TuneRepublic

Music for the people by the people

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Music is a fundamental element of the human experience, but our relationship with music has changed dramatically in recent times. Developments in the last 30 years have accelerated this change as personal technology affords people unprecedented choice over what they hear. Before inventions like radio broadcasting and record players, people had little control over the music they listened to. Now capacious digital music players, advertised with taglines like "1,000 songs in your pocket," let people create the equivalent of a personal radio station that plays only songs they like.

This increase in individual control over music playback has outpaced control of music playback in public spaces. Technology associated with music in public spaces remains rudimentary. Although it has been shown that "individuals produce and consume music within specific social contexts...within specific networks of social relationships," in some public spaces people have no control over music[1]. In fact, music is used to control them: in certain retail environments, companies engineer their in-store playlists to provoke certain emotions.[2] In other settings people can ask a DJ to play their song, or choose from an available selection on a jukebox, but this are still fundamentally limited tools. These experiences suggest a disconnect between people in a setting and the music playing there; music is not matched to the people in the physical space. A system that allows users to control music playback beyond an individual level is missing.

Considering the issue more broadly, there is a deeper problem: people are sharing physical space without establishing any meaningful connection. At one time people who shared a physical space tended to engage one another and form communities. Increasingly this is not the case.[3] Though people may be having valuable interactions in virtual spaces, abandoning physical settings eliminates an important venue for social interaction.

We seek to address these two problems: the technical problem of how to facilitate choosing music in a public space, and the social problem of reduced interaction between people in a shared setting. Fundamentally, people want to share music. This fact is underscored by the popularity of concerts and peer-to-peer music sharing. However, as listening to music becomes increasingly individualized, a tension develops with the communal aspect of music. We envision a system that enables group control of music playback and that provides people opportunities to form relationships based on their shared interests in music.

Although these problems could be addressed in a number of specific settings, we chose to approach them specifically as they exist in a coffee shop environment. We selected this venue for several reasons. Coffee shops typically play music constantly. A large number of people pass through or spend time in them, which makes them potential hubs for community interaction. The problem we have described of people not interacting in public spaces is an issue particularly for coffee shops offering wireless Internet access.[4] [5] One patron at Nomad Café, a coffee shop in Oakland, described the locale as a "computer lab."

Since many visitors to coffee shops use laptops and other mobile devices, however, we can use these devices in our proposed solution.

In general terms, our project will examine how a mediated system might enable community control of a locale's ambiance. Our system will involve shared contributions from users to construct a musical ambiance for an environment. A system that allows people to choose music collaboratively could reinforce real-world communities—people who share a physical space can participate in shared action—and facilitate the creation of new in-groups by allowing users to connect based on shared taste in music. Framing the problem in this way allows us to approach it in the context of collective action creating a public good. Below we discuss in greater detail how our system encompasses these concepts. Users would collaborate by contributing their opinions about music to play to produce the best music for a coffee shop, or a selection of music that the greatest number of listeners present are likely to enjoy most.

Based on our understanding of this problem in the context of collective action, we can make some assumptions about the needs our system must fulfill. The system itself must provide a framework for users to organize their action. We also know that users will confront the free-riding problem. If people are contributing to construct the music ambiance of a locale, some may be tempted simply to enjoy what others have produced. However, if all users do this, the new system will perform no better than current systems. Consequently, our system must have a low barrier for participation and provide incentives for casual users' participation to discourage free riding. To approach the problem of people not interacting, we must also provide mechanisms and incentives for

users to leave the confines of a virtual system. Our mediated system should foster people's participation in the real world.

