Musical Fingerprints: Collaboration around Home Media Collections

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ABSTRACT

As people collect more and more digital music, photos, and video, the growing scale of the collection challenges how families share and collaborate around home media collections. We studied the intersection between physical and digital media collections. Through 20 two hour, in home interviews, we explored the when, why, and how of the households' organization, access and sharing. Our grounded approach is framed through the use of the media lifecycle and the spectrum of intimacy of the collector and others involved in the stages of the lifecycle. We found a range of accommodations to facilitate collaboration around media collections in the home. For example, media collections often begin with an individual, but as they become shared and integrated into a household, a member of the household will often play a key curatorial role that includes making changes to the organizational scheme, setting aside sub-collections and selecting items to play that account for the entire household's taste. Our findings identify key practices that can inform the design of future media software for the home.

Categories and Subject Descriptors

H.5.1 [Multimedia Information Systems]; H.5.3 [Group and Organization Interfaces]: Collaborative Computing; J.5 [Arts and Humanities]: Music

General Terms

Design, Human Factors

Keywords

Media collections, media management, music sharing

1. INTRODUCTION

Kenzie has been collecting CDs since she was a pre-teen. In the beginning she could only afford a CD a month, but in college she discovered used CDs and Peer-to-Peer (P2P) digital sharing and her physical and digital collections multiplied. She lived with a variety of roommates over the years, burning CDs for them if they wanted something, but always keeping her collection separate from theirs. Now Kenzie is moving in with her fiancé. Setting up the media center in the living room, she is unsure how to proceed:

Should she combine their music and video collections or keep them discrete? Their tastes overlap, and they own duplicates of some things. Should she get rid of the duplicates? Should she treat their digital and physical collections similarly? How can she make it easy for her and her fiancé to find what they want?

The progression from physical media collections to digital collections exacerbates Kenzie's situation. On the one hand, digital collections free owners from the space and cost restrictions of physical collections. On the other hand, digital collections can grow so large as to be difficult to manage and are now making the family media center a new challenge. How individuals manage expansive collections is not well understood. We know little about how or when people begin organizing their collections. Further we know less about challenges faced and techniques employed to facilitate collaboration around personal media.

We are studying the intersection between physical and digital media collections, as they grow arbitrarily large. We explored media collections in the home, observing and questioning practices, motivations, and strategies. We tested organizational schemes through systematic probes. We found collaborative aspects of media collecting as participants discovered, added, organized, selected and shared items in their personal media collections. Likewise, we observed a tension between the qualities that make a personal collection personal and the accommodations needed to share the collection inside and outside of the home.

This paper first reviews the prior research on personal media collections. We then introduce our study methodology and characterize our participants and their collections. We frame our findings using a media life cycle identified by Brown, et al. [3, 4], reviewing the various stages from finding out about new media to sharing of media. We address sharing and collaboration along a spectrum of intimacy modified from work by Voida, et al. [29]. After presenting our findings and observations, we discuss the notion of a media life cycle as it relates to personal media collaboration. We close with implications for future media management software.

2. PREVIOUS WORK

As personal media collections grow, media management software struggles to meet the needs of media owners. Designers turn to the growing body of literature on human-computer interaction (HCI), music information retrieval (MIR) and personal media for insights and inspiration, yet the literature has critical gaps. Research in HCI and MIR focus on systems for discovery of music [12], analysis of query types [13] and automatic genre categorization [19]. A small number of studies have considered photograph collection management [7, 21, 26] and MyLifeBits [14] studied

daily life data collection and management. Some have explored small or medium sized personal music collections [2, 4, 5, 10, 28, 29] or personal collections of digital video [3]. Our study and subsequent findings differ in that we are focusing on the specific management strategies employed around large and growing music and video collections in the home.

Brown, et al. [3, 4] introduced a concept useful for framing the other work in personal media collections as well as our own findings. Brown, et al. [3, 4] identified a media lifecycle that includes learning about new media, acquiring, listening or watching, sharing, organizing and collecting. We use the media lifecycle to structure our review of the prior research.

Because many of the stages of the life cycle happen in collaboration, we will also elaborate on a notion first described by Voida, et al. [29]. They mapped the design space of music sharing, juxtaposing the intimacy of mixtape sharing against the anonymity of P2P sharing, finding that iTunes sharing among colleagues fell somewhere in between. Later we flesh out the axis designating it an *intimacy spectrum*. For our findings, we adopt the media life cycle, and situate our examples along a spectrum of intimacy.

The media life cycle begins with discovery of new media, People learn about new media by both passively encountering it and actively seeking it [3, 11]. Research suggests that people prefer to discover new music by themselves or with close friends while browsing in the store [9, 11] or through recommendations from friends and colleagues [4, 5, 11, 29].

After media is discovered, people then choose whether to acquire and eventually collect the items. Reasons for acquiring include a desire for immediate and permanent access [29], better control of the 'programming' [6], and sometimes for the joy of collecting a complete set [3]. Acquisition and collecting should be distinguished. An acquired item may not be considered collectible such as a copied CD, or a DVD that does not move past an "audition" into the actual collection. The format of the media may affect its collectibility. Tangible media has been considered more collectible than digital media [4, 5]. However, the acquired format of media also relates to the envisioned use of that media in the collection. For example, digital music is perceived as important for mobility and lower quality sound is acceptable, while physical music is important for high quality or 'audiophile' listening [4].

