Listening In: Practices Surrounding iTunes Music Sharing

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ABSTRACT

This paper presents a descriptive account of the social practices surrounding the iTunes music sharing of 13 participants in one organizational setting. Specifically, we characterize adoption, critical mass, and privacy; impression management and access control; the musical impressions of others that are created as a result of music sharing; the ways in which participants attempted to make sense of the dynamic system; and implications of the overlaid technical, musical, and corporate topologies. We interleave design implications throughout our results and relate those results to broader themes in a music sharing design space.

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iTunes, music sharing

ACM Classification Keywords

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INTRODUCTION

Music sharing technologies appear to exist tenuously between the possibilities supported by technical innovation (e.g. peer-to-peer discovery protocols) and the constraints of political, legal, and ethical considerations. These political, legal, and ethical considerations – digital rights management laws, in particular – have catalyzed much of the change in music sharing technologies and have led to an almost exclusive research focus on those issues [e.g., 3, 12,13].

There is, however, a gap in the research that is available to inform current music sharing technologies – a lack of understanding about users' actual practices surrounding music sharing (a notable exception to this is [4], a comparison of music sharing offline with online music sharing via Napster).

Apple Computer's iTunes[1] digital music jukebox software has been one of the few music sharing technologies that has successfully walked this apparent fine line between taking advantage of certain technical innovations while conforming to the constraints of political, legal, and ethical considerations. A study of iTunes music sharing practices enables the research community to better understand the moving target of music sharing technologies and practices and the implications of the positioning of music sharing technologies between technical innovation and political, legal, and ethical considerations.

In this paper, we report findings from an interview-based study of the day-to-day practices surrounding iTunes music sharing among employees of one corporation. We describe a variety of iTunes music sharing practices and examine their relationship to the technologies of iTunes – the interface and discovery protocol. Prior to this study, what was known about iTunes music sharing came from media reports that largely focused on use in the college setting [11]. These reports placed their emphasis on a single social effect of iTunes usage – a type of musical voyeurism, termed "playlistism," that has been hyped in college newspapers [2].

The ability to see and subsequently judge others' playlists arose when Apple released a version of iTunes that supported the sharing of music collections on the same subnetwork via the Rendezvous (also known as OpenTalk or ZeroConf[2]) discovery protocol. All of a sudden, individuals could listen to and examine not just their own music collection but those of anyone on the same subnetwork.

This change, from iTunes as a single-user jukebox application to a tool for music sharing, clearly brings with it the potential for social effects that have not yet been studied. What are the everyday practices involved in iTunes music sharing? Are iTunes users really casting musical judgments upon other iTunes users? In what ways does the design of iTunes impact how the impressions of others are being constructed? What additional kinds of work are created by the desire to make sure that the impressions others are constructing are desirable ones? What are the implications of a technology whose social

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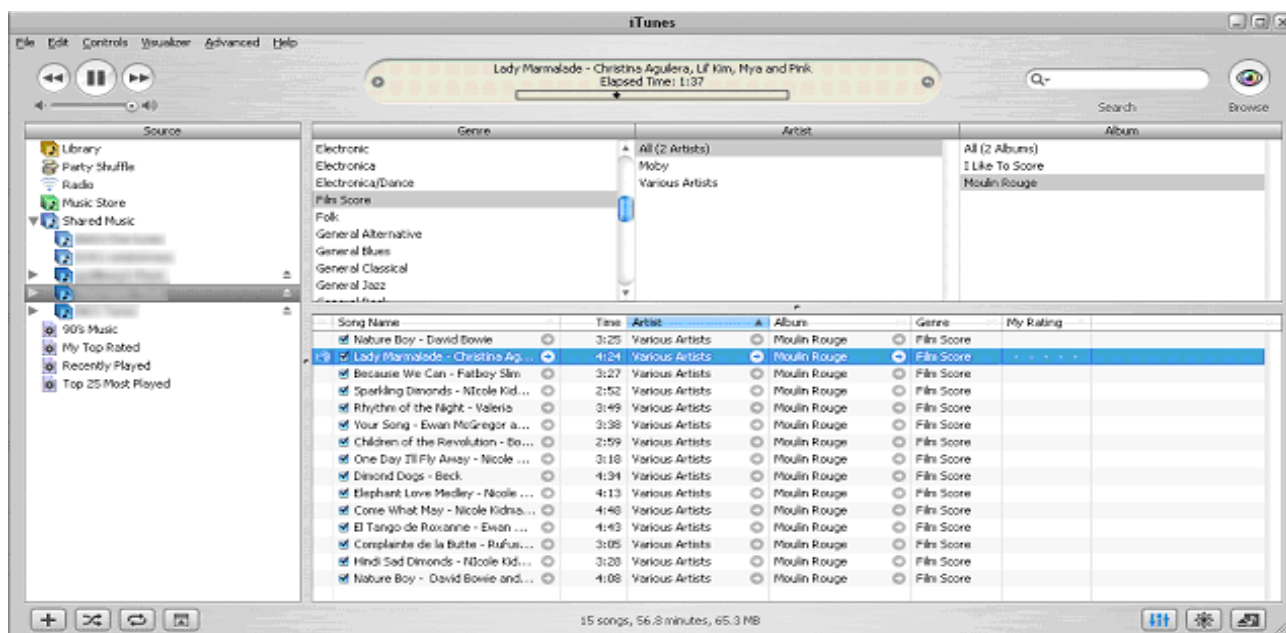
[1] http://www.apple.com/itunes