Stakeholders

When we began to consider our project as set in a coffee-shop environment, we identified four stakeholders: (1) the locale's customers, (2) store management, (3) local musicians, and (4) the established music industry. While each of these groups stands to benefit from the system, we consider customers as the primary stakeholders. The customers are the principal users of the system, and they stand to benefit most directly from it. Customers will gain the ability to control the music in their environment, will be exposed to new music by peers and store management, and will have a new avenue for interaction with those around them. Store management constitutes an important stakeholder because they bear the costs of implementing and maintaining such a system. As the ultimate controllers of the locale, they must be satisfied with any new system's overall functionality, costs and benefits. In interviews with store management at Café Nomad, we learned that such a system would be of great use to their staff in order to reduce staff meetings regarding music selection, and to avoid having to explain to staff what kind of music is appropriate. We have also discussed a number of revenue-generating ideas with store management such as integrating store advertising such as weekly specials, into our system's display, methods of reducing store squatters who do not make purchases, and incentives like free drinks to motivate user adoptions of our system. In our current implementation, however, our main focus is not direct revenue-generation.

A third group of stakeholders is local musicians, who stand to benefit by gaining a new venue for their music. A public, location-based music system provides a new venue for local bands and musicians who may have an interest in using such a system to gain greater exposure for their music. An important feature of our system is the "Manager's Selections," where managers pick preferred songs that are played automatically. This feature allows managers to promote local artists' music.

The last significant stakeholder in this system is the established music industry: the Recording Industry Association of America (RIAA), musicians, and performance licensing groups like the American Society of Composers, Authors and Publishers (ASCAP), and Broadcast Music Incorporated (BMI). Whenever commercial music is involved, musicians and the trade groups that represent them have a vested interest in seeing that artists are fairly compensated for public performances of their work. Given the significant legal ramifications of the music industry's reaction to our system it is important that these stakeholders are satisfied with the system's structure and operation. Having recognized the main stakeholders in our project's implementation, we are focusing primarily on the customers' interests and store management's interests.

Description of Features

While developing a solution to our proposed problem, a recurring issue was limiting feature creep. As such, much of the work in designing this system consisted of determining which features *not* to include. The features outlined below represent a realistic picture of the features that we believe would be necessary for a working first version of this system. More features could be

added later, as time and resources allow. During a feedback session with classmates, we learned that this system is ripe with potential for useful features, and we devote space to review these ideas after our system description.

Our system is a web application that users access on a coffee shop's intranet. When patrons first connect to the store's wireless Internet access, their browser displays the dashboard page for our jukebox system. To enable user control of music in the store, our system implements two fundamental features: song selection and voting.

In our implementation, songs are selected for playback through three mechanisms. Like a traditional jukebox, our system will contain a local repository of songs that encompass the store's music collection. Unlike a traditional jukebox, this system takes advantage of modern storage, which provides nearly unlimited space for songs. Like MP3 players and popular music software, our system provides easy access to songs by searching song titles or artist names. When no users are actively selecting songs, the system automatically selects songs for playback from the local repository. As mentioned above, an administrator or manager may configure the system with a set of "manager's selections," or a subset of all the repository's songs that will be used exclusively for playback. These songs consist of artists that the management finds to be of particular interest, such as local artists.

Users receive "credits" when they create an account and sign into the system. These credits can be used to select songs for playback. The number of credits, which is replenished automatically over time, is limited to encourage careful song selection, and to minimize users' tendency to set up an office in the

Café. With credits users may select songs from the system's local repository, or upload songs from their personal collections.

Songs selected via any of the methods above are added to the queue. The queue displays information for each song including the artist name and title, the name of the person who selected the song, and a set of up and down arrows. These arrows form the interface that allows users to vote on songs. Users have an unlimited number of votes that they can assign to songs currently in the queue, though they may only vote once on each song. User votes comprise a song's score. The score — the net sum of positive votes (worth 1) and negative votes (worth negative 1) — determines a song's position in the queue. As users vote on songs, the songs' scores change and the songs move in the queue such that the song with the highest score is at the top, and the song with the lowest score is at the bottom. Our system does not show a song's current score to avoid biasing the vote. As explained by Cheshire et. al., "social approval [has] a strong impact on contribution behavior simply by informing individuals about how much others liked their last contribution to the system."[6] By keeping the total vote on a given song hidden, we aim to mitigate such biases.

