smaller so that it could easily be put anywhere.

The latest iteration of the soft-skipping experiment makes use of clickable NFC buttons. By sticking them on the back of a smartphone, the user can perform the aforementioned actions at all times, as long as their phone is unlocked. I have been using this setup myself for the last few months. The Android (and iOS) operating systems prevent usage of NFC when the phone is locked due to security concerns. While this does impede the UX slightly, I still feel like the soft-skipping buttons provide a valuable addition to my mobile music controls.

One of the major hinderances as of now is the full randomness of the newly selected song. This often leads to undesired songs being selected (such as interludes) or repeats of the song that played just now. Further research is required to find an algorithm that selects songs in a non-random, yet serendipitous way.

The reason for its absence in the Dynamix demonstrator is a technical one. The Spotify Web API is limited in some key aspects. Due to these limitations, the soft-skipping software does not actually ‘swap’ the song. It adds the new song to the queue and skips one track forward. This works if there are no other songs added to the queue. Within the Dynamix demonstrator, adding songs to the queue is crucial. It was therefore not possible (or at least, beyond the scope of this project) to add the soft-skipping buttons. We do still feel that they could be a valuable, and socially translucent input that really would really shine in the context of a shared music control interface. Especially since the Dynamix interface makes automated suggestions, we hypothesize that users would benefit from the option to swap out a song for one from the same album or artist.

Appendix B: Social Translucence Within Shared Music Controls

This appendix provides a brief description of one of my previous research endeavors on the topic of social translucence within shared music controls. This (unpublished) research paper shaped some of the choices and assumptions made during the Dynamix project.

With the rise of streaming services such as Spotify and Apple Music, most music control nowadays is done from a smartphone. This makes the actions taken to choose the music very obfuscated. Moreover, the rise of those same streaming services has created a never before accessible quantitative insight into user's music listening habits (their streaming history). With this in mind, I designed a socially translucent probe that aims to re-centralize and re-socialize shared music control.

The mission of making shared music control more social is achieved through the usage of a visualization of the users' approximate enjoyment of the music being played. The visualization works in two parts. The vertical position of the 'orb' highlights the 'song affinity.' This is a metric based on that user's total streams of the song that is playing. The size of the orb visualizes the 'music affinity.' This music affinity works on the same principle but is taken as an average of all music that has been played during the get-together. In short, the vertical position communicates individuals' current enjoyment, while the size of the orb communicates their average enjoyment. Both are of course approximations of enjoyment since stream quantities do not fully line up with enjoyment, but the approximation has proven

to be useful. The research focused on the following question and sub questions:

Q1: "What are the effects of Social Translucency in the context of shared music listening?"

SQ1: How does Social Translucence affect the music being played?

SQ2: How does Social Translucence affect the social dynamics at play during shared music control?

The findings of this paper were quite interesting. Users verified the original hypothesis that the visualization would create more social translucence, which would in turn lead to better cooperation during the selection of music. Interestingly, users preferred the social aspects of the design even more. Especially the 'song affinity' visualization played a vital role as a conversation starter. Before the visualization would update, users would quickly guess who played the current song the most. Moreover, when people were surprised by an individuals' song affinity, it often became a topic of conversation (e.g., 'Wow I didn't know you like this song as well!').

The positive reception of the song affinity visualizations lead to the exploration and inclusion of the 'social prompts' within this design. While the execution is different, it operates upon the same fundamental principle; users like to talk about and compare their music listening preferences.

Demo day page: <https://projects.id.tue.nl/id/7zIaeG/>

Appendix C: FBP – AUD_I/O: Short Summary

Car music control systems have traditionally been designed for the radio. Music streaming services often feel like an afterthought in car interfaces. The AUD_I/O project redesigns music interactions from the ground up with streaming, big data, and future mobility in mind.

This fundamentally distinctive design basis resulted in new and innovative interactions. Music recommendations are augmented by journey data, such as location, speed, road type, E.T.A., and many more. Furthermore, passengers can easily couple to the car's music listening session, creating a more social environment where everybody can enjoy the music. This social aspect is not limited to within the car. The AUD_I/O system even provides the opportunity to send music between cars, while waiting for the traffic light to turn green, for example.

Demo day page: <https://projects.id.tue.nl/id/nAII5e/>

Appendix D: Additional Algorithm Improvements

This appendix highlights some of the additional improvements that can be made to the algorithm. These improvements, while important, are more about improved functionality, as opposed to creating new functionality.

Multipliers

Currently, there is no biasing towards certain ‘fallback stations.’ If we take genres as an example, there are currently no systems in place to favor the inclusion of one genre over another. In some cases, however, we might find that it would be preferable to bias the system towards certain genres. This biasing could be implemented on a system-wide level, as well as a user-specific level.

On a system-wide level, we might choose to learn from the genres that users like to click. With over 1000 genres available on Spotify, not all of them are intuitive and musically cohesive. By monitoring the genres that users like to select, we can bias the algorithm to include these more. It is of course important here to strike a balance as to not fully suppress the more esoteric genres.

On the individual level, the users’ streaming history could also play a more sophisticated role in the algorithm. If we take the case of a certain group of users exploring rap music for the first time together, it might not make sense to overload the UI with all the various subgenres. So, in this case, one might want to consider the estimate user knowledge of the music being added to the queue, to adequately guide their exploration of the (sub)genre.

Appendix E: Mood Board Image Sources

Images from left to right:

Roden Crater by James Turrell. CC Magazine.

<https://ccmagazine.es/en/james-turrell-the-architect-of-space-and-light/>

Bang & Olufsen BeoPlay A9. OnlinePlayShop.

<https://www.onlineplayshop.nl/beoplaya9-mk4.html>

Clay vases. The Crucible.

