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Synth

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Abstract

Music is a powerful tool for identity expression and social bonding, yet most streaming platforms frame listening as a solitary or passive experience. In this paper, we introduce Synth, a multiplayer music guessing game designed to foster socially grounded music discovery among friends. Drawing on a generative study of young adult listeners, we identified key themes around gamification, identity, and peer-based exploration that informed the design of our system. Synth integrates with Spotify to transform recently listened-to tracks into rounds of social gameplay where users guess which friend played each song. Through a multi-week field deployment with 27 participants, we collected quantitative and qualitative data to evaluate engagement, social impact, and design challenges. Our findings show that Synth facilitated music-based connection and playful identity discovery but revealed friction around retention, repetition, and song saving. We contribute design insights for music-based social systems, highlight new approaches to gamified music sharing, and extend HCI conversations around music, play, and social computing.

1 Introduction

In a world full of streaming music and algorithmic recommendations, the social and emotional aspects of music sharing tends to go unnoticed. But for many young adults, music is a important way to express identity, sustain and develop friendships, and to explore new sounds together. While platforms like Spotify and Last.fm offer vast catalogs and some degree of sharing, they tend to frame music consumption as a solitary or broadcast-like experience, missing the more intimate, relational potential of music exchange. To bridge this gap, we conducted a generative diary study and interviews to better understand the affective and social drivers of music sharing among young adults.

From our four central questions about gamification, cross-user exploration, group identity in music, and motivations for sharing. These findings led to the design of Synth, a music sharing game that integrates Spotify to gather players' "recently listened" tracks and turns them into the basis for social game play. We then deployed Synth to multiple people (27 people) over a few weeks of testing using field studies and logging data to assess usage patterns, qualitative reactions, and opportunities for refinement. We manage to contribute to the broader HCI and social computing discourse in three ways:

(1) We uncover more about how identity, social bonding, and meaningful gamification levers interact in small groups. We extend previous works that treat music sharing as broadcast or crowdsourced recommendation.
(2) We introduce Synth a multiplayer and solo music game that allow users to discover music via their friends' choices.
(3) Our findings showed that the game helped deepen social ties between friends, while also revealing key design challenges like asynchronous play needs, song repetitions, adjusting game lengths, and improving song saving.

From early explorations of the music-sharing ecosystem to generative inquiry and system deployment, this paper brings together user research and design to propose a more socially grounded, emotionally meaningful path forward for music discovery.

2 Related Works

Existing research and products in music discovery and sharing reveal key insights into how social interaction, gamification, and identity shape user engagement. This section reviews both academic literature and current apps to highlight what we learned, how those insights informed our design, and why open questions remained that motivated our generative study.

2.1 Social Dynamics in Music Sharing

Wang et al.'s [6] findings helped focus our research on exploring social features to dedicated music sharing content rather than general content because dedicated platforms foster more relevant and supportive engagement. Ubaldi et al. [1] developed empirical methods for identifying how our social network of acquaintances influences our discovery of new musical content. These methods found that a user's social neighborhood significantly affects their listening behaviors. Last.fm, a longstanding platform that tracks users' listening habits across various services, uses these principles in their app to create visually engaging, real-time, shareable stats for a mobile-first

audience. These works highlight the power and complexity of social environments in shaping engagement and discovery.

2.2 Gamification for Engagement and Exploration

Hook versus Hope [2] works to outline several key gamification principles that maximize user engagement and retention, including rewards, social interaction, progress tracking, and encouraging prompts. These gamification features give users a sense of control, growth, and discovery to the user. Gamispotify [3] is the first academic research to explore using interactive methods like gamification, social networking, and crowdsourcing for music recommendation. Researchers found user engagement and satisfaction to be higher on Gamispotify than its counterpart. These results display the potential for personalized recommendation, gamification, and crowdsourcing to positively affect music streaming applications' user engagement and enjoyment. The researchers acknowledge that gamified systems can easily become shallow and even work to drive users away; this is a fine line. Discz is a music discovery and sharing app that allows users to connect around music and culture, find communities, and build customizable spaces to showcase their interests. The features include: discovering new music by sharing mixes with your friends, AI song recommendations that you can swipe through, and the ability to unlock skins, stickers, badges, & more to customize your player. Both academic papers and apps like Discz confirm that well-designed gamification can promote discovery and stickiness, but only if the rewards feel purposeful.