Our system's voting allows both positive and negative votes. This arrangement allows users to suppress songs they do not want to hear. Songs in the queue with a negative score appear below "the line of reckoning," indicating that the majority of voters do not want to hear the song. Songs below the line of reckoning stay in the queue for a designated period of time (e.g. 15 minutes) while users are given a change to rescue the song. Unless users rescue a song by voting it up, it will disappear from the queue, and be logged to a "not played"

list. Songs on this list cannot be added to the queue for a period of time (a few hours).

Users will always see a minimum number of songs in the queue. If nobody selects songs to play, the system will randomly select songs from its own repository and add them to the queue. Note that users can still vote on songs added in this way. This establishes a tiered set of actions users can take which keeps the barrier for usage low. Users who do not want to take the time to select a song for playback can nonetheless vote on songs the system has picked randomly.

Once a song reaches the top of the queue, it becomes selected for playback. The currently playing song appears above the queue. This display alone is an incentive for users to access our system. Often people want to know what a currently playing song is, and using this system they have easy access to that information. If a customer asks a store employee what music is playing, the employee can suggest that the customer access the store's jukebox system to find out.

One important design decision we made regarding our system's operation is that music playback should not be jarring or disruptive. For this reason we decided that once playback of a song begins, voting controls no longer appear, and it can neither be affected by user votes nor stopped, except by management. Administrative users can stop playback of any song at any time to provide a check against malicious users (e.g. submission of a song with falsified metadata).

User behavior forms the basis for the reputation features of our system. These features are directed at solving the problem of users not interacting with one another in the real world. Each user has a profile which displays implicit data about the user based on actions within the system. Information in a user's profile includes: length of membership, the number of votes a user has made, the number of songs the user has added to the queue, and the number of positive/negative votes the user's submitted songs have received. These characteristics together give off information about the user to other customers. Based on the profile, other people can ascertain how active a person is within the jukebox system, or how the person uses it. They can answer questions like "how long has this person been using this system?" "does this person just vote, or submit songs as well? and "have other people liked the songs this person has played?" Within our system reputation does not have an effect on a user's privileges in the system; it is simply a mechanism for users to evaluate others' behavior. By associating these reputation metrics with a user's account, we are trying to incentivize users to maintain a single account and to reinforce the notion that their actions contribute to other users' perceptions of them.

Users access profile information through links to other users' profiles. Recall that each song in the queue displays the name of the person that added it to the queue. The user's name is a hyperlink to the user's profile, which displays these reputation metrics. Additionally, the user may provide a profile picture and contact information, facilitating interaction outside the electronic boundaries of the system. A profile picture may allow me to identify you as the person sitting in some area of the store, connecting my perception of you based on your online persona with you in real life. Because songs in the queue will generally have

been placed there by people co-located in the Café, seeing a user's picture makes it easy to identify him or her.

To provide another mechanism for user interaction outside the virtual world, our system provides a list of "users like you," for the current user. This list indicates other people within the system who have similar tastes in music. The system produces these matches based on users' stored voting data. Although the specific implementation could change, one possible algorithm is to consider users as vectors with components (-1, 0, 1) for each song played in the system. Then we find similar users by calculating the cosine between user vectors and selecting a few of the most similar ones. To provide more accurate information, this algorithm should not be limited to individual songs. We can represent users' votes as vectors in different spaces for each artist within the system, or each musical genre. This way we can match two users, one who voted up on "Tiny Dancer," and another who voted up on "Rocket Man," as having a shared interest in music by Elton John. This space has been explored extensively by the PartyVote system.

Attempting to match people from their voting preferences is based on a premise that seems intuitively correct, but that can be problematic. We assume that a vote up means that a person likes a song and that a vote down means a person dislikes a song. This may represent the typical use case, but consider these two statements:

"I don't want to hear this song now."

"I dislike this song."

These are not semantically equivalent, yet we cannot distinguish between the two with simple positive and negative ranking of songs. Expressing a desired play order is not the same as expressing an opinion about an individual song.