[2] http://www.zeroconf.org

Figure 1. iTunes

structures are predicated on solely technical network structures? How does the discovery protocol and dynamic nature of the system impact user experience? How do users make sense of the comings and goings of users and their music libraries? These were some of the questions we set out to answer in our study.

In the remainder of this paper, we provide a brief orientation to the iTunes application and an overview of technology and music sharing, including a discussion of related work and a design space for music sharing technologies. We then present the results of our study; these results cover a range of topics, including the adoption of iTunes, the impression management involved in iTunes music sharing and the impressions that are created, how users make sense of the dynamic system, and implications of the overlaid technical, musical, and corporate topologies. We also offer design implications based on these results. Finally, we relate our results to broader themes of the music sharing design space and of the positioning of music sharing technologies between technical innovation and political, legal, and ethical considerations

ITUNES

iTunes is a "digital jukebox" for organizing, sharing, and listening to music on both the Mac and PC platforms [Figure 1]. Each music file can be tagged with a name, artist, album, genre, and rating. These tags can then be used to sort libraries or portions thereof. In addition, genre, artist and album tags can be used as filters on a library, filtering out all but the "film score" genre, for example. A user can also search within music libraries.

Any sort, search, or filter operation will result in a transient music playlist. Users have two options for creating persistent playlists within their library. First, they can simply drag selected songs into a normal playlist. Second, they can create a "smart" playlist by defining a set of rules over the library, such as a playlist containing all unplayed music. iTunes generates several default playlists including, for example, "My Top Rated" or "Top 25 Most Played."

Using Rendezvous, iTunes users can share their music in two ways – either by sharing their entire library or by specifying which playlists to share. Rendezvous, a zero-configuration networking protocol, supports publishing (the act of sharing) and discovery (the act of finding) across a subnetwork. A subnetwork (colloquially known as a subnet) is a small division of a computer network, created a priori by an administrator, that reduces the volume of network traffic by allowing machines on the same subnet to bypass routers and communicate directly with each other. Users see others' shared music automatically; they do not have to take any explicit network connection actions.

In contrast to previous online music sharing technologies, iTunes music sharing does not support copying music over the Internet. In iTunes, music files reside only on their host machine and, when shared, are streamed to another user's computer. One side effect of this mechanism for sharing is that when a music sharing host shuts down iTunes, her music is no longer available to anyone who might be listening.

Other features of iTunes that are not directly relevant to this study include the ability to rip and burn CDs to and from one's own library, access to Internet radio stations, and an online iTunes music store.

MUSIC SHARING & TECHNOLOGY

The history of the relationship between music sharing and technology goes back to at least 1963 when Phillips

introduced the cassette tape [14]. Music sharing was carried out via mixtapes (or party tapes, as they were originally known) [16]. The use of mixtapes thrived in certain musical subcultures, such as the hip hop subculture, in which many of the best records were "not legally available" [6]. In these subcultures, mixtapes helped individuals develop a collective sense of identity based on shared musical interests [5, 10].

In both musically-oriented subcultures and among other individuals, mixtapes provided a means of establishing and maintaining social bonds with other people. For example, dating has long been facilitated by the ever popular romantic mixtape – a carefully crafted collection of songs given to a person as a sign of an existing or desired relationship. While the underlying technology may have changed to CD-Rs, the social practice of gift-giving that surrounds mixtapes and the intent of that exchange to forge a closer bond through shared music has remained the same.

In contrast, the first wave of peer-to-peer file sharing technologies (e.g. Napster [4], Gnutella [1], and KaZaA [9]) brought with them very different music sharing practices. Collectively, these systems provided access to huge quantities of music. Because of the massive volume of content available, users were bound to find almost anything they looked for. Theoretically then, these systems made it possible for individuals with divergent musical interests to share files with each other. In practice, however, one could only find a song through an explicit search. It was impossible to browse through another user's library without first conducting a search for the name of a specific song in that library. Searches, then, were more likely to lead a user to music libraries with shared or overlapping musical interests than they were to lead a user to a library with completely divergent musical taste.

These large-scale, peer-to-peer applications also tended to anonymize music sharing interactions [4], making "the human" in the system secondary to the explicit search for a specific music file. Even after locating a desired file, the music sharer was often relegated to being the signifier of a

desirable or undesirable bandwidth for serving songs over the Internet. In addition, while some of these peer-to-peer systems had built-in chat functionality, we know of no accounts of this functionality being used. Some systems (e.g., Napster) separated chat from song download in its interface, making it difficult to talk while getting music and further decreasing the potential for sociality.