Prior research on the strategies employed for organizing personal media collections suggest that behaviors range from meticulous and systematic to chaotic and eccentric [2, 10]. The location of devices and purpose of the media influences the collection's organization [4]. Often collections exist in multiple locations [10], with a main collection, an archive and a smaller pile next to the media player [4, 10]. Of course, the collection's organization may be disrupted if others use the collection [10]. Vignolis' [28] study identified genre as important for browsing, while others have found genre useful for organizing [10, 28]. People also employ personal categories with personal media such as music for certain events, moods or activities [2, 10, 18, 28]. Playlists are used to organize music into personal categories, to tell a story with music or to manage shared collections [8, 29]. Brown [4] found that digital and physical media are collected with different envisioned use, but another study [28] found that an owner employs similar organizational schemes for their digital and physical collections. Taken together these two conflicting results suggest that factors other than envisioned use and format may influence the specific organizational strategy placed on the media.

Little research has considered how people select media for use. One result suggests that targeted item search is uncommon and that people largely satisfice when looking for music [2]. On the other hand, Brown, et al. [3] noted that users who recorded or downloaded video were more actively engaged in all aspects of the video lifecycle than those who simply watch broadcast television including specific item selection for occasions of viewing or listening.

The last stage of the lifecycle concerns sharing media. Collections that are shared with members of the house or simply with friends are often curated by the owner who fore-fronts items of interest to the shared members [29]. Several studies have indicated the ways in which a collection represents a person's identity [5, 17, 23, 27, 29]. The collection is a singular and comprehensive depiction of the collector. This identity, when shared with others, becomes a social identifier. It can allow people to bond on common music interests [1, 5]. Owners of shared collections may modify the presentation of the collection to more favorably represent themselves to others [29] or to cater their image considering social circumstances [27]. Voida, et al. [27], like Brown, et al [5], questioned the social aspects of media sharing software, hoping to facilitate the intimacy associated with mixtape sharing, something lacking in the nearly anonymous world of Peer-to-Peer sharing.

The number of items in the collection influences the need for organization. Accordingly, the size of the collections in prior studies may have influenced those findings. Only a few studies cite the size of the collections [2, 10, 28]. The collections in [10] ranged from a young girl's single CD to a decade old collection of 700+ albums. Participants in [2] had a minimum of 100 CDs, and 10 of the 13 participants had over 300 CDs. Lastly, the seven subjects in [28] had digital collections between 1200 and 3500 songs. Our study differs from prior work because we selected participants with much larger collections, further we systematically probed the organizational schemes employed by the participants. In a later section we express our findings organized by the media lifecycle highlighting the collaborative issues revealed by our analysis.

3. METHODOLOGY AND PARTICIPANTS
We conducted a qualitative, ethnographically informed, study of personal media collections in the home. We looked for individuals who owned both digital and physical collections and were presumably dealing with the transition from physical formats to digital formats.

3.1 Methodology
During three recruitment efforts over the course of four months, we conducted 20 *in situ*, open-ended, semi-structured, interviews. This method is commonly used for studies of technology use in the home [2, 7, 16, 20, 21, 25]. Two researchers were present at every interview. We asked participants several open-ended questions about the collecting process. We then took a tour of the collection(s) and their devices. Finally, we asked them to retrieve items from their collection and to reflect upon the process.

Our retrieval questions or *probes* were designed to test the participants' organizational scheme as they sought named items, but also prompted them to further reveal issues related to media collecting. These task-based probes explored recency ('What was the last thing you listened to or watched?'), landmarks ('What was

the first item you ever collected?'), social settings ('What would you play at a dinner party?'), personal significance ('What item is evocative of a person in your life?'), and historical events ('What piece reminds you of your school years?'). For each, we prompted the participant to think of an item related to the probe, to name that specific item, to retrieve it while describing their seeking process, and to share any concerns or thoughts related to collecting the item.

The two hour interview protocol was not based on the analytical frameworks in prior literature. Instead the questions in the protocol explored social, relational and collaborative aspects that link people and their media collections, while our probes explored the structural and organizational aspects. Interviews were recorded and transcribed. Transcripts were analyzed using a Grounded Theory approach [23]. We conducted open and axial coding to develop initial categories. Again, our category generation was not biased toward any prior analytical frameworks in the literature. Analytical memos were developed to clarify themes and explore the relationships among categories.

3.2 Participants

Participants were recruited in two major metropolitan areas in different states via Craig's List, postings on campus at two large state universities (one per city), in coffee shops around those universities, and in city weeklies. We screened candidates considering the size and format (physical, digital, or both) of their video and music collections[1]. Early participants (P1-P5) had small to medium sized collections. We identified recognizable concepts and themes from prior literature from these interviews, so we turned to participants with larger collections. The remaining 15 participants (P6-P21) were selected because they owned large or extra large collections of music and several had large video collections as well (see Table 1[2]). In spite of campus recruitment, our participants ranged in age from mid-twenties to mid-sixties with the majority of participants in their thirties. Our participants are likely to express the issues with large and growing collections, which are a property of collecting over time. We believe that teens and youth are not represented in our participants because they have been collecting for a shorter period of time, and are likely to have smaller collections. The latter 15 participants' collections all exceeded 500 albums (>5000 songs) and all but one had greater than 1000 albums (>10000 songs). Participants with the largest collections were often unsure of exact numbers, instead measuring things by the storage space needed in feet or gigabytes. Measurements often differed among formats even in the same household. For example, P15 measured his digital recordings of live performances by hours (over 2000) and physical collection by album (9000 CDs and several thousand LPs).