<https://www.thecrucible.org/guides/ceramics/>

Stem Player by Yeezy Tech. The Verge.

<https://www.theverge.com/2022/2/18/22940748/donda-2-stem-player-kanye-west-exclusive-music>

Speckled Ceramic Vase. Trongtinbatrang.

<https://trongtinbatrang.com/2022/02/13/cach-phan-biet-do-gom-cac-cach-xac-dinh-do-dung-trong-nha-cua-ban/>

Axel Vervoordt (inside one of his interiors). De Morgen.

<https://www.demorgen.be/nieuws/ik-wou-van-kinds-af-aan-rijk-zijn-wie-is-axel-vervoordt-de-man-die-kanye-west-naar-wijnegem-bracht~b2811019/>

Appendix F: Expertise Area Reflection

Creativity & Aesthetics

A big part of this project was focusing on the aesthetic qualities of the demonstrator. Careful consideration was put into the appearance of the demonstrator as to fit within most contemporary interiors. I have improved my ability to design products that fit inside a home, instead of just designing for a demo day stand. The render explorations have taught me a lot about picture composition.

Technology & Realization

I spent a lot of time this project on the realization of the demonstrator. One of my main goals was to make the module fully wireless and chargeable. Trying to achieve this, I learned quite a bit about the basics of electrical engineering. These newfound skills will help me in creating future prototypes that are deployable within the field without assistance.

Math, Data & Computing

The Dynamix project, is an exploration of what else we can achieve by using big data. As a result, I learned about this expertise area through the implementation of the algorithm. Furthermore, the literature review of recommendation engines has made me more knowledgeable about the underlying mechanics of the systems on top of which I am designing. This makes me more aware of the technical limitations, as well as opportunities.

User, Society & Enterprise

The initial brainstorm session at the start of this project provided a key insight on which the rest of the project was based. This has

shown me the value of early user involvement, instead of only using user tests as a validation tool in later stages. Furthermore, instead of big user tests, I continuously asked people for quick feedback during the process. I think that this was beneficial to the project up until this stage. The FMP will of course involve more scientific user validation.

Business & Entrepreneurship (+DLE)

With people eager to become co-founders and/or investors, I have learned that I should put myself out there more. A business network is invaluable. During the FMP, I hope to include as many potential stakeholders as I can. Having read up upon various business books during the semester, I feel, for the first time ever, that I have a clear grasp on how to start the entrepreneurial journey.

Reflection M21

My mission for this semester was quite simple. I set out to create a hardware device that would augment the services provided by Rootnote. I wanted to combat the static nature of generated playlists. I wanted to create hardware that I could proudly put into a portfolio. I feel like I achieved all these core goals, and I am incredibly pleased with the final outcome of the project. Looking at the feedback I got, I think that it has been some of the most positive yet. This was in part because the demonstrator looked nice (“Wow a round screen!”), but more crucially, people recognized the pain points of the status quo that I was describing. Tony Fadell describes in his book ‘Build’ the difference between a ‘vitamin’ and a ‘pain-killer’ product. Now more than ever, I think that I am close to creating a pain-killer.

There is, of course, always room for improvement. Reflecting upon the process, I think it would be beneficial to deemphasize the development of the backend software. It would have benefitted the project to consider the user interactions more strongly. By relying a little bit more on ‘Wizard of Oz’-ing certain aspects, I think I could have unearthed some more interesting UX insights. My contributions to this niche design field (UI/UX for socially-oriented shared music listening) would be greater than my contributions to recommendation engines. In a similar vein, it was not wise to spend so much time on making the demonstrator wireless and chargeable. I am however glad I did these ‘extra’ things now since they will likely be my last chance where I get the freedom to learn them. It can be

difficult to find the balance between learning activities and doing what is in the best interest of the project. I will try to make sure that the goals of the Final Master Project lean more towards the greater good of the project.

Additionally, another step in the process that could have been done quicker was the research into recommendation algorithms and their various implementations. I think it would have been extremely valuable to discuss the subject matter with some experts, so that they could point me into the right direction. For the FMP, I will be sure to talk to more experts (especially with regards to business and engineering).

One of the aspects of this project that I really enjoyed was the iterative design of the software and the hardware. I think this really makes for a cohesive user experience. In previous projects, there would quite often be a ‘mismatch’ between the software and the hardware that contains it. Within this process, I purposefully chose to alternate between software and hardware. I strongly feel that this choice paid off and I will be sure to remember this for future projects.

In general, I am very satisfied with the outcome of the project. Not only because I personally really like the concept, but because I could see something spark in the eyes of people at the demo day once I explained the problem at hand and the proposed solution. The invitation to participate in the Design Intelligence Awards was the metaphorical cherry on top. Next semester, I will try my absolute best to make Dynamix a commercial reality – and I could not be more excited.

Identity

As a designer, I focus on human-computer interaction (HCI). Moving along the intersection of software engineering and industrial design, I have honed a valuable set of skills that allow me to transform abstract ideas into tangible products. With my work within HCI, I try to design experiences that marry the digital with the humane in a socially-oriented way.

Always eager to learn, I stay updated with the latest technological advancements, allowing me to innovate and maintain the relevance and edge of my work. My personal passion often sparks the initial idea for a project, with a particular emphasis on applying modern technologies to the design domain of music control. My favourite designs aim to create more socially-oriented systems that harness the emotional force of music to bring people together. To achieve this, I like to utilize the concept of social translucence, a design methodology that has awareness, visibility, and accountability as its main pillars. Moreover, I am quite inspired by the works within the field of slow technology, since it highlights how technology can be designed to operate seamlessly in the background, allowing for more meaningful and mindful interactions.

