Pick Up and Play:
Understanding Tangibility for Cloud Media

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ABSTRACT

The transition from local and personally owned file-based media management to cloud-based streaming services such as Spotify and Netflix brings new opportunities for users, but also leaves gaps in their understanding and practice. In this paper we present findings from an interview study that explored early adopters' complex relationships with their collections which spanned physical, digital and cloud media. From this we entered a design process focussing on new material forms for cloud based media. Based on this we discuss our design and point to areas where, tangible or not, affordances from physical and digital media are available to be explored in the cloud. Looking in particular at the concepts of *scarcity*, *gifting*, and *identity* we outline possible reasons why, and why not, they could be incorporated into cloud media services.

CCS Concepts

• **Human-centered computing~Ubiquitous and mobile computing;** • *Human-centered computing~Portable media players;* • Human-centered computing~Collaborative interaction; • *Information systems~Multimedia streaming;*

Author Keywords

Cloud; Media; Music; Tangible

INTRODUCTION

The Internet has disrupted many industries. Perhaps none more so than those producing consumer media – music, movies, and books have all undergone fundamental change, as the objects produced have moved from physical objects to files, and more recently from digital files to cloud-served 'consumption experiences'. While there is considerable variety in how different media have been affected, at the heart of these changes is a transformation in the *experience* of consuming media. With the advent of 'cloud media' streaming services such as Spotify and Netflix, new consumption devices like the Kindle and iPad, and new methods to curate and share consumption like Last.fm, our

experiences of media are fundamentally altered.

Yet many of our concepts of digital media still draw directly on models of interaction developed when media had a physical instantiation. For example, magazines are still distinct from newspapers, we 'rent' and 'buy' movies, and digital rights are tied to individuals or households. In some cases, the persistence of these concepts is beneficial – they are easily understandable to end users, and have developed over hundreds of years. Yet it may also signify a failure to exploit new possibilities that digital media affords. In this paper we explore old concepts as new possibilities for the cloud. The focus of our attention here is on 'consumer media' – media recorded, published and distributed to enable it to be 'experienced' multiple times including music, video, news articles and the like.

To explore the current innovation in these formats and their implications, we draw on thirteen interviews with early adopters of digital media who have moved, to a lesser or greater extent, to such 'cloud media' services – in particular the commercial service Spotify, Europe's leading cloud music service. While cloud media systems break considerable new ground, so much of the history of media has been tied to physical objects meaning that much of our existing behaviour and language has been transferred over from physical media formats – but entwined with this are the changes forced or afforded by the move to the cloud. In our interviews we were interested in unpacking these changes, and understanding how the relationship to digital media is evolving: that is, the conceptual and practical challenges faced by cloud media users, how they understand and use new features, but also how their broader relationship with media has changed.

These interviews then served as a basis for a design process to develop new cloud media concepts, in particular exploring the *physical* form that media can take. We focus not on the results of this design process (a design catalogue of ten media interfaces and a functioning prototype of a tangible interface to Spotify) but on what they can tell us about the friction between the practices of consumers and the affordances of cloud media services. Intertwined with the concept of *scarcity* are the practices present around *gifting* and *identity* we use to discuss the opportunities that looking back at media consumption can bring to us going forward.

RELATED WORK

Cloud media has quickly grown into a major way of accessing video, audio and related media. Services such as Spotify, Pandora, Netflix and the like are systems where a large library of media is streamed over the internet to computers, mobile devices and TV connected video streamers. As of 2015, Netflix has around 57 million streaming subscribers, Spotify has over 20 million paying subscriptions and 75 million active users, and Pandora has around 79 million active users. Compared to the only 13% of early adopters who had even tried streaming media in 2006 [27] the growth of streaming media services is apparent. The advantage of these services is that media can be accessed without the need to download the media, or buy physical formats such as CDs or DVDs. Payment for media is either at a fixed rate, or free and subsidised by advertising revenue.