Table 1. Study participants and the sizes of their physical and digital media collections.

Part #	M/F	Age	Music Dig	Music Phys	Video Dig	Video Phys
1	M	35-39	S	M		M
2	F	35-39	S			S
3	F	45-49	S	M		S
4	F	55-59		S		S
5	M	25-29	L	S		
6	M	30-34	XL	XL	L	L
7	M	35-39	XL	XL	S	L
8	M	40-44	S	XL		
9	M	35-39	L	XL		
10	M	35-39	L	XL		S
11	M	25-29	XL			
12a & 12b	F & M	35-39	M	S	L	M
13	F	25-29	XL	XL		
14	M	40-44	M	XL		
15	M	35-39	XL	XL		
16a & 16b	M & F	30-34	XL	L		L
18	M	25-29	XL	S	XL	L
19	F	30-34	S	XL		XL
20	M	34-39	S	XL		L
21a & 21b	M & F	60-64	L	XL		M

In the households we studied, only four of the 20 participants are single and live alone (P2, P3, P4 and P9). Three of the 20 participants (P11, P12 and P18) discussed having a not-entirely-residential significant other or companion that spent so much time in the household as to share the media experience with the participant. The remaining 13 participants live with a significant other, family and/or children. Four of these 13 have one or more platonic roommates. In three homes, we spoke with the primary participant as well as a significant other.

4. ANALYSIS AND FINDINGS

Categories emerged naturally through grounded analysis. Home media collections have many different facets. The analysis presented here focus on the collaborative aspects of media collections in the home, while the management and retrieval strategies uncovered in the task-based probes currently only available in unpublished form [22]. As a convenience, we present our findings related to collaboration in the home, using two prior frameworks. We structure our presentation using a slight reordering of Brown's media life cycle [3, 4]: learning about new media, acquiring, collecting, selecting for use, organizing, and sharing with others. We overlay the media lifecycle with an

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1. We standardized our measure of collection size in the following way. For music we define 1 album as equivalent to 10 tracks. A small collection is less than 100 albums; a medium collection is 100-500 albums, a large collection is 500-1000 albums, an extra large collection is anything over 1000 albums. For video a small collection is less than 50 videos, medium is 50-100 videos, large is 100-500 videos, and extra large is anything over 500 videos.

2. Participant P17 was dropped from the study. During the interviews with P12, P16 & P21 an additional member of the household added impromptu comments. The primary participant has been indicated as "a" and the secondary as "b."

intimacy spectrum inspired by Voida, et al.'s [29] description of the music sharing design space, specifically the axis from intimate to anonymous. From the perspective of the collector, Voida, et al. [29] described the degree to which a person shares herself with another. Here we have switched the perspective in order to address the role another person plays in the life of the owner. Over the spectrum from intimate to anonymous we identified sharing experiences with partners, family, housemates, friends, colleagues, and strangers. Within each stage of the lifecycle we present our observations about roles and practices along the intimacy spectrum.

4.1 Learning About New Media

The media life cycle begins with learning about new media. Participants who lived with significant others were often the manager of the collection and primary contributor. Although partners may add to the collection, rarely do they add artists unknown to the main collector. The significant other, on the other hand, may use his/her partner as a source of new media.

> *<P16a> is more seeking than I am, because I think, he's in my life, I just get enough exposure to things through him and that's enough for me. – P16b*

Similarly, P19 described her role as "*getting stuff into rotation*" and introducing her husband to new music.

Friends and colleagues were not frequently cited as a source of discovery for new material, in contrast to [4, 5, 10, 11]. Although participants noted that they received recommendations and CD mixes from friends, it was only the participants with smallish collections who found this a useful way to discover new material (P1, P2, P3 and P5). Participants with large collections rarely mentioned receiving CD mixes and regularly reported that they had few friends they could trust to introduce them to new music. This is likely attributable to the immensity of the collections. When asked if he received recommendations from friends, P21 responded,

> *P21a: Not many give me ... like I said, I give more information than I get. – P21a*

P9 noted that he had to seek out "*experts*" to have knowledgeable discussions about music, while P15 turned to a newsgroup to find people to talk to about music. P6 and P8 expressed frustration with friends and others who did not keep up with new music. P19 explained that few friends are as interested in music as she is.

With television and video, on the other hand, friends were frequently cited as sources of recommendations. P12a and P12b regularly borrow DVD sets from a friend while P6 explained that friends keep he and his wife up to date on new shows.

> *...with television it's a big part of the social scene. Like what you are watching on television is a favorite topic of conversation… – P6*

Only P18 and P19, owners of extra large video collections, complained that friends were an insufficient source of new information.

Participants with the largest collections of either music and video commonly 'researched' new media through external sources or strangers – reading magazines, listening to the radio, or pivoting on 'like' items on Amazon, IMDB, or eMusic.

While previous work has concluded that people prefer to discover new music from friends and those closest to them, this may have less to do with intimacy and trust than with confidence in the quality of the recommendation. As collections swell and owners struggle to find new media, they must expand their discovery horizons to include absolute strangers who are equally informed and express similar tastes in media.

4.2 Acquiring and Collecting Media

Our participants acquired media across the entire intimacy spectrum from family and friends to absolute strangers. We found that whether media was acquired had little to do with the intimacy spectrum. Instead, expense largely informs acquisition. The largest collections we saw could be attributed to cheap or free access to media. Intimacy, however, may influence whether an item that is acquired is kept or collected.