In this first wave of peer-to-peer file sharing, then, not only were the interactions anonymous, they also acted as filters, filtering out those users with no overlap in shared musical interest or knowledge. Perhaps, in part, as a consequence of this lack of strong social connection, some researchers interested in peer-to-peer file sharing focused more on what were perceived to be crises in collective action [1]. Other researchers responded, instead, to broad concerns about economic and legal consequences of peer-to-peer music sharing [3, 12, 13].

The difference between the strong social bonds among individuals sharing music via mixtapes and the relatively anonymous experience of online music retrieval mirrors the findings of Brown et al [4]. Indeed, they argue that much of the sociality has been stripped away in massive-scale online music sharing and, as a result, propose that technologies be designed to support the sociability that exists in face-to-face music sharing. As a new type of technical artifact, we were interested in seeing whether the specific features of iTunes supported sociability better than the massive-scale online music sharing systems.

iTunes populates novel territory in the music sharing design space [Figure 2]. First, by making people, not music, the first class objects in the system, iTunes does not favor shared musical interests over divergent ones. This potential to support music sharing among individuals with divergent musical interests sets iTunes apart. Second, since discovery is restricted to a subnet, it occasions music sharing among people who may be quite intimate all the way to people who may never have met. Yet, music sharing interactions over iTunes will never be as anonymous as the massive-scale, peer-to-peer systems because the scale is smaller, the human aspect of the system is fore-grounded, and perhaps most importantly, because each group of users has IP addresses on the same subnet, each group will share something in common, be it working for the same company, living in the same dormitory, or frequenting the same coffee house.

METHOD
We conducted 13 semi-structured interviews of iTunes users. The interviews lasted approximately 45 minutes each and were held in the participants' offices. To the extent possible, the interviews focused on specific examples of social aspects of iTunes use. For example, we asked participants to tell us about the last time they discovered a new music library in iTunes or the last conversation they had about iTunes. The 13 participants were all employees of a mid-sized (~175 employees) corporation. Ten of the participants were researchers in various technical
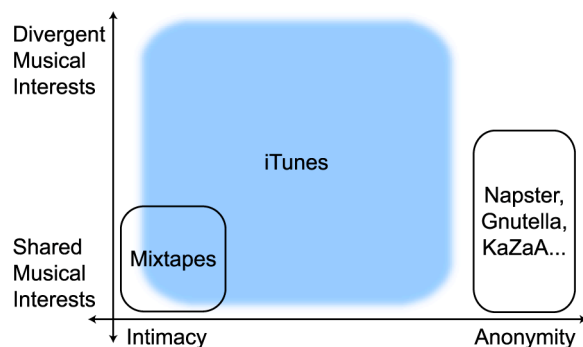

Figure 2. Music sharing design space

Subnet	Number of participants	Number of known iTunes users
Floor 1	2 (P1-P2)	3
Floor 2	2 (P3-P4)	7
Floor 3	1 (P5)	0
Dept. A	8 (P6-P13)	12

Table 1. Participants' subnet distribution

disciplines; three of the participants were administrative support staff.

The network topology of this company consisted of four wired subnets. Three of the subnets were defined by the physical layout of the building – floor 1, floor 2, and floor 3. The fourth subnet was used by the members of a department within that corporation. Theoretically, then, our participants belonged to four different groups of iTunes users; participants were able to view and share the music only of those members of their subnet group. In reality, we interviewed between two and eight members of each of three subnet groups, ranging in size from 3 to 12 known members. One last participant did not share his music library; if he had tried, he would have belonged to the third floor subnet group which had no other members [Table 1].

RESULTS & DESIGN IMPLICATIONS
Adoption, Critical Mass & Privacy
Twelve of the thirteen participants in this study shared their music via iTunes. Those who used iTunes as a personal music library prior to the version release that enabled sharing upgraded their versions of iTunes and started sharing immediately. The rest enabled sharing as soon as they started using iTunes; sharing, as it was seen, was part of the "ethos" of the application.

> …the fact that you can then see immediately that other people are sharing their music then sort of implicitly makes the whole ethos be that you ought to share (P12) [3].

Only one participant did not share his iTunes. Sharing, he felt, was something that students, not coworkers, would do. Although he was incorrect at the organizational level, it was interesting to note that his machine was connected to the only subnet in which no one else shared their music, so his intuition was correct for his closest coworkers.

Design Implications: Jumpstarting Network Effects
The visible foregrounding of others' music libraries in the interface seemed to encourage people to share their own music collections. The challenge, then, would seem to be to get the first person to share their music. In our data, we

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[3] All identifying information, including names of participants and their music libraries, department names, and, where necessary, genres of music, have been changed to preserve anonymity.

noted at least one pair of users who initiated iTunes sharing on their subnet by making a commitment to share their music with each other. The number of individuals sharing on their subnet grew from that initial two. For iTunes, unlike many collaborative applications, the critical mass required to fuel adoption may be as small as one or two users willing to share their music.