Another possible scenario is when two songs, appear next to each other in the queue. If a user likes both songs, but wants to hear second one first, she may vote on it and not the other, despite liking both songs equally. A possible partial solution to this problem, which we considered but did not implement, is to use a non-linear ordering of the songs available to be played. Users see a pool of songs, from which the next song will be selected, but without any indication of which song will be selected next. In this scenario, we believe that users' tendency to vote to order songs explicitly will be diminished. In the implementation we designed, we did not opt for this pool-selection mechanism because of the design complexities it entailed, but these issues remain salient factors to consider when calculating user similarity.

While assessing the features necessary to our system we also listed classes of users we expected to use the system. Each class has different capabilities based on users' needs and the incentives needed to motivate users. We separated users into five categories with associated privileges: anonymous users, authenticated users, Internet users, managers, and administrators. Anonymous users are those who have not signed into the system and they have limited privileges. Since these may be new users who have not yet created profiles, they have some abilities granted to attract their interest in the system. Authenticated users have logged into the system and have increased privileges exchanged for their established identity. Internet users, a class we did not consider extensively in our

implementation, are people accessing the Café's system from outside the Café. Because they are not physically present, they have no decision-making power regarding the music that is played, but they can stream the Café's music. Managers, like café staff, have additional privileges needed to facilitate the system's smooth operation and to intervene when abuse threatens the system's utility. Finally, administrative users like the coffee shop owner or software developer can change settings in the system. The privileges of each group are outlined below:

Category	Action	Anonymous User	Internet User	Authenticated User	Manager	Admin
Content Creation / Deletion	Upload song from browser to queue	No	No	Yes	Yes	Yes
Content Creation / Deletion	Add songs to manager's selections	No	No	No	Yes	Yes
Content Creation / Deletion	Delete songs from manager's picks	No	No	No	Yes	Yes
Local Repository	Add / Delete songs to / from local repository	No	No	No	No	Yes
Local Repository	Browse local repository	Yes	Yes	Yes	Yes	Yes
Local Repository	Add songs from local repository to queue	Yes	No	Yes	Yes	Yes
Playback Management	Delete song from queue	No	No	No	Yes	Yes
Playback Management	Add / remove song to / from blacklist	No	No	No	Yes	Yes
Playback Management	Start / Stop Playback	No	No	No	Yes	Yes
Playback Management	Adjust volume up / down	No	No	No	Yes	Yes
Playback Management	Advance to next song (with fadeout)	No	No	No	Yes	Yes
Playback Management	Go to previous song	No	No	No	Yes	Yes
Playback Management	Vote songs up / down	No	No	Yes	Yes	Yes
Profile Management	Create new profile	Yes	Yes	No	No	No
Profile Management	Edit profile	No	Yes	Yes	Yes	Yes
Profile Management	Delete own profile	No	Yes	Yes	Yes	No
Settings	Adjust frequency of manager's picks	No	No	No	No	Yes
Settings	Change reputation settings	No	No	No	No	Yes

Category	Action	Anonymous User	Internet User	Authenticated User	Manager	Admin
Settings	Adjust access control (this table)	No	No	No	No	Yes
Settings	Review/edit/delete User Profiles	No	No	No	No	Yes
Settings	Block and log off users	No	No	No	No	Yes
Statistics	Review list of songs played	No	No	No	No	Yes
Statistics	Review list of songs not played	No	No	No	No	Yes
Statistics	Review user login history	No	No	No	No	Yes
View Rights	See current queue	Yes	Yes	Yes	Yes	Yes
View Rights	See reputation of others	Yes	Yes	Yes	Yes	Yes

This privilege system would be implemented as configurable file that could be customized for different installations.

Discussions of CMC Ideas

In our design process, we considered the queue and the music ambiance it consequently produces to be the main public good created by the jukebox system. People present can benefit from this good without excluding others' access to it; one user's enjoyment of the music does not preclude any other's. This means the good is non-rival to the extent that the locale's seating capacity is not an issue. When we consider the issue of adding music to the queue, it may appear that the system is rivalrous to some extent: there is a limited amount of time and playing my song excludes your song for a time. This is true, however, of many collective goods: my writing a specific section of Wikipedia excludes you from writing the same section. This consideration does not significantly affect our interpretation of our good as a non-rival and non-excludable.

