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New computer applications, such as the infamous "Napster" system enable the sharing of music over the Internet, with limited communication around this sharing of music. This paper discusses the use and opportunities for these music sharing technologies using interviews with users of both conventional and new music sharing technologies. The data show that music sharing is a practice that is richly linked with other social activities. New music is often discovered through friends, by listening to music together, or in the form of compilation tapes. In these environments, sharing music is a natural activity. With music sharing over the Internet, however, much of this social context is removed. This suggests opportunities to turn music sharing into a more collaborative and community-related activity. These opportunities are explored with the "Music Buddy", a system for browsing others' music collections without infringing the copyright of artists.

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Abstract: New computer applications, such as the infamous “Napster” system enable the sharing of music over the Internet, with limited communication around this sharing of music. This paper discusses the use and opportunities for these music sharing technologies using interviews with users of both conventional and new music sharing technologies. The data show that music sharing is a practice that is richly linked with other social activities. New music is often discovered through friends, by listening to music together, or in the form of compilation tapes. In these environments, sharing music is a natural activity. With music sharing over the Internet, however, much of this social context is removed. This suggests opportunities to turn music sharing into a more collaborative and community-related activity. These opportunities are explored with the “Music Buddy”, a system for browsing others’ music collections without infringing the copyright of artists.

Introduction

One of the most controversial computer applications of late has been the “Napster” file sharing system. Napster has made front-page news worldwide, with the legal drama around the service causing much comment and attention (see for example (Hellmore, 2000, Richtel, 2000)). Napster is a program that allows a user to copy MP3 music files over the Internet from other machines running the Napster program. When a user runs Napster, their music files are automatically shared onto the Internet creating a community of users from which music can be downloaded. At the time of writing, the Napster web site from which the program can be downloaded has become one of the most popular web sites worldwide, and the Napster system itself has more than 6.7 million active users (Konrad, 2000).

While sharing music over the Internet was possible before Napster, it involved setting up a server on which music could be stored and downloaded. Since sharing music over the Internet is an activity that is at best of dubious legality, finding individuals who would be willing to do this was difficult and such servers were easily shut down. Napster, however, uses a peer-to-peer sharing model in that any machine running this application can act as a file server without needing to have a permanent connection to the Internet. This extends the number of possible servers to just about any machine that can be connected to the Internet. By enabling the sharing of music between its users, Napster has attracted the attention – and lawsuits – of the music industry. Currently, Napster is still involved in numerous lawsuits, but has settled with a number of the labels and is attempting a transition to a pay-for-use service.

Napster computerises an activity that has been commonplace for many years – the sharing and piracy of music between individuals. In this paper, we would like to investigate what lessons there are for CSCW from investigating music sharing with both conventional and new media. The data we have collected for this paper come from in-depth interviews with users of both conventional music media and early adopters of the new MP3 technologies. This lets us unpack some of the contrasts between sharing with physical tangible media (such as tapes or CDs) and sharing with MP3s over the Internet.

We start the paper by exploring the relevance of music sharing to the field of CSCW and briefly review the existing literature on this topic. We then move on to discussing the study itself which was based around thirty-six interviews with music enthusiasts. The paper then looks specifically at how conventional music media were shared, and in particular the social activities which took place around sharing music. We then discuss sharing music online, and in particular the differences in *tangibility* between MP3 and physical music media. In the implications section, the paper then draws out the relevance of these findings and discusses two new concepts we are developing using the results from the empirical study to explore new opportunities for digital music media.

Relevance of music sharing to CSCW

While music sharing is a novel activity in terms of CSCW, its importance is underlined in both its massive popularity and the opportunities it presents for exploring socialisation. Online music sharing through Napster has been very successful. Along with the media attention and controversy, the system itself has gathered a huge user base in a very short time. Indeed, Napster is something of a large-scale live experiment in online file sharing. By investigating the success of Napster, we can learn lessons for more conventional CSCW applications. In turn, by understanding the social processes which are involved in conventional music sharing, we can gain understandings of both how new music technologies might evolve and how better to design products and services which support music activities.

Music sharing is also an activity that allows us to explore issues surrounding friendship and community. Many existing Internet and CSCW technologies are used

for communication between friends. Perhaps the most researched are instant messaging systems (Bradner, *et al.*, 1999, Nardi and Whittaker, 2000), but other systems such as IRC and photo sharing sites (e.g., Shutterfly <http://www.shutterfly.com/>) also support friendship. However supporting the activities associated with friendship has not, until recently, been a topic in its own right in CSCW, although it has attracted research more broadly in the CMC field (Kollock and Smith, 1996, Preece, 2000). Its relevance to CSCW was highlighted by Robert Putnum's keynote to CSCW 2000 where he asked researchers to look to design technologies that *bring people together*. That is, to design technologies which enable people to enrich existing friendships and make new friends and social contacts both in leisure and work activities. In this paper, we explore music as one potential platform for this.

