

# ASSIGNMENT M2

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**Abstract**—This series of qualitative and quantitative studies will cover different stages of interface understanding, design, and evaluation for a mood-reading music player which has its controls governed by an app on a phone. The music player is meant for a playroom at home or at a school where children spend significant amount of time. Music has a long-standing effect on children's cognitive and emotional capacities; this device will be responsible for deciding what to play and when with a desired ambience/accomplishment as a goal. The music auto-playing system has two components – the environment-reading music device and the phone app which controls this device. We will be studying the interaction of the user (the educator/parent/guardian) with the app's control panel given fixed assumptions on the manner in which the settings will regulate the environment-reading device's input and output.

## NEED FINDING OVERVIEW

### 1. Need-Finding Results I – Participant Observations

I took a retrospective view of childhood, and used my music and psychology knowledge to execute this. Summarized analysis -

- a. Different personalities of children –
  1. Introvert and practical self-gain maximization
  2. Introvert and self-gain maximization in certain situations or to a certain extent, and risks giving with no returns
  3. Introvert and often risks giving others at cost of losing
  4. Extrovert and self-gain maximization
  5. Extrovert and self-gain maximization in certain situations or to a certain extent, and risks giving with no returns
  6. Extrovert and often risks giving others at cost of losing

There is a reason I have picked this mentality – this base mentality is not good or bad in any way but simply related to what a child might've experienced and how they learn. All of them have logic

behind it – but the reason I chose this level of fundamentality is because these mentalities result invariably in certain occurrences in their life – many of which they will arrive afterwards back to their playroom and have that on their minds – music played should be able to enhance positive feelings and stimulate introspection on possible negative feelings.

- b. Different situations of children –
  - 1. Related to child...
    - a. Physical capacity – Impaired, normal, above-average, prodigal
    - b. Mental capacity – Impaired, normal, above-average, prodigal
    - c. Emotional capacity – Struggling with day-to-day emotional functioning, comparatively free of pain but self-focused, extending happiness, living to uplift lives
  - 2. Related to child's environment (out of guardian's control)
    - a. Physical effect – safe, uncomfortable at times, rough
    - b. Monetary effect – middle, upper-middle, wealthy
    - c. Emotional effect – nurturing, indifferent, demeaning
- c. As per plan, we also have different age-groups of children, for which we will summarize cognitive and emotional goals based on scenarios in point (a) and (b) –
  - i. Age 5 to 8  
For those facing physical and emotional struggles, the goal would be to bring them to a calm state of mind, refresh the mind for the next try. For those who are cognitively impaired, bring their mind to a meditative state, if they enjoy music, play different intricacies they can pay attention to a get lost in. This may also be included for the environments that cannot provide enough to children at school or home.
  - ii. Age 9 to 12

This would resemble the goals from age 3 to 5 but with some additions since children are becoming more aware. Physical and emotional struggles are often augmented with songs that give a sense of hope to offset the despair children feel. For the cognitively impaired, why meditative, and expressive music also works, there needs to be control over when this played so as to keep the child from being distracted by the former or becoming bored of the latter.

iii. Age 13 to 15

In this age range, we bring over the goals from age 9 to 12. Those who face environmental troubles are enriched through a wider sense of music, information on music, meaning behind music. Those who are on the cognitively sounder side, may not prefer music for studies or then again might want something specific playing that helps them focus better, this too is one of the goals.

Based on this, we have some goals that parents and guardians would be interested in tackling.

The **bias avoidance for personality planning comes under an interview** with a psychologist. The **bias avoidance for goals in the playroom are covered under surveys**. And finally, the **bias avoidance for the aspects of music relevant to these goals are covered by this domain research** of the following papers followed by their findings –

- a. From the paper on Interactive Music Infilling Interface<sup>[1]</sup>, it was determined, that the users should be provided with following levels of control - track density, polyphony, occupation rate, bar tonal tension, melody/bass/harmony.
- b. From the paper on Analyzing Children's Music Listening Behavior<sup>[2]</sup>, two points are established through quantitative studies, one that music tastes of children aged 6 to 17 are highly complex, and next, there was a general theme where, as children

get older, they move from a lighter to darker theme of music (with a small exception group), which is hypothesized to be due to the introduction to negative feelings later on in life.

- c. The user interface study for such an app from the paper on Music Creation by Example<sup>[3]</sup> introduced the use of example inputs, where a song/tune is given as input, and a generation is modeled on it, and if there exists a custom panel for users, the most important music aspects were found to be – tempo, volume, instrument, multitrack, octave, cycle and one which isn't on our list – the specification of defining moments (crescendo's, base drops, patriots, and such mini-masterpieces).

## 2. Need-Finding Results II – Surveys

To begin with – 17 *parents/guardians strongly agree* that music during childhood has effect on cognitive and emotional development. 11 *parents/guardians agree* (non-vehemently), and 4 *are neutral*.