Despite this popularity, there is little literature which investigates the changing nature of media and cloud computing. One exception is work by Odom and colleagues which explores what it means to be in possession of an object in the cloud [20] highlighting the problems inherent in the curation, control and access of such objects. In further work [21], the design opportunities of bringing digital, cloud-based possessions into other settings, such as the home, are discussed. While it does not directly address recorded media, Marshall *et al* explored the challenges that users encounter in understanding how cloud services work, in particular in collaborative settings [18].

More specifically with respect to media, Brown *et al* examined the emergent, social practices around sharing playlists [4] and digital music more generally [19]. The changes in social practices brought on by the introduction of recording and file sharing to the social structures around video consumption is explored by Barkhuus & Brown [2] and by Jones [12] with her investigation of the changes streaming media services are causing in home life, especially with respect to broadcast media. While we argue later that the frictionless quality of obtaining media can dilute its value, sharing files with friends has been seen as a way to impart meaning to digital music [15] and sharing music playlists a way to add meaning to social networks [13]. There is a large body of work on personal archiving – especially the management and maintenance of personally produced content such as photos and videos, drawing distinctions between physical and digital mementos, and what this shift implies [14, 21], however very little has been said about the role of consumer media in these studies. Lindley *et al* [17] point out how there may be some value in considering the web as an archive in itself and not just as a means of finding new media, or as a backup for content hosted offline.

INTERVIEWS

We conducted thirteen interviews in total, five in Sweden and eight in the UK, recruiting 'early adopters' of digital media and cloud technology – people who used services such as Spotify, Netflix, Dropbox, Google Docs and Soundcloud. We recruited five women and eight men, between *26* and *38* years old (median age 31.3) of which 11 were Spotify users and five used Netflix. We used adverts on Facebook and Google to recruit self-selected users of cloud services. The interviews were semi-structured and lasted between 45 minutes and one hour. We were not looking for statistically generalizable points, but rather understanding of how changes in the access to files and services has impacted behaviour around media, and also how digital media itself was conceptualised by our interview subjects. As such, our approach to analysing the interviews drew on an interpretivist stance, with the development of an understanding of the problems and practices of those being studied. The analysis involved open coding of the interviews, and the development of themes through an iterative process of concept development.

RESULTS

While we ask questions generally about cloud media, the music service Spotify dominated the 11 interviews with Spotify users. Amongst those we interviewed it appeared that Spotify was the most 'mature' cloud media service that was used. Accordingly, while we will discuss cloud media more generally, our focus will on cloud music.

We divide our results into three main sections. We first examine the concepts and issues around the *format change* that usage of the cloud initiates. Then we discuss general issues and reactions to the cloud and the use of cloud media, in particular the ways in which broad access to media was perceived. Finally, we articulate different aspects of the life-cycle of media, outlining some of the practices around discovery, curation and social practices, and investigate how these relate to use of cloud-media.

Format Change

Dealing with format change is an ongoing challenge of contemporary media consumption. Formats can be defined as the particular *form* that a media takes. Formats such as DVD, Minidisk, 8-Track cassette or MP3 files have all, at some point, been presented as the ultimate format before going through a process of acceptance and then decline. Yet these different formats have distinct characteristics of use, characteristics that change as technology impacts upon the production, storage, transport, and use of a format. It was noted in our interviews that the cloud was yet *another* format, a format that needed to be maintained alongside all the others – with different affordances and features, some beneficial some not. As the latest format to arrive, cloud media was seen as a trade-off – older formats still have to be maintained and managed alongside the new. Finding media in a library split across formats can be challenging, in that one must first locate the relevant media type. This was cited by a number of participants as a reason they were yet to commit to cloud based media streaming services. The cloud would be just another place where media could get lost, as

well as losing (or displacing) much of the investment of time and money they had put into their current file or physical collections:

"Because we have lots and lots and lots of music on different places [...] I need to search both on our home computer and on hard drives"

"Sometimes, "Now, I want to listen to the Beatles". Because they are not on Spotify. Then, I actually do import the Beatles MP3s into the library of Spotify, so I can listen to them . [but] It's only playable on that computer. I can only listen to those rare groups when I'm at home."