2.3 Identity, Belonging, and Symbolic Music Use

The study on the symbolic consumption of music [4] used in-depth interviews and diary entries to highlight how music consumption extends beyond a mere auditory experience and serves as a symbolic act that reflects identity, social belonging, and cultural capital. This work further reveals that sometimes participants' music choices reflected a group identity rather than an individual one. We think that this finding could create interesting design implications for a music sharing app. The app Airbuds allows users to spy on what their friends are listening to, react to songs, play music on the app, and start conversations. You can swipe through a feed-style view of all the songs your friends have listened to recently while listening to previews of each song. The 24/7 visibility led to mixed reviews, many wishing they could remain in ghost mode for longer than 24 hours at a time. Music is a medium for constructing and performing identity, individually and socially. The literature underscores music's symbolic role, while Airbuds gesture at identity-building features with mixed success. These insights shaped our interest in shared identity experiences (e.g., group-curated playlists), but no current model fully supports this as a central feature.

2.4 Temporal and Contextual Influence on Discovery

Pálovics and Benczúr's [5] work with temporal song discovery utilizes a dataset represented as a graph network containing 71,000 users (nodes) with 285,241 edges as their starting point. Authors develop a time-aware recommendation algorithm that predicts a user's interest in an artist based on their friends' recent listening history and the past frequency of engagement/influence between two friends. The recommendation algorithm developed in this paper achieved a 4% improvement in recommendation accuracy showing us that the timing and freshness of music activity impact discovery. Real-time sharing can heighten relevance and serendipity, a finding supported by Last.fm's early innovations and echoed in Airbuds' weekly recaps. These findings push us to consider building time-sensitive elements and live updates, but we still lack clarity on the best balance between surprise and predictability.

Each of these systems and studies explored important aspects of music discovery, music sharing, platform engagement, and gamification. However, information was still lacking from the literature on how people want to discover and express identity through music. If we uncover the emotional and social stakes in sharing music, then we can build an app that makes exploration and sharing feel meaningful to different user types. Can we even work to foster group identity formation through music? Furthermore, we want to explore gamification as an approach to authentically sustain engagement from our users. With this background, we set out to design our own study to address these questions and provide inspiration for a new way to discover music socially. Our generative study worked to uncover the potential nuanced user needs and social tensions at play on an app that promotes diversity and meaningfulness of music listening.

3 Motivation

Our generative study focus was on four major research questions:

(1) How can gamification be leveraged to improve music discovery diversity and encourage exploration? How can lower exploratory users be coaxed into interacting with higher exploratory users, in turn, boosting the engagement and exploration of certain users? How can design choices make this a pleasant/negative feature?

(2) What are meaningful and motivational incentives to use when gamifying the exploration of music? What specific combination of these factors can maximize user engagement & satisfaction?

(3) If music consumption can reflect group identity, how can we create an environment that allows the community in the group to thrive?

(4) What are the key levers behind keeping users engaged in sharing content with friends?

These were questions we had from our literature review and we used these questions to drive the diary study and interviews we had. Specifically we wanted young adults ranging from 18-26 and see how they shared and discovered music. We went with a group of freshmen that had a variety of music listening habits. We wanted to find a music listening expert, someone who listens to new music everyday, another who views music as a very personal experience, and someone who is a social listener.

In our diary study, our participants would download the app Airbuds and connect with each other on it. Then they would check the app three times a day at their discretion, and then answer a few questions at the end of each day. They would then send those responses to us, and then at the end of the study they would answer a different set of questions.

Questions for Diary study:

- When you saw the other songs they were listening to, did it spark an interest in that song? Did you listen to it?
- Did you yourself judge any of the music choices you saw your friends listening to?
- Post-study final reflection:
- Did you change your music-listening habits when you knew others were watching at any time?
- Anything else you want to mention?