As a medium, music is also of interest as an example of computerisation. In earlier research we have looked at the differences between paper and electronic documents (Sellen and Harper, 1997). This work emphasised the different affordances of both physical and digital documents. While electronic documents are easily manipulable, they lack many of the affordances of paper documents, in that they are harder in some ways to share, control and use. Music is an interesting new genre to explore in this way. Only recently have computer-based tools to store, share and manipulate music become readily available to users. Furthermore, by contrast to paper documents, music recordings require some kind of technology in order for users to access them. Thus it is possible that the advantages of physical *tangibility* may not apply as they do in the case of documents. However, as we will discuss later, we discovered that this was not the case, and that with music, the tangibility of physical music recordings is still a very important issue.

Music technology is also an area which is itself attracting increased interest. For example, Bowers and Hellstrom (Bowers and Hellstrom, 2000) have discussed the creation of music using innovative music technologies for improvising music in live performance. There has also been work on interfaces to pre-recorded music (Pauws and Bouwhuis, 2000). However, research in this area has yet to address the opportunities that the new distribution and compression technologies offer.

Lastly, while music sharing is an activity that is not normally thought of as "work", household and social activities have increasingly been recognised to be of relevance and importance to CSCW in that both the methods and findings in these areas have relevance to the core issues surrounding collaboration and work. As an example of this, McCarthy's 1998 CSCW paper describes the *music-fx* system (McCarthy and Anagnost, 1998). This system was designed to support group music choices in a fitness centre. The system automatically chose music channels to play based on the music preferences of who was in the fitness centre at that time. While this system was obviously not designed directly for the workplace, (it supported *workouts* rather than *work*), it has had relevance for other research in CSCW. There is also an increasing body of work that applies the techniques of CSCW to the design of non-work technologies (Hughes, *et al.*, 2000, O'Brien and Rodden, 1997).

Legality

A more contentious issue surrounding this area is the legality of music sharing. Value judgements about music sharing are inherent in the terminology that one used to talk about the activity – does one speak of music piracy, or music sharing? Very different values are evoked by both of these terms. One evokes the values of theft and abuse, the other of community and reciprocity. For example, showing careful use of language, the UK anti-piracy organisation calls itself the “federation against copyright theft” (FACT), evoking a direct analogy between theft and piracy. However, as has been discussed in the legal literature on piracy there is no simple analogy between theft and piracy (Couser, 1999). For example, theft as an activity denies someone else the use of an artefact, whereas in music piracy, almost the opposite happens - the use of some media is extended to whoever pirates a copy of it. This is not to downplay the damage that can be done to recording artists if they are not properly compensated for their efforts. This provision – that artists are compensated sufficiently to record new material – is at the heart of American copyright law. It is for this reason that within the U.S. the sharing of music between friends for personal use is legal (Plumleigh, 1990). While an in-depth discussion of these issues is outside the scope of this paper, it is an important consideration that any technology we build helps, rather than hinders, the reward of artists.

Music Sharing in the Literature

One of the first recorded instances of music piracy was the copying of Allegri’s *Miserere* by Mozart in 1769:

“Young Mozart attended a performance of the celebrated *Miserere* of Allegri which could be heard only in Rome during Holy Week performed by the papal choir. By papal decree it was forbidden to sing the work elsewhere, and its only existing copy was guarded slavishly by the papal choir. Mozart, however, had heard the work only once when, returning home, he reproduced it in its entirety upon paper. This mind-boggling task soon became the subject for awed whispers in Rome; it was not long before the Pope himself heard of this amazing achievement. The Pope summoned Mozart, but instead of punishing the young genius with excommunication, he showered praise upon him and gave him handsome gifts.” (Galan, 2000)

Despite young Mozart’s efforts (or perhaps even because of them) copyright entered international law with the signing of the Berne convention in 1886. Copying music and the associated problems of piracy have remained ever since. Chesterman and Lipman (Chestermann and Lipman, 1988) describe three types of pirated music. *Counterfeits* are copies of music sold for profit in shops or markets and often passed off as original copies, *bootlegs* are unauthorised release of artists work, such as recordings from live performances, and *home-taping* is the copying of music by individuals for use in their car or to be given to friends. It is home-taping which we will have most interest in here, since it is the category of piracy which is most relevant when discussing new technologies such as Napster.

Controversy has ranged around “home taping” since the event of the compact cassette tape in the sixties. While the record industry has claimed at various times that

home taping is “killing music”, tape manufacturers have claimed that home taping increases sales, as individuals come to hear music they would not normally purchase (ibid, 141). For example, the British music industry’s representative body conducted a study that claimed that 55% of the population used tapes to copy music, whereas the tape manufacturers claimed 22%. For the music industry, however, the key question was what proportion of copied music would otherwise have been bought. Their own surveys suggested 51% of copied music would have been otherwise been bought, whereas the tape industry argued that copying actually increased sales as individuals copied music to “try before they buy”. This debate has generally remained unresolved, with the arguments moving onto legal measures (Plumleigh, 1990).

These issues have been cast into sharp relief with the advent of technologies such as Napster. Along with Napster there is a bewildering array of new technologies which attempt to provide similar functionality. Gnutella, for example, allows files to be shared without any form of centralised server. While few of these technologies have yet to reach the notoriety of Napster, peer-to-peer file sharing is a rich developing topic for both software developers and researchers (Oram, 2000).