Another sharing design decision also played an important role in iTunes adoption. By default, music sharing is turned off; users must explicitly turn it on. One participant (P9) reported that if his music had been automatically shared, he would have strongly resented it and turned it off. Giving users control over whether they share their music from the start respected users' privacy concerns in sharing.

Impression Management & Access Control
By turning iTunes' music sharing on, people made their music libraries available to others on their subnet. This act also brought with it varying amounts of additional work – the work of determining what identity to portray through one's own music library, something sociologist Erving Goffman termed "impression management" [7, 8].

The most intentional account of impression management came from a participant who already had a small iTunes library when the version of iTunes with sharing functionality was released.

> I just went through it and said, "Eh, I wonder what kind of image this is, you know, giving me," right? I just went through it to see if there was not like stuff that would be like, I don't know, annoying; that I would not like people to know that I had (P11).

For this participant, music sharing led to the additional work of ripping more CDs to create a more "balanced" portrayal of himself.

> When the sharing happened…I had not ripped everything from my CD collection.…It was fairly heavily skewed toward the classical and soundtrack part of my collection…the order in which I'd popped the CDs in. And I remember thinking about this and was like, "Gee, that's not very cool.…" So when we started sharing, I started reripping things, adding stuff to my collection.…I added more to kind of rebalance it and cover a wider breadth of genres that I had in my collection (P11).

Another participant had not given the contents of his music library the same degree of scrutiny. With respect to constructing an identity, the contents of his library were complicated by the fact that he occasionally purchased music online for his wife. These songs were by artists that he did not listen to or like, and he was disturbed by the impression that these songs could give others.

> I mean if people are looking at my playlist to get a picture of the kind of music I like and don't like, you know. Or to get a little insight into what I'm about, it'd be kind of inaccurate 'cuz there's, you know, there's Justin Timberlake and there's another couple of artists on here that…Michael McDonald, you know. Some of this stuff I would not, you know, want to be like kind of associated with it.…I guess part of it is it wouldn't be bad if, you know, people thought I

was kind of hip and current with my music instead of like an old fuddy duddy with music. I mean I sort of like to experiment a little bit with stuff. I mean I'm not like totally wild but I like to experiment with, you know, some newer stuff. So I guess it would be okay if people thought that I had good taste. It wouldn't be so good if they said "God! He likes Justin Timberlake? That sucks!" (P1).

Expertise played an interesting and differentiating role in the ways that our participants crafted their identities. Some of the participants felt their libraries should foreground the kind of music in which they had expertise, creating a definitive repository of Jimmy Buffett music, for example. Another participant used his own national identity to give his library…

> …a particular focus on all of the German bands actually that I have, because…if I have something to offer on the network, I'd like to be able to give, you know, albums and artists that other people don't have (P11).

However, expertise not only caused users to augment and foreground music in a library, it also caused users to hide and not share music in their library. These participants described their expertise as being in an area they felt that, at best, others would not "relate to" and, at worst, would be a "horrible experience."

> I have a lot of Hindi music that is stuff that I listen and I don't expect other people to relate to. So that is not there (P4).

> I don't want to bother sharing all of my stupid band clips 'cuz that would probably be a pretty horrible experience (P12).

Sometimes it was not sufficient for users to craft a static identity. As more and more co-workers joined the iTunes community, sometimes the identities were actively managed. Most notable were the changes that one participant attributed to the arrival of some managers to the community.

> Some people have expressed some concerns especially when the managers started sharing, started browsing other people's collections, about being exposed to other people and like the contents of their playlists, like how much they like Abba or whatever….I'm trying to remember if [employee] changed her name when [manager] showed up (P12).

The name change referred to by P12 is supported by the ability within iTunes to label one's collection. By default, when a user turns sharing on, the name given is "[OS user name]'s music," but this name can be changed. Making the name of a music library more appropriate for a manager to see was one factor in naming a music library. Other names referred to the hobbies or interests of the library's owner (e.g., "Cat's Meow") while others commented on the contents of the library (e.g., "Doghouse Blues").

Design Implications: Supporting Users' Ability to Manage the Presentation of Self

Participants utilized several of iTunes' mechanisms for managing identity. First, people changed the name of their music library in response to the audience of potential music listeners. Second, iTunes allowed users to share either their entire library or to specify which playlists to share. People who wanted to remove certain types of music used playlists as a means of controlling what was shared.

Based on our findings, particularly regarding the role of expertise, we believe other types of sharing control (including share by genre, country of origin, album and artist) would have been well received. Further, as libraries get large, managing the sharing gets complicated, so offering individuals the choice to make new music part of the shared collection at the time it enters the system may also help.

Several of our participants reported problems with their workplace iTunes music libraries resulting from additionally using iTunes at home. One participant (P1) had music in his library that he had downloaded at work only to take home for his wife. Another participant (P2) had to construct a completely separate music library for work because his music library at home contained so much of his son's music. The overloading of multiple identities in a single library raises other design questions and suggests that providing some mechanism to share based on "which user you are" would be of value.