We also had interviews with other participants and had them answer some questions about their habits. Overall we took quotes from these studies and then organized them into different categories depending on what they said.

4 System Description

Synth is a social music-based game that combines Spotify integration with interactive, multiplayer gameplay to facilitate music discovery and competition with your friends. There are two primary game modes within the Synth app.

4.1 Multiplayer Mode Flow

The first game mode is Multiplayer Mode which allows users to create or join a game over WIFI. After players join, decide on the number of rounds they'd like to play, and start the game, five recently listened to tracks are pulled from each player's Spotify account. These songs are pooled together and then randomly sampled n times to supply the n rounds each with a unique song. Each song is played for 30 seconds and each player has to guess who listened to this song by voting for the corresponding player on the voting screen. If a user wants to see this song in Spotify, they can easily do so by pressing the open in Spotify button located below the album cover. Players who guess correctly are awarded a point, the next song is played, and so on.
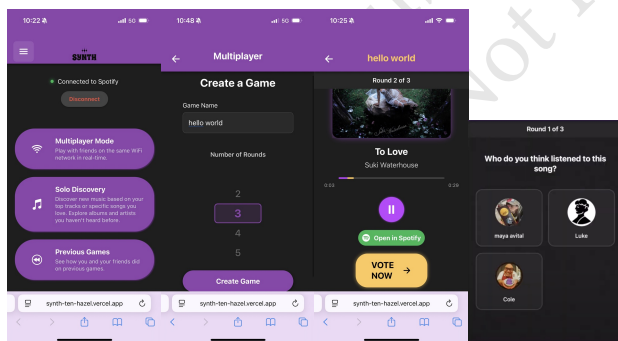

Figure 1: (a) Home (b) Create Game (c) Song View (d) Vote View

4.1.1 Game Summary Screen. After the game, a leaderboard displays the final scores of each player and the overall winner! Below the scoreboard is a summary of the songs played during the game with its corresponding owner listed next to it. To incentivize music discovery, players can revisit old games in previous games.

4.1.2 Previous Games Screen. This screen lists each game you've played in addition to the songs played each round. To the right of each song is a '+' button which when pressed will direct users to that song in Spotify to allow them to easily add it to their library.
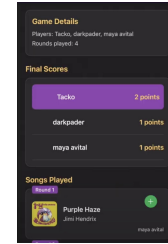

Figure 2: Previous Games

4.2 Solo Discovery Mode

The second game mode is Solo Discovery. Within this mode, you have two methods to discover new music. The first will fetch six tracks similar to three randomly selected songs (seed songs) from your most-played songs. The second option puts more control into the user's hands and allows them to enter up to three songs they like to find additional songs that are similar. Once you click the start discovery button, six songs are selected and then arranged for the player to listen to. Like Previous Games and Multiplayer Mode, an open in Spotify button allows players to add the corresponding song to their playlist or library easily.
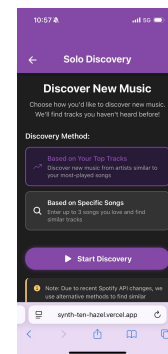

Figure 3: Solo Discovery

4.3 Generative Study & Key Themes

Before building this app, we performed three one-on-one interviews and a three-day diary study where participants used the music-sharing platform Airbuds. After aggregating the feedback we received in our generative study, we established the following key themes:

- People have meaningful reactions to the music that people listen to.
- Sharing music is an important feature in music discovery.
- In-person music sharing adds value and depth to the kinds of interactions that can be had.

- Participants like social games but there's mixed sentiment around other forms of gamification such as badges, streaks, etc.

The above feedback guided our decision to design our app be a social, music-sharing game that people would play in person to facilitate meaningful interactions. As such, we knew that our app needed to have multiplayer capabilities, access to Spotify's API to connect a player's music library with our game, and some kind of database to store and fetch relevant player/game/song data.

4.4 Technical Implementation

Briefly, we will outline the technical implementation of Synth from Spotify authentication to gameplay, to the fetching of previous games. To authenticate a user with Spotify's API, we use the PKCE authorization flow which provides Synth the necessary privileges to fetch profile information, listening history, and general song information from Spotify.