Data plays a crucial role in my professional identity. I use data-driven design methodologies to gain insights into user behavior, preferences, and needs, helping me to make informed design decisions. Furthermore, I am fascinated by rethinking the possible utilities of 'big data.' Data is also an invaluable tool that I use for

business validation, by employing 'Lean Startup'-style methodologies to validate assumptions.

Since my designs include a social element most of the time, I prefer to validate their effectiveness through field deployments. This gives me more insight into the real-world effectiveness. My pragmatic mindset is another reason I like to design for the real world, in the near future. Making daily interactions just a tiny bit better can have a huge impact on the world, which makes me eager to design for this context.

Instead of adopting a generalized approach, applying one skillset to a wide variety of contexts, I favor a more focused strategy. I immerse myself deeply into a single topic, delving beneath the surface to unearth subtle nuances and complexities that might otherwise remain hidden. This intensive exploration allows me to understand the subject matter at a deeper level, revealing opportunities for innovation that a cursory overview might miss.

In short, my identity as a designer is characterized by a strong interest in innovative technologies, and how they might be applied to the everyday social aspects of life. I am driven by a desire to improve human-computer interaction by making it more human-oriented. With a passion for music, and a strong interest in data-driven design, I aim to contribute deep new insights for the designs of tomorrow.

Vision

I believe that the data-driven companies of the 21st century have the power to strongly augment social interactions. While our data is now mostly used to feed into recommendation engines, I think it should play a bigger role in helping create and support interpersonal relationships. Since the rise of computing, most services have aimed to maximize interaction efficiency. While this is certainly beneficial in professional environments, it leaves quite a lot to be desired in the domain of, for example, the home. Take the process of selecting music as an example. Over the years, some of the social aesthetics of choosing what to listen to got lost. Flipping through a CD collection, or selecting a vinyl record, were not only personal choices but also social signals. These actions provided opportunities for shared experiences, conversation starters, and insights into someone's personality or mood. They also provided a level of serendipity and discovery that is often missing in the era of algorithmic playlists.

In contrast, platforms like Spotify and Apple Music have extraordinary recommendation algorithms, which, while incredibly efficient at predicting our musical tastes, have minimized the active engagement and social interaction once inherent in music selection. We should therefore think about how these platforms can integrate with physical spaces to recreate the tangible, social experience of music listening. There is a wealth of opportunities for innovation in this area, blending the convenience of digital music libraries with the social and tactile experiences that were lost in the transition from

physical to digital. My aim is to redefine how we interact with and share our data to others, making it a more communal experience than ever before.

Large data conglomerates are, of course, not oblivious to the social potential of personal data. Services such as Spotify Wrapped allow users to share their favorite songs and artists once a year. I argue, however, that the integration of such social aspects should be more profound and deeply woven into the user experience. The social interactions should be thought through even on a hardware level. When applied correctly, I envision systems that are not only more fun to use, but also more socially translucent and engaging.

FMP Proposal

Mats Erdkamp

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June 15th, 2023

The Vision

While the final master project's exact details are not set in stone, one thing is for certain: the project will focus on music and our (social) interactions around it.

The Dynamix preparation FMP project has concluded with a demonstrator that shows my personal vision on the future of shared music listening. While Rootnote gives music communities the tooling they need to bond over the music they all enjoy. While their approach is quite different, their mission is the same: to use users personal streaming logs to augment the social aspects of music listening.

The unique perspective on design as taught at the Eindhoven University of Technology gives me the knowledge to look at the issue at hand from a more socially-oriented perspective. I think that this is something that is currently severely lacking from music control interfaces, and music-oriented services in general.

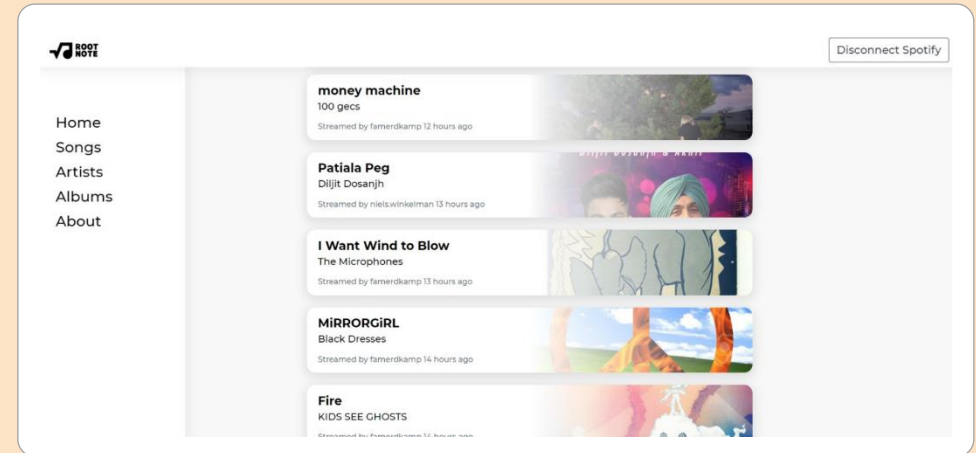
Within this proposal, I highlight some of the key differences between the software and hardware side. Subsequently, I set up two schedules of how the planning during the Final Master Project might look. One is software-oriented, while the other is hardware-oriented. No matter which direction is chosen, both focus will focus on user validation and business development. As it currently stands, both trajectories would work towards an investment moment as the ultimate commercial feasibility test.

Why M.E.?