A related part of the hesitation in moving to the cloud was questioning what was being lost with the new format. This move (from local files to the cloud) can be framed as a technological progression, with an inevitable move towards a 'better future'. Yet new formats do not necessarily supersede older ones. Different affordances between the old and new formats means that some common practices may be lost while others are gained.

"I used to be a DJ, so I like to have the music on my computer because I want to be able to fade, to be able to scratch in the music. You can't do that kind of thing with Spotify"

Another aspect of the change in format is a change in language used to describe their interactions. The file-based notions of *download*, *buy* and *save* become ambiguous when talking about actions concerning cloud based media services.

"*But now, because of paying the monthly fee, I just buy whatever takes my fancy"*

"So I'll have, like, kind of a country-ish playlist...or whatever and just download things into that"

The act of adding a song to a Spotify playlist was sometimes described as *downloading* or *buying* the song – which would normally not result in a download taking place or any additional payment being made. In addition to this, Spotify does offer an option to download music in order to make it available offline, but this is an action to be taken on an entire playlist and not an individual file. Our participants showed that they understood the results of these two different actions, yet lacked the grammar to express them unambiguously.

"We were both saying, 'Oh, listen to this' and we were sending each other tracks"

Similar ambiguities were present when talking about sharing playlists and media with friends. The action of *sending* a song or playlist to someone using services such as Spotify is inherently different than sending a file or a CD. These problems allude to those set forward in [9] –that the move to cloud-based systems calls for a move away from traditional file-based language and to something more

suitable to the actions and affordances of services such as Spotify.

Interfacing with the cloud

While a common computer science concept, the notion of 'the cloud' was certainly an ambiguous one for those we interviewed, even those who worked with technology. That said, there was a reasonable understanding of the differences between server-based services, where content came over the Internet, and local file-based systems, where content was kept on local devices. The clear advantage cited by our participants was the availability of media at a single cost, online, in a form that could be accessed so long as one had Internet access and that this encompassed a large proportion of desired music or video. This did not mean that *all* media was available of course. For music there are notable absences, such as the Beatles, and video is even more fragmented. These limitations meant there was a need to 'fill in' using older formats:

"More and more I'm resorting to on demand services. [But] I do still buy CDs... 'cause I think it limits choice"

Future disruption of services due to a media service company going bankrupt was not seen as more than an inconvenience for subscription services. However, those who had purchased media as digital files had the expectation that they would perpetually be able to re-download any lost file that they had paid for:

"I have paid for it and, so yeah, if I ever lose it I would just go back to iTunes and get it again"

There was considerable acclaim for the ability to access a large library of media online without having to worry about purchasing or renting individual files. Yet the nature of cloud services did present some challenges. In particular, the interface to cloud services often did not support as quick access to music as older formats – one could not just hit 'play' and access music (such as with a CD player). There was also no clear equivalent to the collection of CDs held around the CD player that could be accessed quickly. This said, the ability to choose which music to play from mobile devices did allow for music choice in a broader range of places. These issues raised points about the control of playback, there is no longer a reliance on access to a specific machine when music can be streamed from a phone or tablet without concern for the file or disc location:

"What's the value of having an MP3 file on your hard drive? There's no value in it. The value is in listening"

These moves are further complicated by the advance of different streaming technologies (such as over Bluetooth or Airplay), with the ability to stream directly to speakers. In our interviews participants talked about how the particular media interface (such as the Spotify app or the Netflix website) fitted with their media consumption.