If media was freely obtained it came from friends, record label promotions, Peer-to-Peer sites, and by checking things out of the library and "*backing them up*" (P16a). Consistent with findings that owners of smaller collectors discover new media from friends, P2 travels and stays with friends, ripping their CDs to her laptop. At the other end of the spectrum, P14, who amassed an immense collection of recordings of live performances of groups such as the Grateful Dead, explained "*Blanks and Postage*" – a method to get a copy of a show – one gives a 'taper' a blank cassette and postage to return it. Our participants also reported buying media at music stores, thrift shops, garage sales, video rental places, as well as through Amazon, iTunes, and eMusic.

We noticed a difference in how *inexpensive* music and videos were acquired between physical and digital collections. In physical collections, cheap typically meant the collector purchased or acquired used media. Participants scoured thrift shops, garage sales, and used record stores to facilitate this growth. P15 attributes his multi-room collection to this strategy: "*Cheap [is] the operative word.*" Two participants also cited discontinued media such as LaserDiscs as the way they acquired videos inexpensively.

> *It was practically cheaper to just go buy stuff than to rent. So, I mean, at a certain point, it was like, "Oh, it's five bucks? Well, I'll try it." – P19*

Digital music, on the other hand, does not change ownership in the same way as physical media. Thus inexpensive (as opposed to free) digital media seems more difficult to acquire. Cited methods include using some sort of service such as eMusic, Napster, or Rhapsody, which involves paying a monthly fee and often encourages buying the media on a song-by-song basis rather than by the album. P5 creatively combines strategies, purchasing used physical CDs, ripping them, and then reselling them for store credit.

As in [3], our participants were concerned about the collectability of certain formats. LPs and CDs were highly valued while eight-tracks were dismissed as curiosities you might "accumulate" but not collect. Unlike [4, 5], few contrasted the collectability of physical versus digital. But participants were concerned about the completeness of the media and the associated materials, such as cover art, lyrics, artist notes, and band composition. P11 adds to his entirely digital collection using Peer-to-Peer sharing. He cites very high standards for the items he adds. In addition to laboriously locating album art for every one of his thousands of albums, he rigorously updates the metadata to ensure consistency throughout the collection. Totality rather than tangibility seems to inform collectibility. For instance, when ripping music to his digital collection, P5 prefers commercial CDs.

...it kind of disturbs me to get Journey's Greatest Hits on a little silver thing with Sharpie writing.... If I like something then I kind of want to see the whole package. I want to see what they intended. – P5

Of course, there are qualities that will make a "*little silver thing with Sharpie writing*" collectible. Several participants cited receiving CD mixes from friends. Participants were often conflicted about gift mixes. Among the physical collections, we only observed P8 actually inter-filing CD mixes with other CDs. Participants P2, P5 and P18 (digital collectors) all complained about the lack of track information that often comes with a mix.

I feel like mix CDs often create more work than they're worth for me. So I typically just listen to those in the car. – P18

Still, P18 continues to hold onto the CD mixes perhaps because he has sentimental attachment that overcomes their less desirable nature. Similarly, approximately 5000 items in P14's music collection are cassette recordings of live performances. Although the collectibility of the physical media is low, for many of these performances, this was the only way to acquire a recording. Collaboration and access to others who have original recordings was vital to the collecting process and as discussed later is a prime motivator for sharing media with others.

When it comes to acquisition, participants readily accepted items along the entire spectrum influenced more by cost than by intimacy. Collectibility, on the other hand, can be influenced by the rarity of the item, but also directly relates to the degree of intimacy of the gift giver over-coming even the less desirable formats.

4.3 Organizing Media

Previous work on organizing media relayed the frustrations of managing multiple devices. Owners often juggled CDs in different rooms of the house, ripped music for work and or created cassette copies for playing music in the car [4, 5]. As a result, organization was often organic, existing in multiple locations in closets, shelves, piles and travel sleeves [4, 10]. Although previous authors did not explicitly call it such, these piles show evidence of collection subdivision. To our knowledge, no one has extensively examined the methods of subdivision or the complications of collection combining with housemates.

While we observed piling and subdividing behavior similar to other work, our interest in collaboration drew our attention to the strategies used in organization to manage multiple users. While housemates may affect the use of the media, in the homes we visited with adult roommates (P5, P6, P8, P13), we found little evidence of collection merging. Only P6 noted that his roommate's video collection was partially filed with he and his wife's videos.

Homes where partners reside illustrate a variety of ownership manifestations. In some homes, the partners' collections are maintained separately. This occurred in homes where the participants' partners had recently moved in (P10, P18), as well as in homes where the partners had lived together for some time. P1 laughingly explained the reason he and his wife of several years separate their music collections:

We have a relationship built upon an intricate understanding of "mine" which is exclusivity and not sharing. – P1

P20 also maintains a separate collection from his long-time girlfriend. He clarified why they keep their collections separate:

I'm not sure I ever want them mixed just because it's... I don't know like it's. . . that's one thing that's all mine. We share a lot of other things plus the other stuff . . . but that is just all my own. – P20

The notion of individuality and possession is important to both P1 and P20. Other times, the separation happens almost accidentally. P8's organizational style is more eclectic. He describes it as filing by "*layers of sedimentation*." Items that are purchased in the same time period are grouped together. When asked about whether his partner's collection was separate, he responded:

Yeah. And that's kind of an odd thing. I've never really talked about it with her, right? Because in the beginning of a relationship you do that because the relationship might fall apart. To make it easier to separate your collection, right? And that's the real reason you keep them separate in the beginning. That concern has long since gone away. So, why don't we all file them all together? –P8

Because the items in his collection tend to be grouped together around certain sentiments or time periods, it complicates combining items from the period before he and his partner moved in together.