Turning to understanding the usage of these new file sharing technologies, the literature on conventional piracy is of only limited use. There are no descriptions of the details of copying practice, of why media is copied, for what purposes, from whom, and as part of what other activities¹. These issues come to the fore if we are to understand (and perhaps better exploit or control) music sharing applications. The main focus of piracy research has been the economics of the situation, where it has been argued that piracy – in certain contexts – can be of net benefit to a market (Bakos, *et al.*, 1999). However, there is little empirical data in the literature from the actual sites in which piracy occurs. In one recent study of online file sharing Adar and Huberman (2000) have argued that there is a “tragedy of the digital commons” using a study of usage of the Gnutella system. While widely reported, this research has been criticised for over generalising from the specifics of one system (Shirky, 2000 and see also Turner, 1993 for a discussion of solutions to the ‘tragedy’). Moreover, the tragedy of the commons scenario is itself one which has been open to considerable debate (for example, McCay and Acheson, 1990), not least because it fails to consider how communities might self-organise. This suggests that there may be opportunities for investigating the activities surrounding music sharing in more depth.

Methodology

The data for this paper were collected as part of a more general study looking at the consumption of music media. The aim of this study was to uncover the details of music consumption and to draw implications for the design of new music technologies. A particular focus was on how the affordances of different kinds of

¹ There has been some work on software piracy but this work has tended to treat software piracy somewhat blankly as a form of immoral deviancy rather than investigate it in-depth (Gopal and Sanders, 2000).

music media and technology (e.g. tapes vs. CDs vs. digital music files) influenced these activities. The study looked at the whole “lifecycle” of how consumers use music, from how people first find out about it, to how they obtain it, listen to it, share it, organise it and collect it. A major finding from this was the importance of *sharing music* in both conventional and new media formats. In other work we have discussed the results from this study more generally (Brown, *et al.*, 2001); in this paper we will focus specifically on music sharing and the implications that this has for technology design.

Group	No	Criteria	Av.	% Male
Teenage conventional	12	> 11 music purchases a year and age <20. No use of MP3 files.	16	42%
Adult conventional	12	> 11 music purchases a year and >=age 20. No use of MP3 files.	30	42%
MP3 early adopters	12	> 11 music purchases a year. listen to MP3 files > 5 times a week	27	71%
Total	36		24	56%

Table 1: Choice of participants

Choice of participants

We felt that in a study such as this it was as important to study conventional music media use as much as use of the new music technologies. Accordingly, we chose thirty-six music consumers from three different groups: teenaged users of conventional music media (e.g., CDs, vinyl, and tapes), adult users of conventional music media, and a group of new music media users (MP3 users). The rationale for focusing on music enthusiasts came from an analysis of market data collected in the U.K. by Mintel (Mintel, 1998). Mintel’s survey asked consumers how many music products (singles or albums) they had bought for themselves in the last year. These data show that while only 16% of the population make eleven or more music purchases a year, this relatively small group accounts for 65% of the total number of music purchases made in the market. It seemed to us, then, that understanding this influential part of the population would be a good first step to understanding music use. We therefore screened for participants who fell into this category. We were also interested in understanding teenagers’ behaviour, since teenagers are particularly heavy purchasers of music (Mintel, 1998), and are a key market for the music industry. The selection criteria we used for the three different groups are summarised in Table 1.

Procedure

As the aim of our original data collection was to uncover the details of music behaviour across a broad spectrum, we used semi-structured interviews to ensure that the important issues we wanted to discuss were covered. The questions we asked were designed to probe a range of activities from first awareness of music through to collecting and archiving behaviour. As much as possible we also tried to unpack specific examples of participants’ activities around music. So, for example, we asked participants to describe the last three times they had copied or purchased music. Here

the focus was not just on their interaction with the music but also on the context within which the activities took place (such as where they were, who they were with, and what other activities they were engaged in). We also asked a more extensive set of questions for the MP3 group. In addition, rating scale questions were interleaved with the open-ended questions to complement the qualitative data. In total, participants were interviewed for between 1 to 1½ hours. All of the interviews were audio-taped and transcribed. The rating scales were subjected to simple descriptive analysis (means, histograms etc), as well as analysis of variance (ANOVA) for group differences.

Results and Discussion

To our surprise, in terms of the quantitative data collected through the rating scales, we found very few differences amongst the three user groups. With the obvious exception of the activities MP3 users carried out using MP3 files, there were no major differences between the conventional adult group and the MP3 users. For example, there was no significant difference in the amount of materials copied by both conventional and MP3 users. With regard to the teenagers, apart from the fact that they on average owned less of all types of media, the only difference we found between them and the adult groups had to do with Internet and email use. This was high for the MP3 group and overall quite high for the both adult and teenaged enthusiasts, but the teenagers indicated significantly less use, probably due to more limited Internet access. Further, in terms of what we unearthed in the interviews, many of the same issues arose in all three groups. What was more interesting were the common themes that arose, with little evidence of any systematic differences for the different groups.

For this reason, we will focus on the interview data from this study rather than the rating scale data. Further, rather than discussing each group specifically, we will discuss the findings from the interviews in two different sections. In the first section we will discuss the sharing of conventional media. In particular these results show how music sharing is linked with friendship, collecting and identity. Then we will move on to discuss music sharing over the Internet, focusing on some of the issues which result from the lack of tangibility of digital files. These findings are drawn together in the implications section where we discuss two concepts developed directly from these results.