The cloud-based media lifecycle

Going beyond this there are many different activities that go alongside the direct 'consumption' of media itself. Movies are watched and audio is listened to, yet the 'experience' of media is something that goes beyond these acts. We can differentiate experiences of consuming media from all the activity that takes place *around* that consumption. For example, there is the work of discovering, purchasing, browsing and managing that media, and there are the social activities of discussion and sharing. Media format influences all of these activities too, as much of the conversation in our interviews showed. In earlier work this has been described as the 'lifecycle' of media – of which the direct consumption experience is only one part [4].

Drawing on [4] we characterise the lifecycle that was discussed by our participants into three different classes of behaviour: discovery and acquisition, curation, and social practices. Each of these classes of meta-experience lets us engage with our media in a different way.

Discovery, Acquisition and Sharing

The discovery and acquisition of media are obviously key practices, and have both been the subject of considerable technical exploration – in part due to the expected economic benefit that would be derived by exposing consumers to more media they wish to purchase. This is an area where cloud media services offer considerable advantages through the availability of a large catalogue of various media. Research in this area has focused on recommending algorithms, perhaps most famously with the 'Netflix prize' offered to the best recommendation algorithm for movies. However, thinking about this as a practice suggests that this is not so much something to be optimised but is rather a valuable activity in its own right. One has only to think of the music enthusiasts discussed in Hornsby's High Fidelity [10] – obsessively hunting after rare records in record shops, listening to new music as well as exploring the memories in their own collections.

"It's funny...you go back now and you find 'I listened to that one. That was current.' That's another way of going back in history and memory lane"

The access that cloud media provides to a much larger catalogue of media than in one's local collection supports interesting new opportunities for exploration, particularly of media that is not being advertised or is currently not *in vogue*:

"I think Spotify is a great place to search for new music. I mean if I like an artist and then I get examples of artist that are similar that I haven't actually heard before, I think Spotify is great for that."

In terms of acquisition, much technical work has also explored *limiting* acquisition – in the form of rights management and copy protection schemes. Technologies here have become themselves embroiled in issues around the economic concerns of the media industries, and in particular how piracy can erode the ability of media organisations, and artists, to fund and profit from the experiences of the media they have produced. Whatever the economic issues, the relative scarcity of media – and attempts to legally and technically control access to media through other means – presents a range of issues for those trying to get hold of media.

"If I could not pirate music at all in any way whatsoever, like if I moved to a cloud and then I didn't have control over the hard drive, then yeah, I would subscribe to Spotify or something like that."

Aside from copying and piracy in terms of legal acquisition there are issues of where to get media from, at what price, and in what format. With different services offering different limitations and offering different media types, users must search for suitable ways of getting the media they like at appropriate prices. Acquisition here implies some form of ownership, but actually it is the ability to experience the media here that is central – just as with video rental shops one did not own the hired video, so with many cloud methods of accessing media there is equally no ownership structure.

Another issue concerns the 'costlessness' of media acquisition compared to downloading music online or buying physical media. This takes the frictionless nature of file based media even further than the previous relationship to digital files. While with digital files one could very quickly 'have' an artist's complete discography – there is no cost so thus no real meaning to 'having' cloud media. This means that there is no 'sacrifice' involved and thus the perceived commitment to a particular artist, music, movie, or media form is much less. It loses much of its meaning in terms of its connection to the user. This costlessness is a point we will return to later in our design discussion.

Curation and Ownership

Sease and McDonald [22] in their paper on home media collections document at length the work involved in curating a complex home collection of media. What was clear from our interviews was that the act of media curation is a radically different activity for each of the format types we are discussing in this paper – physical media, local computer files, and cloud-based media. It appears, though, that there are experiences which transcend these differences. For DeNora music is a 'technology of the self' [6]; a part of the social work done to "construct, reinforce and repair the 'thread' of self-identity". Music can be a key component in the work of identity as it offers a "sense of both self and others, of the subjective in the collective" [7]. So the act of curation is not solely a personal, organisational or optimisation activity; it echoes Goffman's point that the action of applying make-up is not only orientated towards presenting oneself for observation but it is about identifying with an ideal for one's own gratification "to be stabilised, justified" [10].