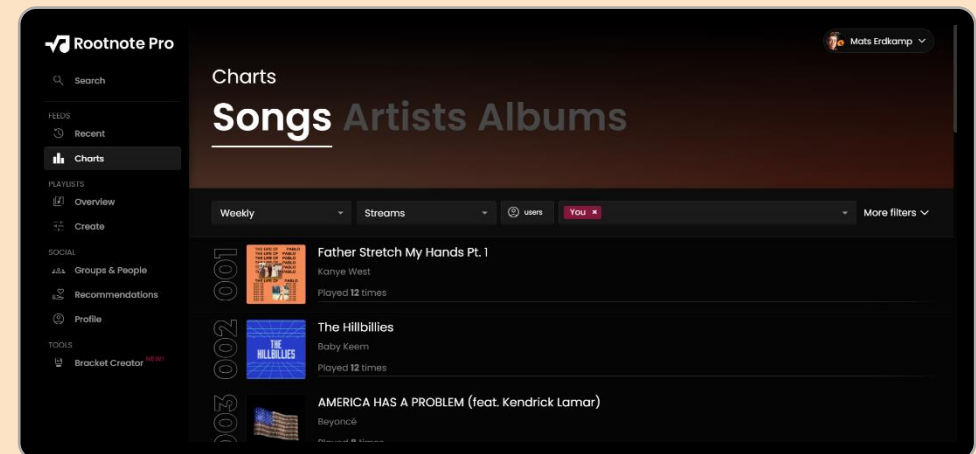
My music-oriented design journey started out of a personal need. Being the assigned 'DJ' of my friend group, I got exhausted of constantly having to figure out what everybody likes to listen. This led to the birth of what would eventually become rootnote.io. I created a website that stores my friends' streams, and automatically generates a playlist with the most streamed songs that week. It did not take long before its shortcoming became apparent. One of my friends sleeps with opera music playing as a sort of white noise. One day, the entire playlist was flooded with Luciano Pavarotti and Andrea Bocelli. I became obsessed with figuring out how to fix this issue.

Once it this was fixed, the shared playlist immediately saw a lot of use during our 'chill sessions.' One thing I did not anticipate, however, is the role the playlist would have in our social interactions. The number one song in this playlist became a coveted position.

What started out as a simple shared playlist, a tool for us to enjoy music together, became a complex, unspoken language of our group. It was a way for us to share our individual tastes, discuss, debate, and bond over the thing we all loved - music. Ever since I have been focused on making this experience even better, and accessible to more people.



Rootnote has changed quite significantly over the last 3 years.



Looking at academic achievements, it becomes clear that I have been thinking about social systems around music quite extensively. The appendices of the main report highlight some of these explorations in text. While these were some of the major projects, I believe that the actual count for music-interaction based project is seven. Some of them are highlighted on the next two pages. With all these projects under my belt, I feel that I am the perfect candidate to do this Final Master Project. With my track record, it would probably be harder to argue for a Final Master Project that does *not* involve music interactions in some way.

I like to design...



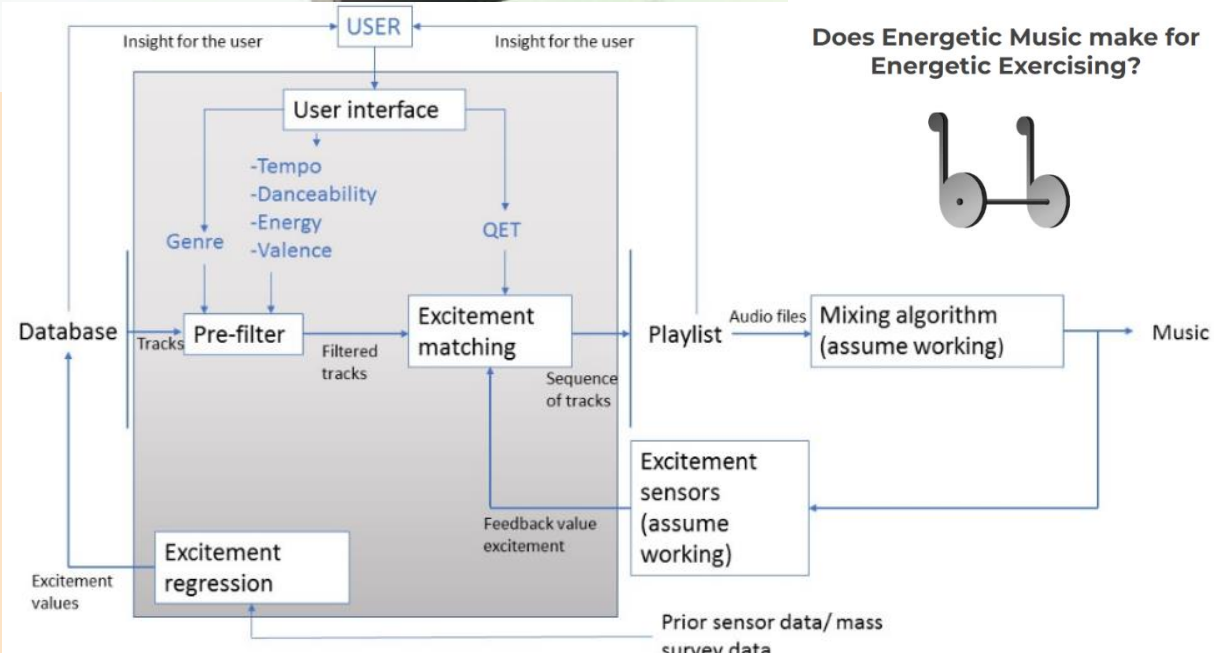
...and research music players

BREAKMAN

HEART RATE ASSISTED MUSIC CONTROL

MATS ERDKAMP - 1342665

01-28-2020



The Choice: Software or Hardware

The Preparation FMP project explored the 'ultimate' version of my vision on shared music listening. While I was busy developing the prototype, I also scaled my website, Rootnote.io to 230 users as of now. This online platform is in line with my vision, but it is a bit more dialed back as compared to the hardware exploration.