More generally, the lengths to which people managed their shared music highlights the relationship between identity and access control. Today, many access control solutions are designed by security engineers with secure systems in mind. But this study suggests that access control is more complex than simply restricting who can see what. Access control is a tool through which users manage others' impressions of them. It is a technology that has been appropriated to support the careful crafting of identity.

Creating Musical Impressions of Coworkers

For the potential listening audience, these carefully crafted views into others' music libraries constituted "little windows into what they are about" (P1). Frequently, participants would browse through the list of genres represented in others' libraries to come to the conclusion that someone is "eclectic" or "easy because he has only one genre" (P11). One participant (P1) drew his impressions, not so much from the musical content of others' libraries, as much as from characteristics of the custom playlists others generated from their content.

However, the ability to determine whose collection was whose was made more difficult by some of the features people used to manage their identity. For example, the ability to customize the name of a music library confused potential listeners.

> People can give names to their collections that are not necessarily obvious. So the first few times that SmallieBiggs here appeared on my list, I was really curious who the heck is SmallieBiggs?…So the first time SmallieBiggs appeared on my collection, I spent, I don't know, maybe fifteen to twenty minutes navigating the collection, and thinking who at [this company] in [this department] could possibly be

listening to this particular music collection. So that was, you know, enjoyable detective work (P11).

Although P11 enjoyed guessing whose collection it was, others found the same confusion more frustrating. In addition to being confused by the name, users were also puzzled by the intent behind obscuring the owner's name.

> I wish I could find out who these people are. That's one thing that would be cool. I mean its kind of a small group. There's only like five or six things shared here. But like I have no idea who SmallieBiggs is. And I don't know maybe it's because they don't want me to know or because they think it's more fun to have like an interesting name or what (P10).

Many people could make educated guesses about some of the anonymous collections by examining the music itself. Some people figured out whose collection was whose by asking colleagues. Most participants felt certain they knew who owned most of the music libraries. Often, if there were libraries that a user had not mapped to an individual, it was a library that user rarely, if ever, listened to; not knowing whose library it was, in this case, did not seem to concern our participants.

Beyond providing simultaneous customizability and ambiguity in naming music libraries, the iTunes interface was perceived as more directly affecting the impressions that were created. For example, when a person clicked on another person's library, the interface displayed each file (usually this equated to one track of a CD) in the entire library in ascending alphabetical order by artist name.

> [That] people's impressions of what your collection is are probably very heavily influenced by the things that happened to be the first thing in sort order is sort of a weird thing….If Pete[4] was here…one of the first things that comes up for him…so I think 10,000 Maniacs is in there and then the second thing I think is he listens to this Jewish humor rap group called 2 Live Jews….If you didn't scroll down that would be like your whole impression of [him] (P12).

Another source for judging other's musical libraries came from an individual's own tastes and expertise. By browsing through their music libraries, one participant was hoping to learn something surprising about his co-workers. In the end, he found he didn't know enough about the types of music to which others listened to know if he even should have been surprised: "I don't really know the first thing about music; it's either classical or not" (P7). This same lack of distinguishability was articulated by another participant, also a classical-only listener. "Their collections are pretty much the same as each other's, so you don't need more than one of them" (P13).

These two classical-only participants were better able to distinguish the distinctions and articulate their impressions of each others' music.

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4 Pseudonym for an iTunes user who was not a participant in this study.

He's got quite an eclectic taste and for me, like, I can try out, especially from more difficult, you know, more modern…music (P13).

To contrast, the user that is being referred to in the quote above as being "eclectic" is the same user that another participant had decided was "easy because he has only one genre" (P11).

Despite the close examination of other's libraries, participants seldom felt that these musical impressions significantly changed their view of a coworker. Rather, they felt it mostly "serves to reinforce impressions I've already got" (P12). Occasionally, however, a participant admitted that knowledge of another's musical tastes impacted his opinion of someone else: "[P6] I have learned is a big fan of whatever current pop is which I suppose to some degree lowers my estimation of him but not by too much" (P12).

The more significant and longer-lasting impact of these musical impressions seems to be the binary judgment that frequently gets made.

> So when there is someone new, I spend a fair amount of time listening to what they have and then…binary process, either I just decide well there is nothing in there for me or I really like it and will come back to it. (P11).

In other words, the first examination of another person's library seems to have a strong influence on whether the visitor will ever return that library.

Design Implications: Scaffolding Impression Creation
iTunes' interface plays a critical role in terms of allowing an audience to examine and judge a collection, thereby creating an impression of a coworker. The name customization feature presents a design trade-off between allowing collection owners to enhance or hide their identities at the cost of ambiguity and of potentially frustrating listeners.

The design decision to present another user's library as an ascending alphabetical list requires individuals to do the work of scrolling down through potentially enormous collections to see the entire contents[5]. Previous research suggests that users are unlikely to scroll [15], but in iTunes, these same users are likely to make a binary decision about the value of the library based on what they do see. Alternate visualizations designed to help novices and experts (of each library and the genres of its musical content) navigate their way through the contents seem valuable.