When a player creates a game as the host, 5 of their recently listened to spotify tracks are fetched from spotify and a flag is set identifying them as the host. When other players type in the game code to join, five songs are pulled from their Spotify listening history as well. The songs from each player are combined into a single list where each entry in the list contains the song and the corresponding owner (for attribution purposes in the gameplay). Because Spotify deprecated the previewURL parameter which allowed a 30 second playback of a song, we utilized Deezer's free API to enrich each Spotify song with a 30 second audio snippet that was used in game.

To avoid the complexities of synchronizing audio between devices, only the host's device plays (and controls playback of) the audio. For multiplayer capabilities, we used Express.js with Socket.io for our server-side framework which enabled realtime communication between the server and devices via websockets. This enabled the synchronization between devices but as we discovered in development, this method isn't always reliable so we also created a force-sync mechanism that would check and force the synchronization between devices.

For the storage and persistence of game data, we used firebase's realtime database to store relevant game information such as the players, song data, and votes between rounds and games. We integrated these server-side components into the client-side experience using a react native with socket.io-client framework.

Since this configuration was relatively fragile, we implemented a polling fallback for the websockets and also ensured this system was cross-platform enabled (between IOS, android, and web). The solo discovery mode at a high level uses seed songs to then search through similar artists or similar albums that aren't in a player's Spotify library to deliver them similar but new songs. Seed songs are either pulled from a user's most listened to tracks parameter or a user can manually input up to three songs to seed the discovery algorithm. The app in its entirety is hosted on vercel as a web application.

5 Study Methods

During our project, we had three forms of gathering notes and information. Our first method was an informational interview where we

interviewed three different playtesters. We asked them questions about their experiences using the app. Interview Questions:

- Was there any predictable repetitiveness across the gameplay that you found lame or annoying? Same song or person over and over again etc.
- What aspects of it requiring the players to be together in person did you like or not like? What other formats of the game would you enjoy using ?
- Could you see this working as a single player game done amongst a friend group similar to game pigeon?
- Who is it fun to play this with?
- What is fun about the process?
- Were there any frustrations?
- Anything that stood out to you?

We then had a diary study with the users so after they used the app they would answer a set of questions. It was for 5 days after our play testing series and it was about 4 people who answered questions. And finally we took notes and asked questions during playtesting that would come up in the moment.

Our participants ranged in age from 18 to 26 and were all Stanford students. Many were freshmen, with some seniors, intentionally selected to match the target demographic we identified during our generative research. Freshmen, in particular, were eager to participate, often expressing a desire to meet new people and deepen their social connections. To study how users engaged with our app, we also collected basic usage data, such as which buttons were pressed, how many rounds were played, and how many games each user completed—metrics we believed would help us understand what aspects of the experience sustained user interest.

Our overarching research question focused on whether shared music experiences could strengthen social bonds and support playful identity discovery. More specifically, we wanted to see whether Synth could transform passive music listening into an active, social guessing game that helped users learn more about their friends and discover new music. To analyze our findings, we reviewed responses from interviews, diary studies, and in-play feedback, extracting common themes and user sentiments. These insights helped us identify pain points, evaluate design decisions, and surface promising directions for iteration.

6 Findings

At the beginning of the project, we recognized three key metrics that we wanted to collect data for and focus on during development. We felt that these three metrics were crucial to the longevity of our app once it was deployed to our market and the viability of our app as a music sharing platform.

6.1 Avg Number of Players per Game : 2.97

Since this is a multiplayer experience, we knew that the more users playing each individual game would mean better gameplay as well as increased music sharing. However, we knew that since our design was centered towards in-person gameplay, there would be barriers to finding ways to increase this number. While our qualitative research was done using smaller groups to foster a more intimate connection with the game, multiple users reported that they loved the social engagement aspect of the game. As P5 said,

"I felt like requiring players to be in person together was a great way to encourage you to hang out / spend time with your friends in person and get to know them more"(P5).