Considering the queue as a public good, our system must cope with free riding. We designed our system to provide a number of specific incentives to motivate user contributions. In addition to the psychological satisfaction users may derive from exerting some control over their setting, users can perceive that their contributions to the queue are valuable. Unlike Wikipedia, where users may not be able to perceive the additional value of contributing, our jukebox system shows users that their contributions make the system better *for themselves*. In contributing, users do not just improve the ambiance for other listeners—a goal that appeals to altruistic motivations—they improve the ambiance according to their own personal tastes. To this extent, queue management resembles a free market system: we assume that the best result, music that people want to hear, will result from individual users pursuing their own interests.

In addition to contributing to a public good, user actions within the system also create individual benefits for users. Based on anticipated reciprocity, a concept discussed by Rafaeli et. al., we know that a person's motivation to contribute aligns with the expectation that she will receive useful help and information in return.[7] Our "users like you" feature exploits this. The more information users provide about their tastes via voting, the more results the system can provide for others who share their preferences. If users do not contribute themselves, and instead rely on the group to construct the setting's ambiance, they do not receive this benefit.

Research presented in Joyce and Kraut found that, "from a psychological perspective, users who contribute more content to an online community were

more likely to repeat their participation in that community."[8] We think this principle applies to our system's design as well. If the songs a user contributes receive positive votes, we believe that users will be more likely to participate in the future. However, even if users' songs receive negative votes, they might learn about the nature of the Café patrons' preferences and alter their song contribution. In either case, users should be motivated to participate.

Taste in music can represent both signals given and given off, the dichotomy described by Goffman.[9] Our system is designed to help people establish relationships in the real world, so we want to avoid scenarios where the system gives off more signals than users expect. Allowing users to give off some signals is essential to facilitate other people forming opinions and creating new relationships, however, as the system is used, it can collect a large database of information that users may not want to share. Some users may vote based on how they believe others will perceive their actions (and not ultimately based just on the songs they want to hear), but we intend voting in our system to be primarily functional, to facilitate ordering songs. Soliciting information for functional purposes, but then also displaying it in a way that sends extensive social signals, may betray user trust.

Legal Perspectives

Resolving the legal implications of a jukebox system like ours is beyond our project's scope, however, we investigated some of the salient issues. We based our legal perspective on information available from companies that offer performance licenses and a conversation with Brian Carver. First, in order to play music in a public venue, like a coffee shop, the venue must obtain a

performance license. Companies like ASCAP and BMI offer blanket licenses that allow venues to play music from nearly all major artists. Both ASCAP and BMI suggest that jukebox operators obtain a license from the Jukebox License Office (JLO). However, the JLO only grants licenses to cover a "coin-operated phonorecord player." In another criteria, the JLO explicitly excludes "digital systems" from qualification as a jukebox. Consequently, store operators would have to obtain a (more expensive) performance license from ASCAP or BMI. A typical performance license from BMI costs $320 annually.[10] By obtaining such a license, cafés should be protected from becoming party to contributory infringement.

Related Systems

During our design process, we evaluated three other systems that approached this problem space, PartyVote, Jukola, and Flytrap[11] [12] [13]. Each of these systems is working on a slightly different version of our problem, however they all aim to aid in the democratic selection of music in a public or semi-public space.

The project that was most similar to our own is entitled Jukola. In the Jukola project, a similar electronic jukebox was created that allowed patrons of a restaurant/bar in Bristol, UK to vote on songs from a local database. Interaction with the jukebox was through handheld devices checked out to patrons, and through a touchscreen kiosk displaying the Jukola interface. There are many useful features in Jukola, however we discovered several that we believed our system would improve upon. Some useful features of Jukola are its ability to look up information about artists and albums from the Internet, and its history

viewer that allows users to look at which songs were played when. A design principle that we have that is different from that of Jukola is with regards to biasing user voting. Whereas we believe that indicating the number of votes upon a certain song biases the vote upon that song, in the Jukola system, "The percentages of votes for each song are presented...so that people can monitor ongoing voting performance." A further design principle that we had that is different from that of Jukola is our belief that the system should be used on occasion and should not be a major focus of patrons' attention. We achieve this by allowing users to vote on several songs all at once, and then to proceed to other things outside of the system. In the Jukola system, votes are completed in rounds that last the duration of the currently playing song, thus users must vote every few minutes in order to fully participate. We believe that this draws too much attention to the system, and that it detracts from users' ability to meaningfully interact in the Café.