Music sharing with conventional media

While market surveys report that 15% of the UK population copy music using conventional, non-Internet, means (Mintel, 1998), all of our interviewees (both MP3 using and not) had copied some original recordings with conventional formats:

“Oh, [I copy] at least once a week. This week I’ve probably made about six or seven but at least once a week I’d say”

“It’s about 50-50 whether I copy it or buy it. It really depends on how available it is to be copied.”

The mean amount of copied material in our enthusiasts' collections was 28%. This suggests that copying was an important part of our enthusiasts' music consumption behaviour. Perhaps unsurprisingly, the major motivation for copying music was to avoid buying the music. The primary advantage of copying is that one saves money and can experiment with music that one might not have otherwise bought:

"That is one of the advantages of (home) taping, quite often you're not sure whether you'll like it enough to get it on CD but by taping you can listen to things and find out about a lot of different types of music and find out what your taste is."

However, this is not to say that those who copied did not buy music. We found no significant correlation (negative or otherwise) between the amount of copied material people owned and the amount they bought. Suggesting that copying did not inhibit his buying, one enthusiast who copied music heavily commented:

"Whatever I've been doing I've always spent as much as I can of my money on music without going bankrupt."

While this could be a feature of our sample (we chose individuals who frequently purchased music), Mintel has also reported that only 2% of their sample of the UK population copy music regularly but did not buy music regularly (ibid).

Music and friendship

The major source for material to copy came from friends. Indeed, copying music was an activity very much embedded in existing social networks. For the teenagers we interviewed, a common social activity would be to visit friends' homes and play video games or relax together. In these settings, music would nearly always be played, providing both a way of moderating the mood of the group, as well as a forum for finding out about new music. The older music consumers we spoke to also discussed music being played in groups, as a way of producing amicable social situations when friends or family visited their house. In these setting it is natural to ask for a copy of music from a friend, since it is easily available at the point where the music is listened to.

These settings are important for spreading the all important "word of mouth" about new music. Friends would play to each other new music that they had purchased or discovered. These social music listening environments promoted the exchange of information and taste about new music. Not only did friends get to listen to each other's music collections, but friends filtered music for each other, deciding what they thought others would like to listen to. This involved a form of mutual understanding; friends would get to know each others taste in music and so design their recommendations, and in turn their opinion of each others recommendations:

"I really value (my boyfriend's) opinion as he usually gets it spot on for me"

"I think its because you get to know a person's musical profile, for want of a better word, you can trust certain people's recommendations"

In this way, our enthusiasts and their friends acted as a form of collaborative filtering mechanism in how they found out about music and passed on recommendations (and copies). Friends also often searched through each other's collections, looking for

music that they might borrow or perhaps copy. Thus friends' collections were used as sources of new media to experiment with and explore. Another important social method by which music tastes were shared was through the swapping of compilation tapes (see also (Willis, 1990) on this topic). This sharing of music, although time consuming and cumbersome with most current technology, was particularly valued by our interviewees:

“All the cassettes and CDs that I treasure are the ones which are compilations. And it tends to be the way I get into a new music area. I recently have been getting into dance stuff because of John who taped his DJ collection for me and is gradually getting me into harder and harder stuff.”

Overall, these social methods of finding out about music were very important for how our participants found out about music. In asking them to rank 14 different ways they could find out about music, “Someone I know played it to me on their Hi-Fi” was the highest ranked. This notwithstanding, a number of enthusiasts also underlined the frustrations they had with finding out about new music:

Int: Do you ever have troubles finding out about music?

A: Yes I do a hell of a lot actually, I always hear it off my mates they always seem to find out about it but I seem to miss it all the time.

These frustrations highlight the potential for new technologies that help individuals to discover and expand on their music tastes. This is a point we will return to later when we discuss implications.

Identity and collecting

As has been remarked before in the literature (Frith and Goodwin, 1990), music choice is tied up with the formation of identity and membership of different groups. Often youth sub-cultures identify themselves using music as a way of forming and establishing their identity. Examples of this include “mods and rockers” (Cohen, 1972), “skinheads” (Clarke, 1975) and more recently “ravers” (Redhead *et al.*, 1997). To our interviewees, this connection between identity, sub-culture and music was also apparent, if in a less extreme way. The participants often would have friends who shared a taste in music. This gave them opportunities to socialise together around music, by going to nightclubs or live music together. Particularly for the teenagers we interviewed, a shared taste in music was an important bond for groups of friends. However, the older enthusiasts we spoke to also talked about having groups of friends with whom they frequently discussed new music, often swapping popular recordings and recommendations. Some enthusiasts even went as far as saying that if someone liked the same music they liked, this created an instant bond which would make friendship far more likely:

“There’s an instant connection, like if I meet someone who listens to the early Verve stuff then I think there’s something really important going on inside them [...] I think it brings me a lot closer to people if you can share the exhilaration that music can bring you.”