One of the confusing aspects of cloud media services is that in granting access to a massive library of media, the notion of a personal collection is obscured. In curating a personal collection of media, one is not only organising media for ease of access, or displaying purely personal tastes, but also identifying with aspects of defined social and cultural identities. This led some informants to prefer the physical copy even though they had access through cloud media:

"I love to have the physical copy. I like that, to put it up and yeah, I like the CD."

Curation for cloud media, presents the challenge in that media is 'pre-curated', but in a generic format that is not personalised in any way. At least with the current Spotify application, one way of dealing with this was the adoption of playlists as the universal way of organising media:

"I think iTunes definitely changed [and I was] making up playlists. Now with Spotify I do that as well, so I make up much more playlists. So I'll have like a kind of country-ish playlist or a folky one, or nineties music or whatever and just download things into that"

With other services such as Netflix curation and collecting were harder to emulate. While media might not be watched or listened to again, beyond a history view attempts to recreate a collection were difficult.

A related issue concerned the display of media that was being consumed. This was mentioned in the interviews particularly around the use of eBooks. Since books are a common wall covering in many of our interviewees homes, a particular issue around moving to eBooks was that there would be a loss of the ability to display ones taste in literature as part of the environment of the home (or even office). This was expressed in the general terms of the love of books as an artefact and a hesitation to part with them, even though eBook technology itself had produced something often more usable in some respects than paper books themselves.

Social Interaction and Gifting
A big part of the lifecycle of media, and the consumption experience, concerns the social situations in which these experiences take place. For example, the gifting of media shows understanding of the person receiving the gift: intertwining the ability to successfully give a gift with the recipient's ability to successfully curate their collection and make that available in an appropriate manner [5]. Without that understanding the gift can be less valuable.

The gifting of digital objects can go part way to fulfilling the gifting obligations felt in social interaction [25] but the interviews show a decline in gifting media. If a piece of media is available in the cloud its value is relatively low – even if the monetary value of the physical media is not. This means that it is harder to understand and sustain its status as a gift of some value [23].

"I did, but I haven't [bought music as a gift] anymore, probably because I am not sure what people have got, and whether they would appreciate having…"

Much of the movement in media technology has been focused on the personal consumption, many times at the expense of communal consumption of media. Mobile streaming, personal head mounted cinema displays and even the streaming of media from personal devices to shared screens and speakers moves the control and awareness of that control into the hands of the originating device owner. One aspect of the social experience that is well supported by most cloud-based media services, or by 3rd party services alongside them, is recommendation among friends – traditionally in the form of Mixtapes this form of sharing is supported with public, shared, and sendable playlists [24].

"People sometimes put comments on Facebook saying 'Oh, I like that track you're listening to.'"

With file-based media there is the possibility of transferring the file to someone else's device to give them the music, so long as digital rights management tools to restrict copying had not been employed in the creation of the file by the original distributer. Indeed, online systems also radically change the social features around media and this has been one area where different systems have attempted to explore the expanded opportunities to share details of what one is listening to or is in one's collection. There was considerable hesitation about using these features though – although the talk around them did bring up subtle issues around how behaviour is changing. One participant, for example, talked about being 'trained' to accept that what he listed to would be publicly available. As he saw it this was something that was broadly desirable but took some adjustment to be acceptable.

"I upload everything … I'm not happy today that it is public, but I don't do anything about it, either."

In summary, these individual accounts provide rich insight into current everyday practices around, and a clear understanding of what our interviewees considered to be the benefits and disadvantages, of cloud services. For our study, they formed the basis of the design process that followed.

In terms of how users generally perceive and understand the services they use, the language to describe their engagement reveals an ambiguous and evolving perception of how they function, the persistence of the media they consume, and the nature of subscription services and individual ownership.