The software route would mainly focus on extending the user base of Rootnote. The next section will briefly describe some of the functionalities of Rootnote, and highlight its current use cases. It is a 'safer' bet than the hardware, since it has already found some commercial footing, as well as the operating costs being much lower.

The hardware route would entail the commercial exploration of the Dynamix prototype. The details of how this would be done can be found within the preliminary planning. The hardware route is high risk, high reward. It is also a more natural progression of the current semester.

Currently, I am leaning towards the development of the hardware, since the feedback has been so positive, and since the unique circumstances of being a student could be of great assistance in helping me achieve my vision. For the software, I think I could do this quite well without guidance from the university. That being said, the final call between the two will be made in the first weeks of the next semester. This is discussed in further detail within the preliminary planning section of the proposal.

Software: Rootnote

The Dynamix prototype was built on top of existing infrastructure used within Rootnote; but what is Rootnote exactly? Rootnote is a web application that allows users to track their streaming habits. More importantly, it allows users to gain insight into listening behavior from groups as well. You can see the 'hot' songs amongst you and your friends, and easily create an automatically updating playlist based upon those songs. Rootnote is not limited to friend groups but can also be used by larger communities. One example might be a music reviewer whose fans have a strong cohesion in

musical preference. It allows communities to peak into their collective musical hivemind.

Additionally, Rootnote provides users with tools to post these insights to various social media platforms. Reducing the friction of creating such posts. What now takes hours of curation, could be reduced to minutes because of the data-driven tools Rootnote creates. One example of this would be the bracket creator. Music communities love to vote on which song they like best. Partially because competition is fun, and because it creates an opportunity to do what they love most – discuss music.

The Rootnote page for Lucid TU/e. It shows the most compatible songs, artists, and albums for its members.

Rootnote Pro

Search

FEEDS

- Recent
- Charts

PLAYLISTS

- Overview
- Create

SOCIAL

- Groups & People
- Recommendations
- Profile

TOOLS

- Bracket Creator **NEW!**

GROUP

Lucid TU/e

MatsErdkamp

Leave group

Overview Playlists Members

Favorite Songs

Song	Compatibility	Rank
Kody Blu 31	19.99%	1
Sprinter	18.51%	2
Small Worlds	17.90%	3
What's the Use?	17.90%	4
The Hillbillies		5