This is perhaps not surprising: music taste, as with other tastes, can be seen as part of an individual’s identity. Others who have similar tastes may have other aspects of their identity in common. Later in the implications section we will discuss how this connection between identity and music can be exploited to enhance socialising online.

This connection between identity and music also followed through into collecting music. In many ways a music collection acts as a tangible presentation of one's taste in music. Music collections were something that the enthusiasts took pride in:

"Your library expresses who you are. If everyone had access to the same stuff [...] it's not the same."

In particular, a collection of *original* recordings (as opposed to copies) was very much valued. Over and over again in the different interviews the enthusiasts returned to their perception that originals were better than owning a copy. While this was often described in terms of the superiority of a purchased original – having the sleeve notes, having a CD over a cassette tape, better quality recording – there was also a strong perception that a copy was less legitimate than an original:

"It's nice to have something permanently and properly, a bit of a feeling that (home) taping is quite scab [...] I don't think it's a moral thing, it's a more sort of genuine thing that you actually like it and gone out and bought it. I'm mildly embarrassed about taped things"

"If it is a band I really like I'll buy it for collectors use."

"I buy something if I think I'm going to listen to it lots, I mean its easy to buy something like the Beatles White album because it's going to last a long time. Although I listen to it far more on the [copied] tape version than I ever do on the CD – that's kind of the irony of it all"

One possible reason for this could be the connection between collecting and identity. In some ways, a music collection is a physical manifestation of an individual's taste in music. Thus if music taste is part of identity, then so is a music collection. A frequent comment from our participants was that if they found they really valued some music they would then go out and purchase an original to replace the copy. This suggests that having a collection of originals that reflects your taste in music is an important reason for buying rather than copying. Having a collection of originals of good music indicate good taste in the owner of a collection. As Belk puts it:

"[A] benefit of collecting is in enlarging the collector's sense of self. [...] the choice and assembly of objects to form a collection is ostensibly a self-expressive creative act that tells us something about the collector. [...] The surest way to undermine a collector is to observe that the collectible or collection 'is not you'" (Belk, 1995, p89)

To some of our enthusiasts, having an impressive collection of originals was a way of standing out from others. In this sense displaying the music collection became important, since the collection says things about us that it would be socially unacceptable to express aloud:

"I believe I've got optimal music tastes and I think my record collection reflects that, other people should respect it! (laughs)"

As will be discussed later, these findings have implications for the design of new music technologies, in that digital music fails to properly support this collecting behaviour.

Music sharing over the Internet

We now move onto music sharing activity over the Internet, as conducted by our MP3 users. Many of the MP3 files which our enthusiasts had on their computers were

recordings that they also owned in conventional formats. A CD can be placed into a computer and the music “ripped” onto the computer’s hard drive in MP3 format. However, one of the key advantages of MP3 files is that, because they are computerised, they can be copied over both local networks and the Internet. Our MP3 enthusiasts exhibited the same kinds of motivations behind copying as the conventional enthusiasts, but took advantage of MP3 files by either downloading from the “Napster” file sharing system or by exchanging them with friends.

In some cases, copying MP3 files followed a similar pattern as conventional copying. In these cases, files would be shared between friends over local networks, such as at work or on a college campus. For example, many of the university students we talked to had personal computers connected to the university network meaning that music could easily be shared between friends’ machines:

“You can [download songs] off the network. I discovered Stereolab, and I liked one of their songs and one of my mates said oh so and so got it on his computer so I went and had a look at that and he’s got both albums on MP3 so I downloaded them off and listened to them.”

Napster

However, the main method of music copying which the MP3 users discussed was the use of Napster. A Napster user obtains music files by searching the machines of users also connected to the Napster system, and downloads music files directly from them. Accordingly, unlike conventional music copying, this form of copying goes on generally between individuals who do not know each other and will probably never meet. This difference in technology also means that the number of tracks available far exceeds what could be copied from friends. At the current time, there are over three million tracks available for downloading. While many of these are duplicate files, this does give an idea of the amount of music available.

As might be expected, this change in the amount of music available changes the copying which is done compared to conventional music sharing. The enthusiasts talked about using Napster to experiment with new types of music that they would not have necessarily bought. This music was downloaded from strangers, without a social context, yet from a far wider range of music than available from friends. In doing so they compiled somewhat eclectic collections of tracks from Napster, instead of downloading whole albums:

“I think there was a Quincy Jones song, the theme from “Minder” – don’t know what came over me that night – and it would have probably been... Jolene by Dolly Parton. I wouldn’t dream of going and buying them.”

“I sort of do it in batches, just old classics that I have in my collection and I want to copy or just records I never got round to buying and I don’t want to go back and buy an old album because I just wanted the one track off it”

So rather than downloading music to directly replace buying, this downloading was more a way of exploring music that the enthusiasts would not normally have bought. Certainly, for the enthusiasts we interviewed they claimed that using Napster had encouraged them to experiment with new music and did not make them any more

reluctant to buy CDs. In fact, some said that this had increased their music purchasing (a finding also confirmed by other questionnaire studies of MP3 users (Jupiter, 2000)):

“I wouldn’t say its cut down on my music purchases at all, in fact to a certain extent it would make me go out and buy it in a way if I hear something by an artist on MP3 if I like it that much I’ll go and buy it.”