In other homes, we found partially combined collections. Sometimes this is a result of the media format. For instance, P14's CDs are interfiled with the rest of the family's CDs, but the collections of cassettes and LPs are entirely his own because no one else in the family maintains that format. P12a and P12b maintain separate residences and physical collections but have pooled their digital video and music collections. In other situations, the separation is made largely by genres of interest. P10's fiancée primarily collects classical music, while P10's classical selection is relatively small. So, he combines the classical collections, but the other CDs that his fiancée owns are separate.

In combined collections, a primary collector or curator seems to emerge. Often the primary owner will organize to accommodate other members of the house. P7 and P16 have subdivided the children's videos. P10 has given his fiancée their combined classical collection to organize as she wants, while P21a created special sub-collections for his wife to make it easier for her to find things. When asked, "*How is the organization working for you?"* husband and wife replied,

P21a: Me? Fine.
P21b: Me? I know where the ones are that I like.

P21b is only concerned about some of the items, and her husband has set the collection up to facilitate that.

Even when a participant did not customize the organization for the other members of the home, he or she may have implemented a scheme to facilitate retrieval. P8 does not re-file music his partner has listened to, but rather lets her put it where she can re-find it. P6 selected a scheme for use by multiple people. He decided to alphabetize the collection because "*it's the only system that is easily communicated to other people.*" This supports the observation in [10] that the organization of a collection used by multiple people is quite fragile.

Collection segmentation and the emergence of a collection curator may also be a factor of collection size. We found that physical collectors often employed organizational overrides – exceptions to ordering rules that would make it easier to later retrieve items. For example, P9 files an album of Black Sabbath "covers" with Black

Sabbath even though Black Sabbath does not perform the work. Overrides work for the owner allowing them to file something by an exceptional key making it easier to retrieve items that would otherwise become lost in an immense collection. Unfortunately, overrides also make the collection organization subjective and personalized. P15 describes his organizational system:

> So it all becomes very idiosyncratic, like if you remember that the flip side of such and such is. . . then you know where it is. ... People would not be able to find things very well. – P15

Increasing the usability of a collection by one person may make it less usable to others in the home, necessitating the creation of sub-collections or the role of curator.

The curatorial role shifts a bit as mobile devices are introduced. For participants with iPods or MP3 players, the mobile player represented a personalized selection from the collection rather than the entire collection because the mobile player does not have enough capacity. Because P6, P8, and P16a provide technical support for their partners' MP3 players, they also all undertook a curatorial position over their partners' MP3 collections. Presently, personal media players encourage users to employ playlists for subdividing the collection along personal dimensions because the management software on portable players includes few tools for managing multiple identities or non-traditional categories.

As with physical collections, though, it was not uncommon for the partners simply to maintain their own digital collections. P1's wife has her own separate digital media collection and iPod, and P19's husband manages his own iPod ripping music from the combined CD collection. Separate digital collections can complicate sharing. P12a and P12b acquire digital videos individually. For instance, P12a has the episodes of one television series on her laptop, as well as many video shorts that she has downloaded. P12b's laptop contains several other television series that he has purchased from iTunes. To share items, they plug a laptop into P12b's big screen TV for shared watching or sometimes upload videos to video-sharing sites.

The source from which a piece of media is acquired can have implications for the way the media is incorporated into an organizing scheme. Several participants acquired media via a variety of networks. P3, P6, P11, and P18 all used anonymous networks of some form, but P12a described how the social aspects of sharing become useful organizationally as they support non-traditional categories as well as account management. P12a uniquely collects video shorts from video sharing sites such as YouTube. She both downloads files as well as aggregates online files by book-marking them using dabble.com and del.icio.us. Both dabble and del.icio.us are social networking sites that allow users to create their own folksonomies [15]. She detailed new genres of video shorts that had emerged through social tagging including remixes, anime music video, citizen journalism, "*put yourself in a music video*" and "*mom walks in*" among others. In addition to being tagged, these videos can be bookmarked and shared. She and her partner subscribe to each other's bookmarks so that they are notified when the other bookmarks a new video. Online, these videos are organized, but when she downloads and archives select videos to her machine and personal collection, they lose all of this valuable metadata.

People further away on the intimacy spectrum appear to have less impact on the organization of a personal media collection. Few participants organized their physical collections to accommodate those outside of the home. Only P6 has adjusted the physical organization to facilitate parties where friends are invited to pick music to play. He has separated "*sentimental*" music from the main collection because it "*would be considered noise to their decision making process.*" Voida et al. [29] proposed that segmentation of a personal media collection into discrete units only viewable by selected individuals represents a form of impression management. While P6 admitted some self-consciousness about the collection, his sentimental sub-collection was still visible to others. Although there is definitely overlap, impression management seems more central to sharing practices than to organizing the collection in the home. Participants were more inclined to modify playlists when sharing than modifying the actual collection.

Participants adopted a variety of organizational strategies including partial merging and curating parts of the collection in order to make media more usable in a multi-person household.

4.4 Selecting Media for Listening or Viewing

While satisficing does play a role in media selection, in shared living environments an owner may make specific choices in consideration of the housemate(s). For instance, P6 and his wife as well as P12a and P12b commit to watching episodes of a television show together.