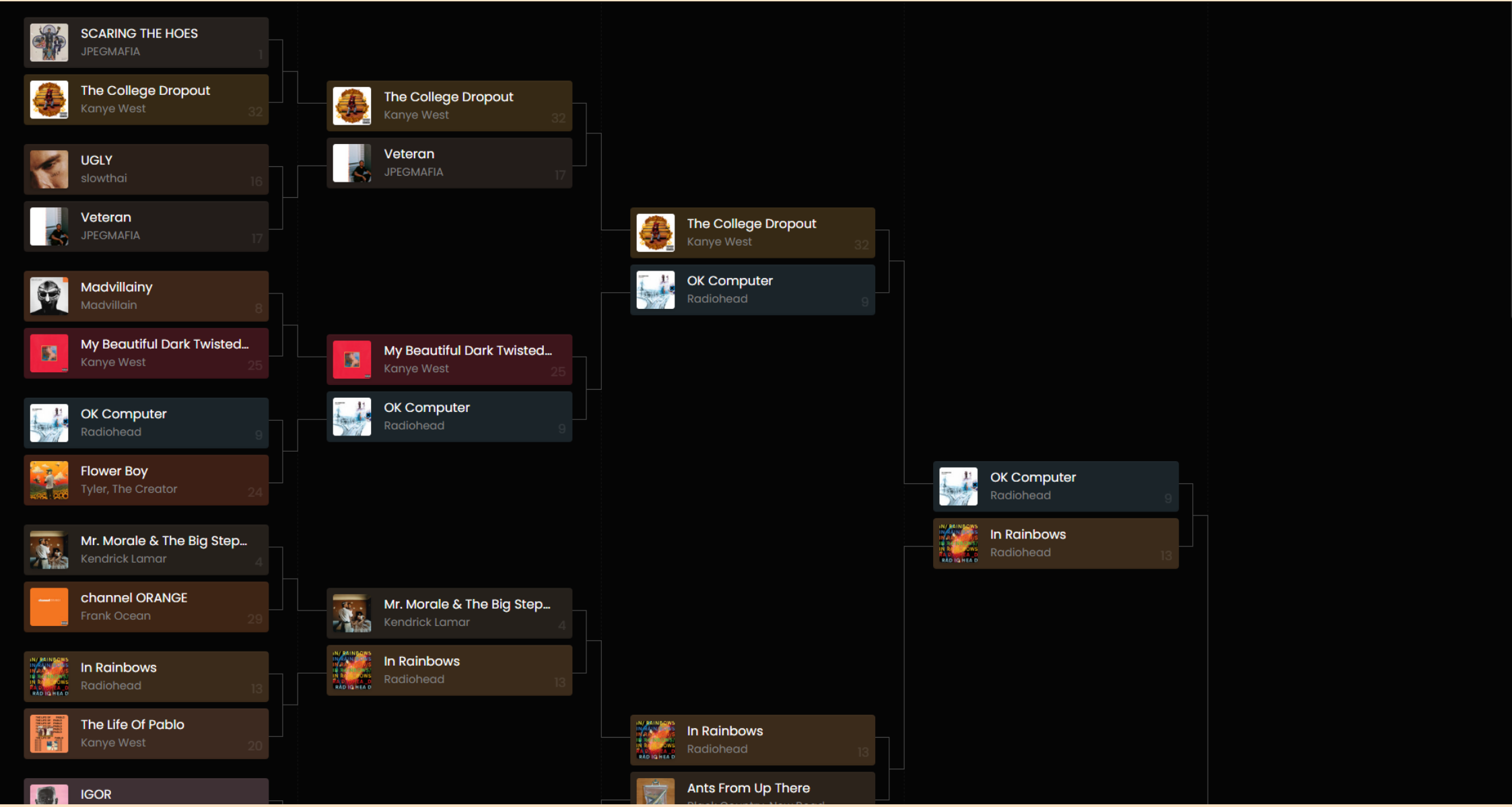
Favorite Artists

Artist	Compatibility	Rank
Mac Miller	40.07%	1
Kendrick Lamar	31.09%	2
Frank Ocean	26.46%	3
Kanye West	25.06%	4
Tyler, The Creator		5

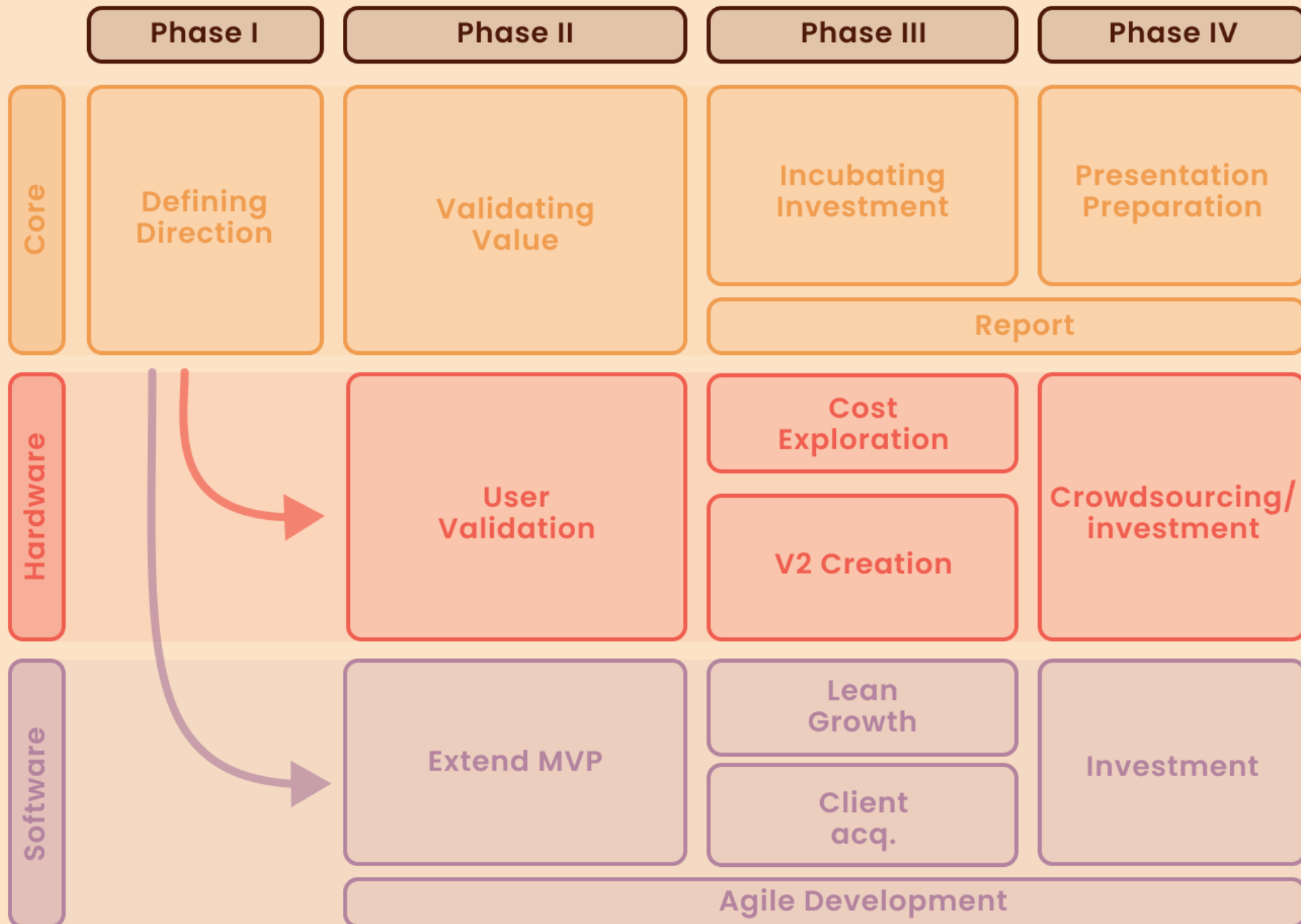
Favorite Albums

Album	Compatibility	Rank
Swimming	28.35%	1
Blonde	22.75%	2
Mr. Morale & The Big Steppers	21.41%	3
KAYTRAMINÉ	20.75%	4
Circles		5

Example of the tournament bracket creation tool. Within three clicks, you can play a game with your communities' favorite albums. This used to take hours to make, and would not be data-driven, but curated by someone. This tool was made this semester and has been successfully tried with the members of a subreddit.



Preliminary Planning



Preliminary Planning

Phase 0

Develop Rootnote (Summer)

While Rootnote is online now and used by 230 users, there are some key infrastructure changes that need to happen. These tasks can be found in appendix A. I will hopefully have most of these done over the summer. These infrastructure changes need to happen and would cost too much time to perform during the Final Master Project itself. By getting them out of the way, more time will be available for the business development.