Finally, while people make significant judgment calls up front about whether they will ever revisit a library, almost all the participants continued to add new music to their own libraries. iTunes did not provide any mechanism to signal that new music had been added to an individual's collection. We think that in addition to encouraging people

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5 Although iTunes provides another view that allows people to filter or browse by genre, artist, and album, it requires activation by pressing a browse icon, a feature which few participants had discovered.

to reexamine libraries that they previously had no interest in, foregrounding new music would also attract people who liked some of the music in another person's library and wanted to see whether they would also like the new additions. In our data, we noted several cases of participants working outside of iTunes (in person or via email) to alert others to the presence of new music in their collections.

Making Sense of a Dynamic System

Although the potential dynamism created by a person adding new songs to their library largely went unnoticed, other types of dynamic events were more visible. In particular, the arrival of new collections on the network and the coming and going of people's libraries were very visible.

We were surprised by the excitement generated by the arrival of a new person and their music collection on the network. More than one participant described the presence of a new collection as an *event*.

> …all of a sudden thirty gigs more music appeared on the network. That was a notable event (P12).

> Someone's collection shows up for the first time…you wonder, you know, what their musical taste is and you want to find out, you go through it, you want to know whether there's going to be some cool music that you can listen to that you don't currently have in your own collection or through the other people that you already know….That's a good event if somebody shows up (P6).

It was the arrival of these new collections that triggered the first and deepest exploration of the library by many other participants.

The more routine coming and going of music collections was not as notable an event, but people did notice. Indeed, some participants were highly attuned to this dynamic system, noting when music libraries disappeared and responding accordingly. Two of our participants had adjacent offices. During one interview, the first participant noticed that the second participant's music library had disappeared: "Oh, [P2] just rebooted his machine. His music went away. [Shouting through the wall at P2, next door]. [P2] what happened? Did your machine crash?" (P1).

For some participants, the dynamic nature of the iTunes virtual world mapped conveniently on to the dynamic nature of the physical world; iTunes became an explicit mechanism of awareness.

> The interesting thing is that so this list is dynamic, so by definition if I see those people it means that they are online and here, which is kind of interesting because for some people it actually sort of doubles the functionality of IM. There are some people here that I don't have on my IM list that I have in the iTunes so I don't have [P6] on IM but if I want to talk to him today I know he's here so that's kind of nice (P11).

For other participants, the mapping was more complex. Another participant had figured out that some music libraries were shared from laptops and some music libraries were shared from desktops. As such, if a desktop user's library were still available, it was possible that user was not actually present but had, instead, left his iTunes application running in the background.

> [P9] and Pete have the stuff loaded onto their desktops and so their things are always here at work…. Everything else disappears….Everybody else has it on their laptop, as do I (P12).

The coming and going of some members of the iTunes subnet groups also fore-grounded asymmetry in the awareness information provided. Assuming one had mapped an iTunes library to its owner, as most of our participants had, one knew whose music one was listening to. The music provider, on the other hand, was not aware of who was listening to her music. When a music provider shut down iTunes, her music was no longer available to anyone who might be listening. For the listener, the music stopped abruptly and without warning. The provider was informed that someone was connected to her library, but it was unclear (a) whether someone had merely downloaded information about the contents of the library or was actively listening to the music and (b) who that user was.

One of our participants recounted a conversation with another participant about what it felt like to disconnect someone's music: "She was saying how she felt bad disconnecting because she figured someone was listening" (P12). Because the listeners likely knew who turned off the music on them, they knew who to hunt down: "I know that every so often when I turn this off or reboot my machine, he comes by and says, 'Hey, what's happened?'" (P3). In contrast, the music provider did not know who they might have inconvenienced.

> I notice that when I power down at night, there's frequently somebody, you know. It gives you that message that says, "Are you sure you want to turn off iTunes, somebody is listening to your music?" That's interesting; I wish I knew who it was… (P13).

One participant felt strongly that music within the subnet groups should be more consistently accessible to members of that subnet group, particularly if someone had just logged off of iTunes for the evening. He knew that their music was still on their machine and that their machine was still connected to the network and the music should, therefore, be available. This participant had considered using a utility like getTunes[6] to exploit iTunes music streaming and to copy the music he wanted access to in the off hours.

Another sense of the loss of music on a larger scale occurred on two separate occasions when two iTunes users left the company. In one case, a participant noted disappointment; he had been in the middle of a process of discovering enjoyable new music from one ex-employee's library. In the other case, a backup CD that included the employee's music files was discovered as his old office was cleaned. That music was added into the music library of a

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[6] http://sourceforge.net/projects/gettunes/

participant, giving the second ex-employee something of a ghost presence on iTunes.