> ... any TV series that we are watching together, we watch it together. That's the good thing about the iTunes, you don't have to watch them when it's on. There is no way we could have watched any of these shows when they were on. - P12b

Music selection is influenced by mood and activity [2, 10], but in shared environments it may be mood of the entire family that affects the decision. P7 explained that most mornings he picks music to play while the family gets ready for the day.

> [I]n the mornings when I come out, I will certainly pick stuff that one of the family members likes more or less, you know or be aware of that, what they like more or less in order to make sure that it is something that we all like and all feel good about. – P7

P7 went on to describe various moods that dictate different music. Of course, participants were also very clear to explain that they did not necessarily want to hear their partner's music. P19, who is the primary collector in the home, describes commuting with her husband and her response when he plays Led Zeppelin:

> I just use this, "Ah, something is wrong with the CD player again ...Wait, wait, why, let me turn this down, oh, that's better." Yeah, it's evil. –P19

Although partners had full and unlimited access to play whatever they wanted, even from separate collections, the curator often maintains the role of primary disc jockey in part for control, but also because of better knowledge of the collection and what would be interesting to all parties. P11 describes music selection when he and his companion are at P11's home.

> Well, when we are here, I control the play of it*, because I* always want to listen to what I want to listen to, but I do make sure that I ask, 'what do you want to listen to?' Or, you know when we go on trips. ... But the collection is so big, that he has more of a hard time selecting what I want. – P11

People further on the intimacy spectrum, such as friends and family, who are invited into the home may become part of the collaborative process of media selection. Media is often an

important part of social gatherings in the home, from background music that creates a "*convivial atmosphere*" (P1) to being the reason for the gathering. P6 invites guests to plug in their MP3 players to the receiver during parties. P20 described "*call and response*" music parties.

> *One person would put something in and then you'd have to respond and you'd grab something else. Like, "This is my response to that" and you'd just go for a couple hours back and forth like, "What do you say to that song?" –P20*

P16a and P16b regularly host record parties where guests bring their own records to play. P12a and P12b have hosted similar video showing parties. They hook up a laptop to a big screen TV so people can share their favorite videos from sites such as YouTube. P12a explained that you avoid items that people wouldn't like or would be boring for them. She advised that there is a reciprocal protocol for watching videos that another selects. She referred to these selections as "*direct recommendations*," which cannot be ignored. A recommendation received through email or through IM can be politely deleted, but in the context of a party, it would be rude not to watch. P14 discovered that he could exploit these protocols to shape or terminate an event.

> *Like the Jingle Cats, which is all the Christmas songs being meowed. That's how, after you have Christmas dinner, how you get your family to start moving toward the door. You put this on. – P14*

Our participants were conscious of the immediacy of selecting media for others. P8 who is a disc jockey at a college radio station, but has also DJ'd at live events, describes the difference.

> *Like being a radio DJ, you are just spewing the music out into the void. You don't know who is listening. If they don't like it you presume that they will turn away, they are not your problem. Right? At social events, it's a completely different experience, where if you are spinning records for people who are dancing, they are voting with their feet. They are letting you know exactly what they like about what you are doing. – P8*

Whether it was selecting for a family member or for complete strangers, participants looked for cues to adapt selection based upon the needs of others.

4.5 Sharing Media with Others

The last stage of the lifecycle comes full circle and concerns sharing media. Just as one can learn about new media from someone else, people often share their media with others. Sharing involves offering others access to the items in a collection, proffering knowledge that comes with having collected that media, and to an extent allowing others access to the knowledge of who the collector is [5, 29].

A person's collection is a unique and comprehensive representation of the person and his or her history. About his music collection, P20 claimed, "*it's a part of myself that I happen to keep outside of myself.*" P8, who is a volunteer disc jockey (DJ) at a college radio station, described how people use music as an "*aspect of tribal identity*"; that people adopt "*emblematic music*" socially to identify themselves to others like themselves. He stressed that the commonalities can join people, but also explained how the entire collection serves also to distinguish one person from another:

> *I would say it doesn't take long for us to know each other by our musical fingerprints. There have been cases where somebody was stealing music* [from the radio station] *and you just knew who was doing it. It wasn't, it wasn't legal proof, but you could just go, oh hell, look at what is missing; we know who did that. –P8*

This "*musical fingerprint*" can be used to identify a person because each collection is a unique combination of items. It is not surprising then that the comfort a person feels sharing the entire collection is directly related to how intimate they are with another.

Participants reported no need to curtail partners' access when sharing the collection. If limits were established with family members, it involved age appropriate material for children. When sharing with friends and colleagues, only P2 removed items from her iPod to shield certain songs from friends with more "*discriminating*" tastes. Participants are clearly aware that judgments might be made and impressions formed because of the collection. P11, who shares his digital collection with his office, described an occasion when a coworker teased P11 for having Britney Spears in the collection. We asked P11 if he would limit the access to avoid that situation in the future and he explained,

> *I want to keep that open environment. So to limit that would then trigger something different… a different reaction that I may not want and that would be kind of pushing them away and that's not what I want to do. So it allows me to not be so restrictive in certain areas of my life. Ok, so it is ok to share. It's ok to have people see a different part of me. – P11*

Participants on the whole were willing to accept that judgments were made. P20 described a collection as both "*utterly private*" and yet "*very public.*" He told us that he wants to share his collection. In Voida et al. [29], the study was bound by the workplace and may have impacted the sharing qualities differently than an in the home study. In our study, only P11 and P16a spoke of sharing media with colleagues at work.