6.2 Avg Rounds Played per Game: 4.67

Since this is a multiplayer experience, we knew that the more users playing each individual game would mean better gameplay as well as increased music sharing. However, we knew that since our design was centered towards in-person gameplay, there would be barriers to finding ways to increase this number. While our qualitative research was done using smaller groups to foster a more intimate connection with the game, multiple users reported that they loved the social engagement aspect of the game. As P5 said, "I felt like requiring players to be in person together was a great way to encourage you to hang out / spend time with your friends in person and get to know them more"(P5).

6.3 Song Collisions: 1.2

A song collision is when two players in the same game have the same song pulled from their playlist. We recognized that this could be a potential issue with our randomized song pulling algorithm, so we wanted to keep track of this number during development.If two users have the same songs in the same game, it not only decreases music sharing, but can also lead to confusion over whose song it is and, thus, takes away from gameplay. During our user testing, we had multiple users mention that song collisions were a source of repetitiveness. One user reports that "after playing with the same people for a few times, the same songs tend to come up"(P4) which causes overly repetitive games and frustration. While we were initially only concerned with song collisions within a single game, our qualitative research showed us that a much larger issue was song collisions over multiple games.

6.4 User Funnels

Since our focus was music sharing, we wanted to evaluate how often a user would save a song using our app features. In-app, we have two methods of saving songs: during game play or post gameplay via the previous game view. With our analytics, we saw that 0% of users saved songs during game play. This makes sense because players were too involved in the game to leave / didn't want to interrupt gameplay. In order to save a song with the previous game view, players had to click "Previous Games", find their game within a list of all the games they played, and then click the "Add Song" button next to the song from that game. Using analytics, we captured this funnel:

6.5 Usage Over Time

When evaluating user activity over time, we see that after our playtest on May 26th,27th, and 28th, there was a very harsh decline in user activity. Despite our user test going very well and users saying they enjoyed the experience, none of the testers used the app of their own volition. However, on June 5th and 6th, we see an uptick in user activity. From this, we know that Synth's social feature is a steep barrier to consistent use and will be used sporadically in the users lives.
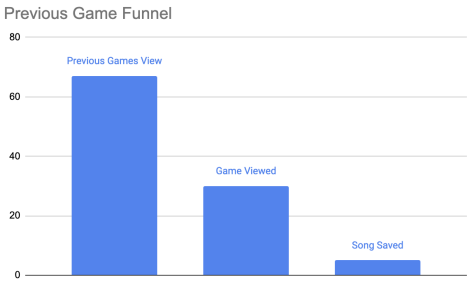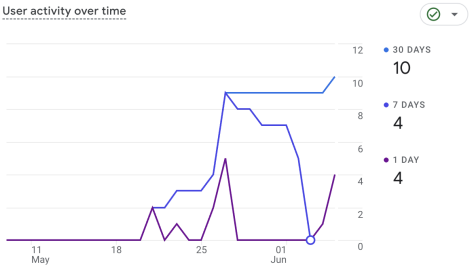

Figure 4: Previous Game Funnel

Figure 5: User Activity Over Time

7 Discussion

Given these findings and themes we are now able to asses the app's usefulness as a system in our user's daily lives. To do this let's first identify the core strengths of our applications experience. From our high average rounds per game and qualitative feedback about in-person fun, we know that users really enjoyed the social guessing format and are looking for game sessions that last longer. All our interviewees reported that the in-person play deepened friendships and facilitated a natural yet engaging music sharing experience. We found that there was a positive reception to the low-stakes casual gameplay, even with the bugs, suggesting the system supports "fun-first" social bonding.

This all being said we still had major drop offs across our field study when it came to users integrating synth into their daily lives. As seen in our quantitative study, when users were given the stand alone app they would not return unprompted and did not establish a self-sustaining habit loop. While this could be a result of the limiting nature of the spotify developer api on our testing group, much of our low retention rates could also be attributed to the game being multiplayer-only. The synchronous design could be creating friction in daily routines, we will speak more about how we will address this when we talk about design implications. With the song saving being underutilized, users rarely save music during/after games, we also can infer that users have yet to place synth as a vital way to discover new music. So while our design is compelling in controlled social contexts, the current design doesn't yet fit easily into users' asynchronous or solo routines. This introduces a clear opportunity for us to explore asynchronous and single-player modes, push notifications, or widget-based integration.