Design Implications: Designing for Comings and Goings
One difficulty with the dynamism inherent in iTunes was the asymmetry associated with closing a connection. Users disconnecting did not know whose music they might be shutting off. The discomfort that people felt after having cut someone off without the ability to warn them or to apologize suggests that listening to music might be like having a conversation; appropriate closure is needed. Facilitating closure in iTunes could happen in a variety of ways – more explicitly by providing a chat facility (although as with Napster, we are not sure whether this would be used) or more indirectly by automatically increasing the size of the stream buffer to allow the connected user to finish the song.

The dynamism of iTunes also fore-grounded the loss of music when individuals logged off of iTunes. Participants reported frustration with the inaccessibility of music that they knew was still on a particular machine and still connected to the network. One might consider making music available regardless of whether a user is logged on or running the iTunes application by implementing music sharing as a system-owned service, similar to the way in which many operating systems implement FTP and Web services. Such a feature could also be useful for civic sharers, those who shared music without ever using the application, themselves (see discussion in the next section).

When a user shuts down their iTunes application or even permanently leaves the community, as was the case with the two ex-employees, there was a "hole" left in the music community. Additionally, one could explore design techniques for leaving "traces" of those missing playlists. These "traces" could be useful if you wanted to purchase any of the music that was no longer available, supporting users who knew they had liked some of the departed music but could not recall the specific album or artist. The "traces" could also support users who were in the middle of discovering new music in the departed libraries.

Technical, Musical and Corporate Network Topologies
Throughout this study we found overlapping networks: technical subnetworks, networks of individuals with shared musical interests, and corporate networks of departmental divisions and employee hierarchies. The interplay among these three types of networks created some interesting sharing patterns.

We found three strong dyadic pairings of "compatible" users who often shared an interest in a type of music that was not widely available on the network. In one case, the pair were both interested in jazz music. While they often talked about music with each other, they had resigned themselves to not being able to share music because they were on different subnets.

In the case of another pair, both interested in classical music, the challenge of the subnet was something more tractable to be overcome.

> You can only share [with] people in the same subnet and I wasn't in the same subnet as her. That's was the reason why I had to have help. Finally someone figured out, oh you're not on the same subnet. So I had to get my subnet changed (P7).

Once the subnet "problem" had been resolved, the manner in which these two shared music was asymmetrical.

> He doesn't have a real extensive collection here…actually he didn't put stuff in his that he knew I already had so he's just kind of filling in some gaps (P13).

In other words, P7 who has never used iTunes, himself, to listen to music, brought CD's to work to rip so that P13 could listen to them.

In the case of the third dyad, we also noticed an unspoken asymmetry. This dyad shared interests that were originally unrelated to music. They made a joint decision to share their music libraries with each other in order to broaden their personal musical horizons. And indeed, this was the case for one member of the dyad who described listening to the other person's music and learning about the genres that his colleague enjoyed listening to. Although he assumed that his colleague was reciprocating, in our interviews we found this not to be the case. The lack of awareness about who is listening to what of your music allowed two people to believe quite different things about the nature of their music sharing.

Another feature of the relationship between technical and corporate networks also struck us in the course of this study. Although we can not draw any causal conclusions, we thought it was interesting that the most populated iTunes subnet in the corporation was the only subnet organized around department rather than building floor.

Even for those on the most populated subnet, the potential for what resources lay beyond that subnet proved irresistible. Most typically, this took the form of questions and speculation. Several participants reported that they were happy to be patient; they were certain that another member of the department, one commonly known to be a tinkerer, would discover a hack that would allow them to share music across the remainder of the company.

Another reason to want to see beyond the local subnet came from a member of the administrative staff who found himself on a separate network from those whose research he was tasked with supporting.

> We're always, in public relations, looking, you know, to sort of get to know the researchers better and get to know little windows into what they are about....I don't know these people that well and I want to have conversation pieces (P1).

Design Implications: Exploring Boundaries of Music Sharing
Discovery protocols vary in how they set the boundaries of what they can "see." Rendezvous happens to use subnets. The level of technical knowledge in this corporation was

significant enough that the subnet boundaries of iTunes' discovery protocol were transparent enough merely through the list of what music libraries could be seen. Yet while the specifics of the technical boundaries may be clear to those with sufficient technical knowledge, we posit that other users would require a more transparent accounting of the technical boundaries of discovery within the iTunes interface.

Alternately, boundaries defined by networks other than technical networks may make more sense for many potential discovery technology users, especially in the case where discovery must be limited. One that we would like to see further explored is the organizational network.

The dyads we noted in the musical topology of this organization wielded a unique sort of power, particularly if they do, on their own, constitute critical mass. It seems important, then, to support these dyads, particularly when the musical and network topologies do not overlap. One might consider ways of allowing these boundaries to have more flexible edges, perhaps by providing guest licenses for music sharing groups.