“It’s influenced which ones I buy but if I like it 9 times out of 10 I will buy it. I don’t think it has replaced buying the physical thing.”

This behaviour may have in part been caused by the time that it takes to download music from Napster (it takes about three hours to download an average album using a conventional modem). However, our enthusiasts with broadband connections showed similar behaviour - the physical media still had a crucial role in their music use. This finding led us to investigate what advantages physical media had which were causing our enthusiasts to purchase music that was potentially available for free over Napster.

Tangibility

Digital files have very different properties from physical music media. Files on a computer do not have a persistent physical presence which can be arranged to create an aesthetically pleasing display. Browsing through these on-line collections is also very different from browsing through physical collections with their accompanying artwork and sleeve notes. In addition, because they are not physically embodied, they are not as linked with social interactions. For example, digital files are not as desirable as gifts. Currently they cannot be as easily purchased as physical media. Moreover, digital files also have a number of serious practical problems with durability. File formats change frequently, and playback devices change:

“I wouldn’t be so keen on that [...] if everything is not physical then you’ve got worries [...] it will be harder to lend to friends who haven’t got the technology to access your collection and also not having sleeve notes and things like that”

“No, there’s no point. I like choosing – I like going through my records and then spotting one, if it was digital I’d have to [...] scroll down and it would be words”

These limitations seem to impact on the *collectability* of digital files. Our participants saw a collection of digital files as inferior to a collection of tangible physical media. When we asked our participants about collecting digital files rather than physical music objects they were consistently negative, even those who used MP3 files extensively. Digital music files were untrustworthy, of lower quality, and unreliable:

“I think I’d always like to have something there – the solid thing. The option of being able to do that [collect the music digitally] would have to be a lot cheaper than having a CD, I don’t know whether I’d actually trust it.”

This suggests that physical objects are more suitable for collecting and that current digital files do not support all the subtle activities involved in collecting. Of course, this is not to say that collecting digital music files does not have its own attractions (as discussed above). As mentioned in the introduction, this finding is similar to our findings on the use of paper documents (Sellen and Harper, 1997), and suggests some barriers to digital music superseding physical formats. For these reasons, we would argue that MP3 should not be seen as replacing physical media but rather as a

complementary format, at least in the short to medium term. Later in the implications section we will discuss how by connecting virtual and physical media this might be exploited technologically.

Music browsing

New digital media does have some advantages over conventional media in that it can be used in new ways. For example, one user described how the technology allowed him to bring together a whole collection of songs to be chosen and played at will:

“I copied all my Aerosmith ones [into MP3 format] so I could listen to them all on the computer – I could listen to them randomly – I could listen to any of the CDs. There’s about 150 [songs]. Mainly for the random capability.”

The new properties of digital media also enable new forms of collaboration around music. For example, one user (who we shall call Julie) developed a way of browsing the Napster system for new music. Julie would search Napster for particular songs from her favourite artists, and be presented with a list of users from whom these tracks could be downloaded. Julie would then use this information to browse through these individuals’ music collections. She assumed that since these users liked (or rather, had) a particular piece of music that she liked, there was a good chance that they would also have new music that she would like. In this way, users can navigate around the Napster network, finding users who have similar tastes in music and going on to search the music that they like. This is a form of music browsing, exploiting the fact that music tastes are often clustered in similar ways. Julie went further with this Napster browsing, turning it into a collaborative application. She would discover music through this browsing, sending the usernames of particularly interesting users onto two of her friends who were also keen Napster users, who would then “co-browse” these individuals. Common songs downloaded then became topics for conversation, both online and through the buddy chat systems that they used.

This use of Napster appears to combine some of the aspects of the collaborative filtering which is done by friends, with the ability to browse strangers’ music collections. This usage suggests opportunities for expanding the socialising around music, and music sharing; points we will return to in the next section.

Implications for Technology Design

In the above two sections, we have highlighted some of the details of sharing music in both conventional and MP3 form. Music sharing with conventional media is deeply embedded in social activities, connected with both friendship and identity. For these activities, the physical nature of conventional media is highly important in how it affords certain uses, particularly the collection of music. For computer-based media, we have discussed the use of Napster and how it differs from conventional copying, and can be used as a tool for browsing and exploring new music. We now turn to some of the implications of this work for the design of technology. We will discuss general implications of this work for CSCW, and then move on to discuss two

specific concepts which we are building based on these findings – the “Music Book” and the “Music Buddy”.

One important finding from this study concerns the tangibility of physical music media. It appears that even though music requires intervening technology in order to make use of different physical forms of media, those physical objects are still of value in and of themselves. Activities such as collecting, sharing, ownership and purchase seem to be deeply embedded in the physical artefact. This suggests that digital music will not inevitably supersede physical formats. Indeed, we would argue that it is in the mixing of physical and digital formats that many opportunities lie, a point we explore in the next section.