The move from the physical instantiation of formats such as CDs, DVDs and printed materials to cloud-mediated services, heralds a number of changes in interaction with the recorded media: users cited the ease of curation and distributed access to almost unlimited subscription based media collections as a clear advantage over storing and accessing their own media via different physical formats on

personal devices, at variable cost and security. Furthermore, a number of interviewees confirmed they now enjoy and consume a wider diversity of media as a result of exposure to the larger collections of media afforded by subscription-based cloud services like Spotify and Netflix.

In contrast, it was noted that experiencing music via cloud service interfaces, like Spotify, can lack the suggestibility of a physical format such as CDs or DVDs – which themselves, provide visual prompts to use. To compound this lack of physicality, the main mode of access content on cloud services is through search, presenting a constrained approach to exploratory browsing and discovery of new media. In some cases, the complexity of interface, such as creating and accessing playlists, proves an obstacle to users. In a related way the lack of physical instantiation of media being consumed, such as books and music albums on shelves, results in the lost opportunity for the presentation of self through display of media choice and preference with co-present others.

Lastly, it is clear that the value of gifting recorded music and video has declined, partly through difficulty in knowing the recipient's preferred media format – do they have a CD player and what titles do they already own? By publishing information on media consumption, the social aspects of cloud media leads to easy knowledge share about music, films and books – as well as actual shared media consumption. The personal history of media consumption was considered of interest and value by our interviewees as a means of accessing the past.

DESIGN OPPORTUNITIES: TANGIBLE CLOUD MEDIA
These interviews give us some insights into user expectations and behaviour around cloud media; as with any technical innovation there are advantages and issues. The ability to access a larger catalogue online obviously has some advantages over more limited individual collections. Yet the loss, or transformation of the collection also caused issues in that it was harder to form a close relationship with the media that was being listened to. Removing the burden of curation in part reduced the value and connection with the media.

In analysing the interviews, our goals were not to predict the future of cloud media but to inform and inspire a design process through identifying and understanding issues such as absences, problems, and areas of confusion in existing media practice. More broadly, we were also aiming to develop new ways of thinking about cloud media. As we discussed in our introduction, many of the metaphors and characteristics of digital media come as echoes of the past, including the language used in relation to physical media, and the associated limitations and affordances that implies. Could we come up with new metaphors or concepts? Moreover, could we understand better the experiential nature of media in its many different forms to again generate new design concepts?

A key point in our design process was when we started to rethink the material forms that cloud computing enables. It is tempting to see the move to cloud media as a lessening of the physical form, a 'dematerialisation' of sorts. Yet this would be mistaken since the physical form of media does not disappear but is transformed – we still need to physically interact with an application's interface, a screen of some sort to consume the media. While the physical nature of media is preserved it is transformed – cloud media significantly decouples the physical form that media takes from the requirements of storage and bandwidth. We went on to draw on three key themes from our interviews in our design process:

Scarcity: We were interested in how the abundance of media available in the cloud affected the previous scarcity of media, and in particular how it changed some aspects like collecting and displaying media.

Sharing and Gifting: clearly the sharing of media is key to its use, and this does not change with the cloud. While the cloud looses some aspects (such as gifting), it enables new ones (such as sending a playlist).

Managing Identity: Identity can be created and performed in many different ways and for a variety of purposes – one that has been studied in depth both in academia and in the arts is the nature of identity established with and through music. This has been, to some extent, dependant on the visibility of musical choice and the ability to *make* these choices visible as a badge of identity and membership. However intertwined with the digitisation of music is the disappearance of many of the practices that could be used to make visible a musical identity – browsing a certain section of the record shop and displaying CDs around the player are being replaced with non-performative actions.

Using these themes we produced an annotated 'design catalogue' of potential concepts, drawing upon the conceptual design work of researchers at Goldsmiths – as Bowers [3] puts it: [an annotated portfolio is] "a means for capturing the family resemblances that exist in a collection of artefacts, simultaneously respecting the particularity of specific designs and engaging with broader concerns." Our design catalogue started with 10 sketches of systems for the home utilising an array of pre-existing technologies such as tablets and televisions as well as a range of speculative hardware, software and service integrations. Each of these designs highlights different aspects of the opportunities that cloud media services offer in combination with local practice.