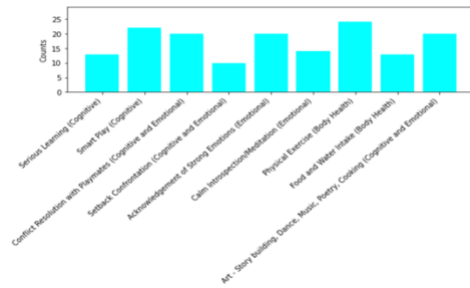


Figure 1 -Belief in Efficacy

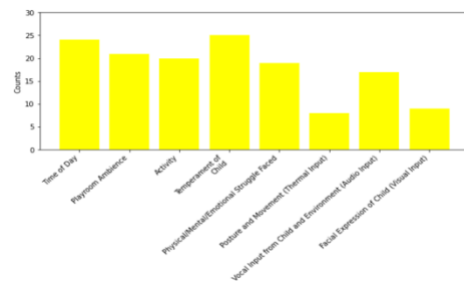


Figure 2 -Aspects

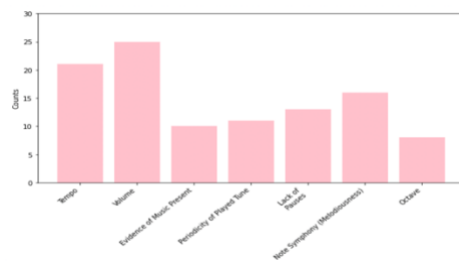


Figure 3 -Music Controls

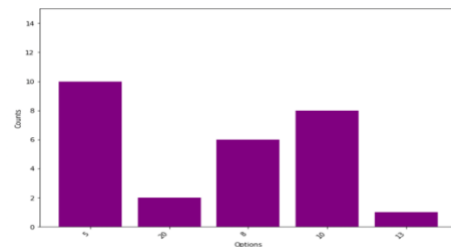


Figure 4 - Number of Controls

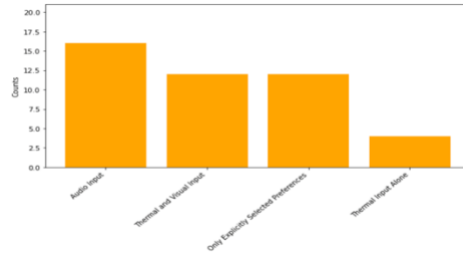


Figure 5 – Input Mode

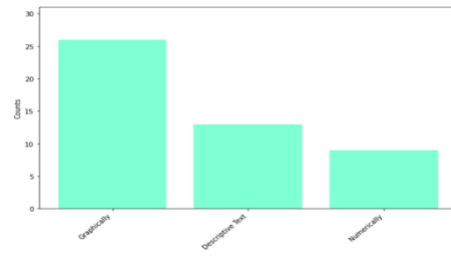


Figure 6 – Output Mode

Summarizing the information for this –

- a. When it comes to **playroom goals**, there seems to be a pretty even distribution across different cognitive, emotional, and physical goals. Physical goals seem to be the maximum – and we may explore that further. **As a takeaway, all options qualify for the app controls** and will be included.
- b. Regarding the **parameters that help generate tunes** – the first five that do not take in audio or visual/thermal information are highly favored – the rest that take in such information are favored by some and not all – **hence this part shall be optional to select from.**
- c. The **input controls graph** has a **non-zero set of guardians who would only prefer explicit preferences** – this supports (b) where explicit preferences are default, and other information is set to what the guardian and child are comfortable with. **However, audio is preferred very much, and I will leave some notes on why audio (as a minimum) might be quite beneficial.**
- d. **Output depiction of what music is generated and if observed, how the child is responding, is graphically preferred** – and there might be an autogenerated summary for more complex graphs. Numeric results would only be used for singular major count-based results.
- e. **Tempo and volume were perceived as having maximum influence** over the child; however, **all controls will be presented** – this graph's analysis is **overridden by domain expertise**. Each control will have a minimum to maximum

control – **minimum is not minimum in value, but minimum in variance (meaning no change over the tune)**. This part will be a little hard to explain to users.

- f. While 5-step control is a majority preference, I will be going for two categories of control – Default and Advanced – **Default will have 8 controls, Advanced will have 20**. I’m doing this at the risk of some people finding this a lot – but a child’s experience is important.

**Handling biases** at this stage will be tackled by these open-answer questions –

Q: What other aspects regarding personalizing the experience would you add to existing choices?

A: Requested was a summary for a user on how different music impacts children, support of open-text feedback on music generation, display of ratings of past successful tunes to reinforce them, support to select genre and mood, no sharing of data (local ML) with deletion options, music for hand-eye coordination and spatial awareness learning.

Q: What other privacy aspects or vetoes would you be interested in?

A: Most of these answers leaned towards vetting audio compliance, not storing identity information such as iris pattern (all of this is at user’s choice anyway), no central server learning.