Voida et al. [29] found that people felt that they should share music with which they had some 'expertise.' We observed similar behavior. Some of our participants felt obligated to share media. For some this behavior began by sharing with friends but grew to broadcast sharing. P6, for instance, created a music server for his friends to use at Burning Man. Later he turned this into an underground Internet radio station and started an MP3 blog.

> *So I kept auditioning music for that server even though I wasn't always going to be going back to Burning Man and then this time it just occurred to me that I should be telling people all about this stuff that I'm coming across, so I started the blog to do that. – P6*

At least five other participants cited similar obligatory feelings to share media they had collected or knowledge they'd gained while collecting. In several cases this went beyond sharing their expertise and extended to sharing rare items. P14 has thousands of recorded cassettes of live performances of bands such as the Grateful Dead and Phish. For some performances he may have the only copy.

> *It's like I collected it, and now it's my duty to see that it is transferred digitally so someone can find that show someday and go wow that's great. – P14*

Similarly, P12a regularly downloads short videos she is afraid may be removed from YouTube or GoogleVideo so she can repost them. Additionally, she feels strongly that copyright holders

should be required to distribute material. For example, before it was available on DVD, the documentary *Hearts of Darkness* was virtually impossible to rent or buy. She explained,

> *So I found an old VHS copy of it, and then I transferred it, and I put it online. Because I know it is copyrighted, but I just think it is the most compelling thing ever and I think people need to watch it and I feel like … This is not a justification for doing it, but in my mind this is a strange way of justifying it or not justifying it, but sort of saying, I'm just going to do this anyway, because in the moral calculus, this is OK. – P12a*

For her, the duty she felt to bring the content to others outweighed the risk of illegally posting the video. She clarified to us that it is not necessarily about making something freely available. She is happy to pay for television episodes and music on iTunes, but she objects to selective access restricted to certain operating systems or pricing items so that they are prohibitively expensive.

The desire to share with others is a subjective thing. All participants were comfortable sharing their media and their media identity with those with whom they are more intimate. Sharing with friends, colleagues and absolute strangers happened less frequently, but if participants felt that they had special knowledge or access to certain media, they were more inclined to share with the world. The more unique the item, the more a collector feels a need to share outside their immediate realm of intimacy, illustrating an ethical dilemma between open access and fair use versus ownership rights.

5. DISCUSSION AND IMPLICATIONS

The media lifecycle provides a valuable framework for considering media in the home. However, reflecting on the current lifecycle as an intellectual construct, we should be clear that it may aptly describe the states of individual media items better than the collection as a whole. Moreover, the important parts of the lifecycle are the behaviors and social practices – the activities – that occur in any given stage of the lifecycle and those that result when a person transitions from activities in one stage to the activities in another. Understanding those transitions offers the most value when we move from analysis to the actual design process.

Understanding those transitions will not result from simplistic studies of practice. Indeed participants have a difficult time separating individual practices into discrete stages. From the perspective of the collector, the activities are often inexorably intertwined. For instance, P14 acquired many of his concert recordings from absolute strangers who happened to have a tape of a particular show. In a 'pay it forward' manner, P14 now finds himself compelled to digitize many of his own recordings to ensure that others have access to them. Here discovery, acquisition and sharing are interrelated through a set of intertwined social practices that surround the media. Likewise aspects of sharing and identity present as a single stage in the lifecycle, but as we found, intrinsically affect the stages of organization and use. The lifecycle should not be seen as a flat uni-dimensional construct, but rather as a intertwined web of behaviors and practices.

One potential complication of studying media use in the home is the growing number of devices that produce or consume media. There is an open question whether a given medium is more or less tightly coupled to a given set of devices. Early studies of the practices surrounding digital and regular photograph collecting did not analytically address issues of the camera and the digital photo frame [7, 21, 26]. However, in our current application of the media lifecycle to studying practices around music organizing and consumption, the role of the portable MP3 player is regularly raised. An assumption of the intertwined nature means that studies of media practices will need to consider an ever-widening space of activity, media, and devices that produce or consume those media. Our current stance, the one taken in this study, is that, while the range of devices should not be ignored, any given device should not be afforded priority in regard to studying practice, unless participants illustrate its indispensible role. Lastly, in regard to the media lifecycle itself, the role of specific devices should be considered as potential layers or overlays to the lifecycle that can either facilitate or inhibit certain activities or transitions among stages of the lifecycle.

The intimacy spectrum also proves useful when we examine the various stages of the media lifecycle. Voida, et al. [29] focused specifically on the sharing stage of the lifecycle emphasizing the manner in which a collection represents a person's identity and the strategies employed to modulate that. Here we have employed the intimacy spectrum as a lens through which we can view all stages of the life cycle: learning about new media, acquisition and collection, selecting for use, organizing and sharing.

Of the five stages, the acquisition stage is least influenced by intimacy. Collectors acquire media influenced by individuals along the entire spectrum almost equally. Whether those items stay in the collection, however, can be influenced by sentiment and intimacy, converting an otherwise undesirable item into a treasure that must be kept.

The media lifecycle is neither linear nor one-dimensional, but the circular analogy captures the connection between the two outer stages: learning about new media and sharing media with others. Participants learn about new media in part because someone else shared that media with them. Owners of smaller collections need not look beyond a comfortable level of intimacy to discover and share media. Large collection owners, who have obtained a degree of specialization, reach beyond their most intimate circles to learn about new media from people with whom they share similar tastes. Likewise, the owner's expertise may increase the likelihood that they will share their collection outside of their immediate realm of intimacy. As the collection size and/or the degree of specialization increases the motivation to seek beyond an immediate realm also increases.