With our app's unique value proposition that focuses on playful identity discovery and music-based bonding, we set ourselves apart from traditional streaming apps and more utility-focused music sharing platforms within the ecosystem. While we share some elements with our competitors, like real-time social discovery on airbuds and Last.fm, synth utilizes more gamified and group interaction and guessing elements. While we fill a gap in social music play our app needs better re-engagement design to maintain presence in the app ecosystem. With re-engagement implementations and a UX that supports the longevity and scalability needed, we will be able to offer a distinct multiplayer music game experience that is missing among competitors.

When comparing our findings to findings from those in our literature review we see that they both affirm and extend the existing literature. Firstly, it confirms that shared identity through music is a powerful motivator, users felt a closer connection to friends after playing. We also were able to affirm the literature on dedicated platform's ability to foster deeper engagement, players valued focused music interaction over general content feeds. Lastly, it reinforces gamification's power to drive engagement, but also warns about reward triviality. Users didn't find song saving compelling, perhaps due to the lack of contextual motivation.

Our study showed us that a discovery system in a gamified environment needs both algorithmic diversity, to avoid repetition, and social transparency, to maintain group trust. Another main finding we uncovered that was not found in the previous literature was that showing the personalization through gameplay roles turned out to be more engaging than pure point accumulation itself. All this said we see that some of field feedback echoed the open questions from the literature about meaningful gamified incentives, social exploration nudges, and asynchronous design. By discussing design implementations we work to push the literature further.

8 Design Implications

In this section, we hope to motivate design implications that have been drawn out of the quantitative and qualitative results of this entire process.

Most importantly, we want to make sure that our application is fulfilling our core user value of music discovery. We hoped that forcing each round to last as long as the 30-second song preview that users would use the moment to intentionally listen to the song and open the song in Spotify to save it to their library. But as we discussed, our quantitative data shows that the open in Spotify button/add in Spotify button did not receive the high interaction level we hoped for. Additionally, our interviews showed that using a 30-second playback during the game session is not the best way for us to encourage music discovery either; users felt it was clunky and awkward. In future iterations, we must design better ways to advertise these buttons to encourage users to explore the songs they are seeing in-game beyond. One change we can make to our existing system is to move the full 30-second preview playback to be with the songs in the previous game summaries for users to listen to there. The in-game song will be shortened to 15 seconds to make the game flow better. One addition to our design system is a single-player music discovery feature, which would be a single-player

song-guessing game with songs that were pulled from friends' Spotify accounts but were not played during a previous game.

Secondly, avoiding song collisions and repetitiveness has been a core design question for us from the start. We can use the findings from our study to affirm our hypothesis on how much randomness/chance exactly to incorporate into the game. In our quantitative data, we saw an average of 3 song collisions between players in a single game, while this is somewhat skewed from our development testing methods, we are aiming for near-zero song collisions in games. Our interviewees and diary study participants expressed similar sentiments about a lack of diversity or repetitiveness. Going forward, we will need to design a more robust algorithm for song pooling that involves some element of controlled randomness that ensures diversity of players being represented in each round and diversity of songs being played.

The data revealed that the average number of rounds played was 5, which was the maximum number of rounds allowed to avoid some of the bugs we had with the server. This, along with our findings from qualitative data, where users expressed wanting to play more consecutive rounds (up to 10-15), shows us that users want to be able to play more consecutive rounds. We need to make sure that the game is playable and bug-free for more than 5 rounds. Making the game capable of more rounds is mutually beneficial for both us and the user. From a user perspective, more rounds mean more fun for longer. From our perspective, more users on the app for longer means more engagement, making any potential future revenue model more successful.

With the average number of players per game being around 3, it tells us that this game might be better suited towards small, tight-knit friend groups or family units. Some methods we learned from our qualitative research are that the game's invite system was unintuitive and didn't foster enough in-app social interaction. One change we would like to make is to flesh out the social aspect of the game with things like user profiles, direct song sharing, point systems, etc.

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