A second finding of relevance to the design of CSCW systems concerns the ability to easily share electronic media over the Internet. While the web has enabled the sharing of documents more easily than before, even the web presents some barriers to sharing files in that one must establish and maintain a web site. Even well designed lightweight systems such as BSCW suffer from a similar set-up cost (Bentley, *et al.*, 1997). Napster demonstrates an even simpler model: simply run a program and your files are shared over the Internet. This suggests that the peer-to-peer file sharing model may offer opportunities for the lightweight sharing of work documents over the Internet, in particular for *ad hoc* groups where the lifetime of the group may not justify the setting up a CSCW shared space. Napster’s peer-to-peer nature means that there is no need for a centralised server, and in turn no need for the administration of that server, reducing complexity and cost.

As we mentioned in the introduction, Napster is of immense popularity. A major part of this popularity is the ability to browse through media, sampling different types of music. This suggests entertainment media as a powerful “hook” for Internet communities more generally. The results above show that while conventional music sharing occurs with friends in social environments, with online sharing much of this sociality is stripped away. Certainly, sharing music online with current technology is an activity that is very ‘lean’ and involves little communication². These findings imply that online music applications could better support communication with friends around their music collections. Further, as discussed above, music taste is also part of an individual’s identity. This means that those with similar tastes in music may have other aspects of their identity in common. If we meet someone who shares a particularly eclectic music taste then there is at least the potential of a bond of friendship. At the very least, there is a common conversation topic. This suggests that online music applications could exploit this to support community and the generation of new friendship around music.

Within CSCW this connection between identity and ownership has been discussed in work on collaborative filtering systems, specifically systems which support filtering for individuals with particular expertise, such as “Who Knows” and “Expertise Recommender” (McDonald and Ackerman, 2000, Streeter and Lochbaum,

² While Napster does provide limited opportunities for socialising around sharing music (chat rooms, a messaging system), these are limited aspects of Napster which is mainly designed for sharing music.

1988). However, looking at the example of music emphasises a connection between identity and *collecting* behaviour which has been previously neglected. This suggests that for some collections there is a special connection between the owner and the collection – since the collection has been selected in part to represent that person. In this case it is music, however other examples are collections of movies, art, books or academic papers. These collections could prove to be especially valuable for identifying individuals.

Experimenting with tangibility: The “Music Book”

Using the results from this study, we have developed two new concepts. The first concept is called the Music Book and combines some of the advantages of physical music media identified above with the flexible nature of digital media. The concept takes the form of small CD sized books. Each book represents one album, yet, rather than storing the music itself, the book is designed to connect with an online copy of the music. Music books contain a small RF tag that acts as a unique identifier. The book itself contains information and articles on the artist and album, much like an extended version of the sleevenotes that currently come with an album. When the book is waved in front of a suitable player, the RF tag is read and the music connected with the book is downloaded from the Internet and played. In this way, the Music Book can be used just as a conventional record or CD would have been, giving a tangible and substantial representation of the music.

However since the music is stored centrally, what is played can be of near unlimited duration and can be accessed from any device connected to the Internet. This means that any Internet connected player – either portable or home-based – can access the music without having to be physically close to the Music Book. This combines the advantages of the physical and virtual. Music Books can be collected and displayed just as conventional CDs are. This supports the all important sense of ownership and collection which was discussed above. Searching for a piece of music can be done by physically looking through the collection of Music Books, rather than having to choose a album on a computer interface. Music Books can also be lent or borrowed.

Music Books therefore combine the advantages of both the physical and the digital music distribution worlds. With this system, users can choose to buy music digitally online. If the music is bought online, the music (or the rights to access the music) can be downloaded to their player. This gives them the ability to instantly listen to the music on their digital player as soon as it is purchased. Soon after this, the corresponding Music Book is sent to them using the conventional post. The music tag on the book links to the digital music content. The individual therefore has instant gratification in that they can listen to the music digitally as soon as they buy it, but they also have the corresponding advantages of the physical artefact. Music can also be sold through existing retail outlets, even though all the actual music is distributed electronically.

Experimenting with music and friendship: The “Music Buddy”

A second invention we are investigating looks specifically at the differences in music sharing online and in conventional media, in particular the amount of *socialising* that takes place around music sharing. As we discussed above, music is an application that is particularly suited to linking with creating friendship or community bonds, since in the physical world it is strongly linked with social activities. A similar observation comes from the collaborative filtering of friends’ music tastes for each other. This suggests that the music collections of friends, and those with similar music tastes, would be a useful resource for discovering new music. With conventional music media, the enthusiasts we interviewed would look through friends’ music collections to discover new music and experiment with music that they would want to listen to. Therefore there may be value in browsing through other’s on-line music collections as a way of exploring music.

These observations led us to develop an application called “the Music Buddy” to help support discovering new music, and making friends through music. In designing the Music Buddy, our aim was to design an application that would combine some of the advantages of physical music sharing with those of Internet music sharing. We also wanted to support the browsing of music collections, yet in a legal way. We were conscious of the various legal and moral implications of sharing music in an on-line application. This in mind, we wanted to design a system which would support rather than undermine the purchasing of music. The system we have designed and are prototyping is shown in Figure 1.