Phase I (3 weeks)

Defining Direction

With the Rootnote MVP being further developed over the summer, the basis has been created to which we compare the hardware option (the Dynamix project).

During these first weeks of the project, I will apply various business tools. Examples include but are not limited to:

- SWOT
- PESTLE Analysis
- Cost-Benefit Analysis
- Decision Matrix
- Competitor Research
- Business Model Canvas
- Value Proposition Canvas
- Stakeholder Onion
- User Interviews
- Questionnaires

Furthermore, since there is interest from **Sjoerd** to be a co-founder and **Victor** to be an advisor to the company, I will make sure to listen to their input.

Based upon all these factors, a choice will be made between software and hardware. This decision marks the end of Phase I



Phase II (5 weeks)

Validating Value

This phase mainly consists of validation of the value proposition. Various user testing tools will be used. This includes but is not limited to:

- Field Deployment
- Focus Groups
- Usability Testing
- Questionnaires

[Hardware] User Validation + Redesign

I will use the feedback to iteratively redesign the current design, if needed. Through these redesigns, we aim to get an idea of the current prototype's perceived shortcomings, before designing V2.

[Software] Extend MVP

If this project goes down a software-oriented route, I will spend some of the time this phase implementing the feedback from the user tests. The idea being that we add some features that are seen as crucial in the eyes of the users before making the 'commercial push' within the next phase.

Phase III (4 weeks)

Incubating Investment

Within this phase, I will try to get the concept ready for investment. Firstly, this means that we will need to figure out how to possibly *get* investment. Secondly, it means doing some key research into the feasibility of the product. A business plan will be created to explain the value proposition to potential investors.

[Hardware] Cost Exploration + V2 Creation

It is hard to sell a product without knowing what it costs. That is why I will try to get an estimate of the manufacturing costs. Since my knowledge of manufacturing processes is limited, I will try to get some experts involved within this step of the process (see Stakeholders & Experts). Some of the costs that would be explored within this phase include:

- Direct Labor Costs
- Bill of Materials
- Manufacturing Overhead Costs
- Quality Control Costs
- Costs of Goods Sold (COGS)

During this phase, a V2 of the prototype might also be created, to incorporate some of the crucial feedback gathered in the last phase.

[Software] Lean Growth & Client Acquisition

Within this phase, we will try to scale the user base by actively promoting the product. More crucially than sign-ups, this phase

focuses on improving the actionable metrics (appendix C). These actionable metrics will be constructed at the start of this phase.

To gain insight into usage, the following tools might be used:

- A/B Testing
- Software Heatmaps
- First Click Testing

Through these metrics, we can estimate what changes need to be made to stimulate lean growth.

Additionally, to extending the user base, I will try to get business clients to partner with. Examples of these clients can be found in Appendix B.

Report

To leave plenty of time to update the final report, I will start working on it within this phase. This additionally allows usage of some of the created graphics/assets in the eventual investment pitches (Phase IV)

Phase IV (4 weeks)

Presentation Preparation

In this phase, the focus will be preparing the presentations, this includes the FMP final assessment presentation, the demo day, and the investment moments.

[Hardware] Crowdsourcing/Investment

For the hardware, it might make sense to work towards a crowdfunding launch. A platform such as Kickstarter could be used to get a sense of public interest. If this is the case, we would need to create the necessary assets for this. This would include the creation of the page itself, and a video shot in a more commercial-esque style. Alternatively, we could seek 'traditional' investment through a seed round. This would be similar to what is described in the section below.

[Software] Investment

Software does not do well on Kickstarter. It therefore makes more sense to focus on private investment in this case. This phase would focus on doing everything that still needs to be done for a successful investment pitch.

(Potential) Stakeholders & Experts

Throughout the master's program, I have come into contact with a few notable people and instances who can play a pivotal role in the success of the project. The following section will shortly summarize these people and instances and their relevant expertise.

- **Bart Hengeveld:** My mentor, Creativity & Aesthetics expert, knowledgeable about music.
- **Kristina Andersen:** Second assessor and knowledgeable about music (recommender systems).
- **Berry Eggen:** Interaction expert and knowledgeable about music (recommender systems)
- **Victor Donker:** ID alumnus and Founder of Usono. Victor is interested in helping me launch Rootnote.
- **Sjoerd van de Goor:** Demo Day visitor, potential co-founder. Knowledgeable about Computer Science and business development.
- **The Gate:** Startup incubator. Knowledgeable about legal stuff.
- **Edgars Treimanis:** ID alumnus, friend, currently in the process of launching his own company.

With educational support as well as commercial expertise, I will have adequate support on both the Creativity and Aesthetics side as well as the Design Leadership and Entrepreneurship side.

To further explore the commercial side, I plan to contact some companies with this concept. This includes but is not limited to:

- **Spotify:** Music streaming service.
- **Sonos:** Speaker (and software) company
- **Bang & Olufsen:** Speaker (and software) company
- **Syng:** Speaker (and software) company

While I do not personally have direct contacts at any of these companies, I will try to utilize my network to find them. If this is not possible, a 'cold call' will have to suffice.

Who Else?

While these experts can surely help me within their area of expertise, there are some experts missing as of right now. Ideally, I would find an expert electrical engineer and mechanical engineer to support me during this project. These experts can be of immense help to design future prototypes, as well as help me estimate and reduce manufacturing costs.

Conclusion

In conclusion, this proposal outlines my intention to further explore the social and interactive aspects of music through a Final Master Project at the Eindhoven University of Technology. Through my journey with Rootnote.io and the Dynamix preparation project, I have seen firsthand the potential of enhancing our collective experience of music, an area I believe current music platforms and services lack in.