REVISITING THE MUSIC SHARING DESIGN SPACE
Intimacy & Anonymity
The workplace, we felt, was a particularly fruitful context for exploring the design space between intimacy and anonymity in music sharing. In fact, the context of the workplace challenged our implicit assumption that the axis of intimacy and anonymity was a single, straight continuum. Over the course of this study, it became clear that there were many facets to an individual's identity and that interactions and relationships may have a different degree of intimacy depending on which facet of identity was being fore-grounded. There were many individuals in our study who worked closely with each other on a daily basis. Many of their workplace interests overlapped to a very high degree. From this perspective, we would probably be inclined to characterize their relationships as being more intimate than anonymous. But until their adoption of iTunes, most of our participants had no idea what kind of music their coworkers listened to. The adoption of iTunes, then, meant that communities that were relatively intimate in some facets of their identities were able to become intimate in previously anonymous facets of their identity.

This study also fore-grounded the importance of context in impression management and the ways in which the grey area between intimacy and anonymity in the design space, the space occupied by iTunes, may be the most critical area with respect to impression management. In anonymous music sharing, the only impressions one has of a music sharer are those from the music library. In intimate music sharing, the particulars of a music library may be a small fraction of all of the outside context or prior experience used to form an impression. As one participant pointed out, however, it is the grey area in between that can be most problematic in impression management.

Music…says something about your identity, you know, in some ways, right; it says something about who you are. I would talk about music with perfect strangers, like someone that I would never see ever again...and someone that I know really well I can do this also because I know they'll be able to sort of interpret my taste with enough background information to know where it is coming from. But there is a sort of in-between state where people can form misguided perceptions and you'll have to interact with them again so this can be a problem but they won't have the context and the background to reframe whatever impression they made of you according to the proper information (P11).

It is the grey area represented by iTunes in which these "misguided perceptions" are mostly likely to form, perceptions created from not quite having enough outside context to balance the impressions given off in iTunes.

Disparateness
Although there was potential solely within iTunes for people to discover new music, it rarely happened. Users looked at others' music libraries and made binary decisions. If the library contained music they did not recognize, they would likely never return. Perhaps we might hypothesize that our participants did not want to discover disparate music, but this was not the case either. Our participants didn't want to become a musical "fuddy duddy" (P1); they wanted to use iTunes to be "exposed to new music" (P10).

It turns out that our participants were discovering new music; the motivation and impetus for doing so was, however, happening outside of iTunes. One participant (P6) was invited to screenings of Bollywood movies and discovered that he really liked Bollywood music. So when he stumbled onto something that looked like it might be Bollywood music in iTunes, he started listening. Another participant (P13) was loaned a book about a musical artist. Although she was primarily interested in the political aspects of the biography and had never before listened to his music, when she found his music on iTunes, she decided to try it. If it were not for musically-related social interaction outside of iTunes, these participants would not have discovered new music inside of iTunes. This suggests the need for increased social scaffolding for exploring new music, particularly within music sharing technologies that afford music sharing among users with disparate musical tastes.

CONCLUSION
In this paper, we have provided descriptive evidence of the practices surrounding the iTunes music sharing of employees of one corporation. We have explored new areas of the music sharing design space supported for the first time by Apple's iTunes. We have also explored the impact of iTunes' technologies, its interface and discovery protocol, on music sharing practices. These technical innovations have allowed for a greater number of ways to share digital music and have supported new technical boundaries among groups of music sharers.

From many perspectives, it would seem that these technical innovations pull the opportunities of design forward while

political, legal, and ethical considerations push those opportunities back. When we fill gaps in research and add studies of users' actual practices surrounding music sharing to our understanding, however, we find that this antagonistic push versus pull perspective does not always hold up. It is through studies of practice that we can come to understand users' underlying motivations. When we come to understand why a user would consider circumventing legal means of music sharing, for example, to download getTunes, we can also come to realize that the underlying motivation for doing so is entirely reasonable and that the desired practice could be supported through entirely legal means, by supporting music sharing as a system-owned service, for example. From a perspective with an additional understanding of practice, technical innovations pull the opportunities of desired practice forward in ways that are politically, legally, and ethically sound.

One of the greatest challenges for technical innovation in music sharing may be in allowing designers to make the leap between treating music sharing technologies as personal music listening utilities and treating music sharing technologies as online communities. Although music sharing has traditionally been a strong indicator of group identity and has reflected shared musical taste [5, 10], our study of iTunes music sharing has demonstrated that even groups with disparate musical taste can form strong group identities. The iTunes subnet groups became iTunes communities, highly attuned to the coming and going of others and impacted by the loss created by the absence of community members.

A study of practice highlights the need for music sharing technologies to support communities of music sharing, allowing community members to establish closure in interactions, providing a lens onto the collective community's (departed) music resources, and perhaps then even supporting the evolution of roles within communities, such as community DJs (e.g., http://www.webjay.org/).

Music sharing is a quickly moving target for research. It is propelled by technical innovations and political, legal, and ethical considerations. Music sharing technologies are both socially implicated and socially implicating technologies and we hope this descriptive account of the practices surrounding their use will enable designers to move forward in supporting desired and emergent music sharing practices more comfortably within the space of technical innovation and political, legal, and ethical considerations.

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