### 3. Need-Finding Results III - Interviews

I conducted four interviews. In each interview we covered personalization and privacy as related to that domain expert or user. Summary -

- 1) **Parent 1** – The emphasis was on how music supports and enhances a child’s already existent state of living, and there was a focus on how instruments matter. This parent chose explicit preferences, no exposure of child observation to device, and preferred the simplest UI.
- 2) **Parent 2** – Being an aficionado and very meticulous in personality, this parent was comfortable exposing audio and thermal information, believes that music can also have a direct development and not just support for the mind. This parent also chose an advanced panel version to be able to really make a memorable experience.

- 3) **Child Psychologist** – We’re debiasing the personality points from the participant mode need-finding stage. The discussion revealed that those who are introverts and take the risk of giving without return (while suffer from ways of life) benefit from the fineness and sweetness of music. Extroverts who are like this don’t introspect as much but also enjoy lighter and more common tunes to introspect. With extroverts who put their needs over everything, often run into a different kind of pain of being alone while still surrounded, and introverts who are self-centered do not get the chance to realize they can be more outgoing and happier – it is for these last two, music with words would have maximum effect. However, that will not be in our scope.
- 4) **Sound Production Specialist** – In this interview, we deduced sets of notes, tempo, volume, and cycle that can be offered as default settings for bittersweet, study-mode, dance, focused-play, hopeful, in anticipation, in retrospection, normalizing, for exercising, and meditative.

## DATA INVENTORY

1. **Who and where are the users** – Parents, educators, and guardians within regions that listen to western music and who have the time and money this. The users are at their homes or schools when they operate this.
2. **Context of the task** –  
The context of the task is the child performing some activity or going through a personal emotional, physical, or cognitive journey while listening to music consciously or subconsciously.
3. **Goals** – Customize music based on child’s innate personality, provide music in a supporting and enhancing manner, protect child from data exposure while still bring a good experience, evaluate music and child response results (*inferred from surveys and interviews*).
4. **Needs – Covered in requirements section (to save space here).**
5. **Tasks and Subtasks (*from surveys and participant need-finding*)** –
  - a. Navigating and Understanding the App and its Effect
    - i. Reading in a few sentences – the effect of music on children, what each default aspect means, when to move to advanced settings, and understand data retention policy.
  - b. Setting Default Preferences
    - i. Personalization – Input reference songs, describe moods, child personality and age, decision aspects.
    - ii. Privacy – Only explicit preferences set, recommend audio.

- c. Setting Advanced Preferences
  - i. Navigation over tempo, volume, octave, cycle, notes over a panel from bias to variance.
  - ii. Describing conditional information intake.
- d. Evaluating Results
  - i. Provision of graphs and how to read them.
  - ii. Textual summaries with few numeric results explained.

## DEFINING REQUIREMENTS

1. **Functionality** – The basic north star is that if anyone voted or significantly spoke about one aspect, music control, privacy/UI setting, then that will be available – whether on default or advanced, that will depend on difficulty in learning and how required it is.
2. **Learnability** – This is directly relevant to two things – the UI and the default and advanced demarcation. The UI will fulfil guiding intuitive navigation over the sections, the advanced settings ought to have extra text-based instructions, perhaps even demos. The default settings UI must be clean and easy to visualize and intuit from. They must also have necessary coverage of controls. The same may be described for output visuals.
3. **Metrics** – The metrics by which I would evaluate would be the use of each control by the targeted sub-groups of users, the positive/critical feedback from users, and the improvement that output visuals show.
4. **Priority of Requirements** – I would prioritize data privacy over all of these, then perhaps trade-off between learnability and functionality.

## CONTINUED NEED-FINDING

These need-finding exercises handled the distributions per feature – such as input and output modes of information, decision aspects, music controls, and control complexity. In further need-finding, we will assess –

1. Exact default settings to offer per personality per age per circumstance.
2. The relation of contextual selections on survey, if they exist.



## REFERENCES

1. An interactive music infilling interface for pop music composition by Rui Guo - <https://arxiv.org/abs/2203.12736v1>
2. Lawrence Spear, Ashlee Milton, Garrett Allen, Amifa Raj, Michael Green, Michael D Ekstrand, and Maria Soledad Pera. 2021. Baby Shark to Barracuda: Analyzing Children's Music Listening Behavior. In *Fifteenth ACM Conference on Recommender Systems (RecSys '21)*, September 27-October 1, 2021, Amsterdam, Netherlands. ACM, New York, NY, USA, 6 pages - <https://doi.org/10.1145/3460231.3478856>
3. Emma Frid, Celso Gomes, and Zeyu Jin. 2020. Music Creation by Example. In *CHI Conference on Human Factors in Computing Systems (CHI '20)*, April 25–30, 2020, Honolulu, HI, USA. ACM, New York, NY, USA 14 Pages. <https://doi.org/10.1145/3313831.3376514>
4. Special thanks to all survey participants at Georgia Institute of Technology and on LinkedIn, to Varsha Prabhakaran for her expertise on developmental psychology, to the parents who took time for the interviews, and Shanthi Sakthivel, a sound production specialist for western films.