As I prepare for the Final Master Project, I'm faced with a critical decision: software or hardware. Both avenues hold immense potential. The software approach would involve extending the user base of Rootnote, leveraging on its existing commercial traction and lower operating costs. The hardware approach would delve into the commercial exploration of the Dynamix prototype, a riskier but potentially higher reward route.

Throughout the project, validation and business development will be at the forefront of my focus, with an ultimate goal of reaching an investment moment, serving as the ultimate test of commercial feasibility.

Whether the focus will be on software or hardware will be decided in the first few weeks of the next semester. Regardless, both paths provide an exciting opportunity to create a meaningful contribution to the field of music interactions, and I am eagerly looking forward to embarking on this journey.

Appendices

Appendix A: Summer Tasks Rootnote (as of now)

Far Future8... +

caches for a group can be done in order to reduce database load (all-time → yearly → quarterly etc.)

make the cron job adaptive to amount of users.

redo URLs to be (close to) constant

implement custom keep alive cache strategy once its implemented in vue3

way we handle is user admin on playlist is kinda ugly

fix the try except pass block in api/albums

make the artist leaderboard cached for as long no one streams them

when a song gets streamed from that album, check if the name still matches. if not, put it on a schedule to be cleaned up

Bugs5

Name is not displayed on current song when no master container

create master child song for song containers that do not have one (could be done on click)

add redirect after pressing logout

distribution chart has zero width for text when no albums and only singles (Acid ft. joost)

Leaderboard overscroll behavior is broken

+ New

Feature7

add option to make someone admin

update leaderboard to api/v2 (allow to focus on friends)

bring stream history chart back

use inject to pass down api_base_url

fix non-explicit versions being put into playlists

add primary colors to groups

instant accept all follow requests when going public

+ New

Doing4

make a second user on local

add redo artist containers button to debug page

music controller artist link broken

aggregated function actually gives wrong output (not compatibility)

+ New

Appendix B: Potential Revenue Streams for Rootnote

I have been exploring various revenue stream options for Rootnote over the course of the semester. This appendix will give a brief overview the possible monetization strategies.

Freemium

Currently, the Rootnote platform is set up as a freemium experience. Users can use the website for free, with certain features being locked behind a paywall. Free-tier users get shown ads to generate revenue. This business model is quite popular for a lot of web services and allows for 'viral growth' due to network effects, while also monetizing the 'power users'.

The main concern here would be the ratio of free-tier users to paying users. If this business model were to be explored further, **lean methodology** will be used to increase the share of paying users.

Business-2-Business

Rootnote has a focus on creating the tooling for music communities. The 'leaders' of these music communities might be more willing to pay a premium as compared to a standard user. The hypothesis being that they would see the Rootnote service as an added value to their brand. Take, for example, a YouTube channel for a music reviewer. This YouTube channel could strongly benefit from the services that Rootnote provides. Subscription would therefore be

more of a business expense than a personal one. This could result in willingness to pay higher prices.

The amount of 'music communities' would need to be verified to gain insight into the potential market. Additionally, it is important to consider which fraction of communities turns a profit. A few examples of profitable communities.

- RapTV: an Instagram page that posts rap news.
- TheNeedleDrop: A YouTube music reviewer.

While these communities operate as businesses, there are plenty that do not:

- r/HipHopHeads: A Reddit page for hiphop fans
- 'Music Twitter': A bunch of music related accounts that discuss with each other about music.

While this second group might also be interested in the services, they themselves are not profitable. They do it out of a passion for discussing music. These communities are leaderless. In other words, no one is in charge. This might reduce their potential willingness to pay a premium. Perhaps a 'crowdsourcing' option could be used for these communities (like Discord Server Boosts¹)

¹ <https://support.discord.com/hc/en-us/articles/360028038352-Server-Boosting-FAQ->

Music Label Collaboration

Looking at the music distribution side of things, it might be interesting to look at labels and artists as potential clients. In this case, the Rootnote platform would allow labels to push their music to users' generated playlists as sponsored content (which you could get rid of by getting a premium subscription).

The labels could greatly benefit from this targeted advertising. Imagine the following scenario: a label has a new artist signed that they would like to commercially push. In their view, there should be strong overlap between this new artist and 'Black Country, New Road' fans. Within this business model, they could use Rootnote to find the music communities that listen to 'Black Country, New Road', and push the music of their new signee to them specifically. This form of targeted advertising can be extremely powerful.

When implemented correctly, it could even be beneficial to the consumers since they will be put into contact with new artists that they would possibly enjoy.

While this would be an incredibly potent business model, it requires Rootnote to achieve a certain 'critical mass' before this would become feasible.

Appendix C: Lean Methodology

During the preparation FMP, I spent some of my time reading various business books. One book that really struck me as incredibly useful is 'The Lean Startup' by Eric Ries. While this book is filled with knowledge, the most important part to me was the objection to vanity metrics. Vanity metrics are surface-level metrics that often look impressive on the outside but offer no deep, actionable insight or predictive capability about the business' performance or future. Examples of vanity metrics may include the total number of downloads, page views, or registered users. At first glance, these numbers may seem impressive and suggest that the business is doing well. However, they do not necessarily translate into a successful business model.

For example, a mobile app could have thousands of downloads, but a majority of users might use the app once and never again. In this case, a high download number is a vanity metric because it does not reflect the actual active user base or engagement level. A more actionable metric, in this case, could be daily active users or user retention rate, which give a more accurate picture of the app's performance.

Ries urges startups to focus on actionable metrics instead, which are more closely tied to the fundamental drivers of a business. These are indicators that demonstrate the effect of specific changes or strategies, provide useful feedback, and inform future actions.