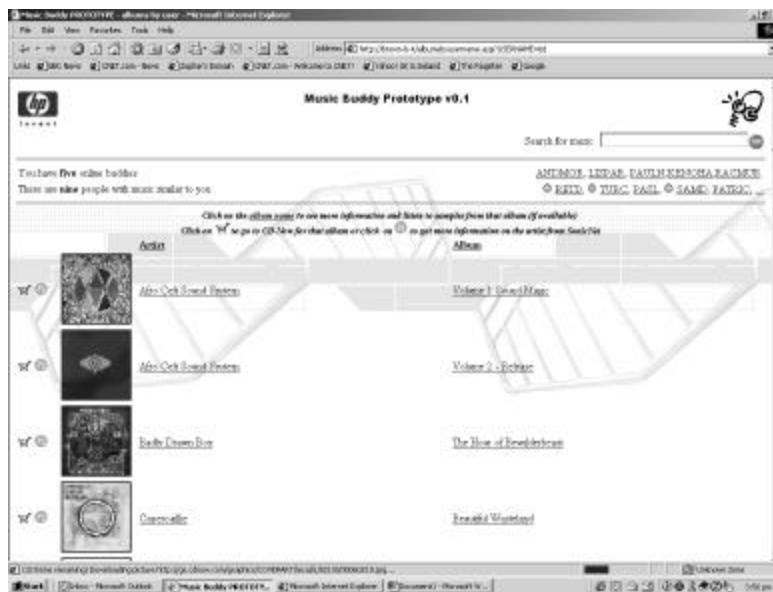


Figure 1: The Music Buddy

The system starts by uploading a list of a user’s music collection onto a centralised server. This is done by an application running on the user’s machine which collects a list of MP3 files using MP3 format ID3 tags which list album, artist and song. This

list is then sent to the centralised server which records which users have which songs. The server then supports the browsing of this and others' music collections using a normal Internet browser. To start, the system displays lists of songs by user. By clicking on a song, album or artist, a list of other users who also have that music is then listed. In turn, these related collections can be browsed. Importantly, this design does not enable copying music or infringing copyright. Instead, it only provides the names of individual tracks which are held on the server. The system then offers links to on-line music retailers to listen to legal samples of the music. In this way, users can explore new albums with the convenience of having an immediate link to a retailer if they should wish to purchase new music.

This "music browsing" functionality is an attempt to address some of the frustrations our interviewees expressed with finding out about new music. Different music collections act as a form of collaborative filter, in that one can browse through different music tastes in a structured way. Existing collaborative filtering systems (such as the Firefly and RINGO systems) work by a user specifying a set number of items which they like (Shardanand and Maes, 1995). With the Music Buddy, however, a user's music taste is automatically uploaded in the form of a list of the MP3 files they already have on their machine. This provides a more reliable and less troublesome way of getting at different users' tastes in music. Once a user's music taste is in the system, the system can then use techniques for matching the user with other users to suggest music that they might like.

While this functionality supports the browsing and discovery of new music, we also want to explore how this system could support friendship and socialisation, exploiting many of the algorithms which have already been developed in the collaborative filtering community (Ungar and Foster, 1988). We are exploring how the system could join small groups of users together with similar music tastes. Our aim is to make this as lightweight as possible so as to encourage new social interactions. We are also exploring how this messaging functionality could connect with existing instant chat and email systems. While the Music Buddy is currently in prototype form, we hope to make the system available over the Internet so as to collect as wide a range of data on music tastes as possible. In this way the Music Buddy is a platform for experimenting with individuals' music tastes. The data in the Music Buddy will be used for the development of agents to predict music tastes based on existing data, and systems for collaborative rating and ranking of music.

Conclusion

In this paper we discussed a study of music sharing in both physical and Internet forms, drawing implications from this for CSCW, as well as describing two concepts which we are building to support the lessons from this study. Using empirical data collected with interviews with 36 music enthusiasts we explored consumers' music sharing practice. While the group that we studied in this paper – music enthusiasts - is relatively small, it is worth emphasising again that this type of consumer makes the

majority of music purchases. This group is also likely to be the one most likely to use new music technologies, such as those discussed throughout this paper.

This discussion took two parts. First, the paper discussed conventional music sharing practice. This was a practice very much tied up with existing social processes, such as socialising with friends. In particular, friends were important for finding out about new music through recommendations and searching through friends' collections. In this way, friends act as a form of collaborative filtering for new music. Moving on to the use of Napster and other new digital music sharing technologies, we commented on the differences between copying music physically and over the Internet. Unlike conventional copying, Napster involves copying music from a vast collection, from people that the user does not know and is not likely to meet.

An important finding from this discussion was the importance of physical original recordings. In particular, collecting original recordings was linked to our enthusiasts' identities; a good collection formed (in part) one's music taste, and contributed to a sense of identity. Taking this implication on board, we designed the "Music Book" as an attempt to combine the advantages of physical and on-line music media. In turn, the implications regarding the advantages of sharing music were used to develop a second concept, the "Music Buddy", which allows users to share the list of the music they have stored on their PC.

To conclude, the research discussed in this paper has investigated the controversial activity of sharing music in both digital and physical forms. Our work suggests that rather than placing barriers to copying and sharing practices, the music production and distribution industry might seek to exploit these practices for their own benefit, recognising that the sharing of digital material might actually facilitate buying in the long run. New music technologies which support sharing and the community around music could turn out to have large value for individuals, as well as encouraging new friendships and new opportunities for social interaction.

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