Like discovery and sharing, the intimacy spectrum also impacts the selection of media for use or play. Here intimacy intertwines with proximity and impression management [29]. A DJ might simply play what he likes over the air, but adjusts rapidly to please a party of people in front of him. As co-listeners grow closer, both intimately and proximately, their influence increases. Guests invited into the home, car or cubicle at work can alter the selections a collector makes.

The influence that another has on the organization of a collection correlates directly to their degree of intimacy. An owner seldom modifies her organization for strangers, colleagues or even friends. Even within the home, the level of intimacy affects the degree to which an owner modifies the collection's organization. Few accommodations are made for roommates, but the needs of family and partners more readily influence the collector and her organization scheme. Additionally, specific strategies are adopted

to facilitate collaboration around the media, the collection may be segmented, and a curatorial role often emerges in direct consideration of the desires of the other members of the home.

The intimacy spectrum is inherently tied to the manner in which a collection represents a person's identity. Voida, et al. [29] notes that identities are multi-faceted things. A colleague may be intimately familiar with one aspect of a person's life and fully unaware of other aspects. The stages of acquiring/collecting, learning about, and sharing are like those facets. One can share only a portion of a collection with a friend, or one can talk about a specific subgenre of music when seeking recommendations. Even with music and video selection for play, only a portion of the collection is ever on display. In the collector's organizational strategies and the representation of the collection as a whole, we most easily see the full vulnerability of an owner's identity. Typically organization affects the collection in its entirety, not just select portions. Thus, the degree of comfort and intimacy a collector has with another influences to what degree the collection will be modified organizationally. Moreover, in shared living environments, merging collections puts at risk not only future retrieval of items but also owner identity, which partially explains why some couples continue to maintain separate collections in spite of years of domestic co-habitation.

5.1 Implications

Creators of media management systems face challenges and opportunities. Designers can learn from overlaying the media lifecycle with the intimacy spectrum as they seek new information and question the existing assumptions about the practices of collecting, managing, listening, and sharing media, especially as they design for the shared context of home and family.

The collaborative social space surrounding media sharing creates interesting possibilities for media management software. Existing social networking sites such as YouTube and del.ico.us have attempted to capitalize on the learning about and sharing stages of the media lifecycle, facilitating reaching out beyond the most immediate realm of intimacy to discover others with similar media inclinations and to allow owners to share their expertise. Of course, users may or may not feel comfortable sharing their entire collections with the world. Mechanisms should exist to allow owners to scaffold the extent of their sharing, making it easier for those who have preserved unique and unusual items to signal their availability, while also allowing a more discrete collector the choice to shield parts from more "*discriminating*" audiences.

Current media management software has inadequate support for collection segmenting whether to promote sharing or retrieval by housemates, separation of compilations from single artist albums, sectioning of labels or series, or grouping by genre and by type of recorded material. The use of playlists as a workaround for creating personal categories is not a generalizable solution to this problem. Playlists store information about the songs within the playlist, but the songs do not reciprocally store information about the playlists in which they reside. Further, effective media management software needs mechanisms for handling exceptions to the main organizing scheme. Current digital software has an opportunity to do what physical collections cannot, support exceptions or overrides, while also making it possible to find material through traditional means. This could possibly mitigate the collaborative tensions in a multi-owner collection, allowing multiple owners to implement their own unique organizational schemes.

Personal media collections, like collections of photographs, capture our personal as well as combined histories. People hold onto items in their collection for sentimental reasons, revisiting an album or a video to evoke memories of events or persons in their past. Further, designers of personal media software should consider the value of creating links between media items and events in personal and family calendars or between media and entries in an address book. The significance of people and events to media was important for many participants. As a gestalt, and because of the extraordinary consolidation of items, the collection then acts as a person's autobiography, providing insight into the person's character and identity.

An assumption that system designers need to dismiss is the notion of one collector/one collection/one library. Over half of our participants reside with a significant other; several have other roommates or children. Partners' collections are often merged. When they are kept separate, participants report doing so in order to preserve what is "mine." Digital media software affords little opportunity for merging collections while maintaining notions of separate ownership. Yet, it would seem trivial for software to maintain the metadata that indicates which member of the household contributed which portions of a collection.

When partners' collections are combined, one member of the home adopts a role of curator. That person adopts organizational strategies to facilitate access by family members, fore-fronts items of interest to the householders, assists in technology transfer for the various devices in the home, and selects media with consideration for the desires of the people in the home. Our participants, who happened to be parents, particularly adopted curatorial practices around media to foster a love of media in their children. Many of our participants reported growing up in a home where a family member influenced their love of media. Future media management systems have an opportunity to see beyond the "one collector" blinders, establishing identity management, possibly in the form of traditional user accounts, for various members of a home, allowing simultaneous merging and segmenting of collections, and adding features that would facilitate curatorial and custodial tasks.

6. CONCLUSION

Personal media collections in shared environments present many challenges for designers of digital media management software. Our observations of how families manage immense collections through all stages of the media life cycle along a spectrum of intimacy illustrate strategies that can be incorporated by designers of media management software as members of a household manage their shared collection. Portions of this work were supported by the National Science Foundation.

7. ACKNOWLEDGEMENTS

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