The next system we evaluated approached this problem space from a different angle. In the PartyVote system, users vote on songs through a single computer in order to determine which songs to play at a party. Similar to our own project, the PartyVote system aims to "[take] requests and [play] music that will appease the most people." Unlike our system, PartyVote uses multidimensional scaling to determine which songs to play. This allows the system to analyze votes, and similar to a DJ, determine songs that may appease more than one person at a time. This is an interesting system, and is similar to a suggestion mentioned below regarding catagory-based voting.

Another system called Flytrap was an attempt to dynamically match the music in a locale with the people present. This approach relied heavily on preprocessing each user's music library. After all libraries had been scanned and analyzed, the system used radio frequency badges to detect which individuals were in a locale. Depending on those present, the system attempts to select songs that accurately represent all users' shared taste. Although our system makes no attempts to adjust the music in a locale automatically based on user preferences, it does ultimately accomplish the same task through user voting. One feature that we considered based on FlyTrap's operation is to provide a mechanism where the system can learn users' music preferences over time. This would be helpful because the system must randomly select music to be played when users are not actively submitting songs. Based on past selections, the system could select songs that are similar to ones that users have liked in the past. This would be an improvement on inserting random songs into the queue.

Future Considerations

During a feedback session with classmates, we received a number of suggestions for features and improvements to our jukebox system. Several suggestions centered on providing alternate means to access the system besides personal laptops. One possibility might be a kiosk in the café that provides users that do not have computers a place to vote and select songs for playback. Such a kiosk could support music player connectivity so users could connect, for example, their iPods and submit songs to the queue. Others suggested varying level of mobile connectivity that would allow users to interact with the system via cell phones or PDAs.

Another suggestion was that it might be embarrassing for users to have their names associated with a song that appears below the line of reckoning. Depending on users' reactions to this situation (discussion with users after deployment would help answer this question), one possibility would be to display all songs below the line of reckoning anonymously. Conversely, however, it is possible that knowing who submitted a song provides users with a reason to rescue the song, if that user is known to have good taste. In addition, by leaving names on songs below the line of reckoning, we further incentivize selection of songs that have a high likelihood of success.

Some people were interested in varying degrees of vote granularity. Instead of having to vote on each individual song, perhaps users could vote for categories of songs, say, "Vote up on anything from the 1980s that's pop," or "Vote down on all Britney Spears."

As users are exposed to new music and a broader range of songs in the queue, it is possible that they may not recognize some song titles or even artists. One solution to this problem would be to allow users to hear a short song preview on their individual computers. Another solution that was suggested was a mechanism to allow users to comment on individual songs. This is another possible way to resolve people's unfamiliarity with songs, and would also serve as additional way to interact with the system. If comments were stored in a database, users could see the history of commentary on a song over time. This could incorporate some aspect of reputation for each song.

Another popular topic for feedback was various metrics our system could report and display. Some dealt with statistical analysis (e.g. most popular song,

user with best taste, etc), others with better music selection through user feedback (e.g. "This song was rejected the last 4 out of 5 plays"), and others with descriptions of user music preferences over time. Some suggested descriptions included visualizations showing the popularity of songs, genres, or artists over time or textual descriptions ("Jazz is popular on Mondays, Rock is more popular on Thursday").

Many people suggested that we implement some mechanism of communication with other users in the café. While we could implement an instant messaging system that allowed users to see and chat with other users logged into the system, one of our principles is to enable users to interact with one another outside a virtual space. Instead of implementing online chat within the system, our present preference is to provide tools for users to communicate *outside* the system.

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