This design catalogue was presented for discussion to the research directors of Ikea, a major Swedish furniture manufacturer and retailer. Drawing upon their own work and the trends they are witnessing in purchasing behaviour across demographics we explored the extrapolated lifecycles of these systems. The theme of Scarcity and its relation to gift giving, receiving, and displaying in the home generated

discussion around the possibility of augmenting existing physical products with cloud media access rights. The visible display of media consumption and its curation was discussed in relation to the growth of such collections and the transition physical media makes between 'front of house' and 'storage.'

We then iterated on these design concepts, to explore and expand on the design space around cloud media. We selected one concept for limited prototyping, drawing on a concept that we felt would visualise most productively our experiments with the material form of cloud media by foregrounding not only the gifting behaviour and the self-presentation & co-present aspects of tangible media use, but also exploiting the benefits that cloud based systems offer such as the access to a vast library, and the ease of exploration and discovery of new music.

Pick Up and Play

The concept which was taken forward to the prototype phase we called Pick Up and Play. At the simplest level Pick Up and Play implements a radically simplified interface to music: the ability to just push one button to hear music, as shown in Figure 1. The cubes offer a distributed interface to choose and start playing music, a way of playing with and discovering music, but also a way of gifting music through physically gifting a cube. The cubes also explored a "tangible" Spotify – a Spotify with a different physical relationship to music than simply a screen.

These screens could be interacted with individually, allowing the user to control the playback of the media through gestures, such as shaking to randomise the order of playback or tapping or performing other touch-based gestures such as swiping and pinching to perform actions such as playing media or changing exactly what media each physical object represented – either a playlist, an album, a friend's music history or a genre-based radio station. The cubes were also able to be interacted with spatially, by placing cubes beside one another in order to expand playlists or in combination with gestures to copy or move content as shown in Figures 2 & 3.

There have been a number of related tangible music systems which have focused on one particular aspect of the experience of media such as the MusicCube device's [1] focus on portability, the Music Cards' [8] focus on the share and transport of playlists, the Nomadic Tangible Music Player's [28] focus on control of the consumption experience and the Music Wall's [11] focus on co-present awareness. We produced the working prototype using

Figure 1: Pick up and Play Prototype

devices called 'Sifteos' (www.sifteos.com) – small, wirelessly connected cubes (measuring about 1 inch across) with a colour display on one face and a touch interface. The Sifteos supported much of the functionality that was desired. Technical limitations caused some problems, however. Sifteos can connect and talk to 'each other' but cannot connect to a PC or the Internet. Our solution to this was using a dedicated Sifteo with a web camera pointing at it, using the display to communicate with a PC.

In using Pick Up and Play a user can just pick up a cube, push the screen and the album shown will play. This is comparable with a CD already being in the player, and in contrast to the service where first the application must be launched, the playlist selected from a list or searched for and then playback initiated. Making it quicker to initiate listening was a key design goal. Moreover, since there is more than one cube the interface can be distributed throughout the home. Physically locating the correct cube can be seen as a sort of search but in taking advantage of spatial reasoning and the multitude of local 'landmarks' within the home. Their placement is independent and therefore cubes can come connected with the space which they are left. A cube that was used to start a 'kitchen' playlist and then left in the kitchen would become a short cut to the kitchen playlist. More advanced functionality allowed cubes to combine different playlists if they were held together, playing a combination of music from each playlist.

Identity

The work of managing a profile based on the aggregate of your historical music listening has been shown to be more active and nuanced than it would first appear demanding a great deal of effort on the part of the listener.

Figure 2: Pick up and Play: Combining Playlists

Figure 2: Pick up and Play: Copying Music

Our tangible music player restricts the amount of information shown to others to a function of the number of connected Sifteos on display making much more manageable and malleable the work of self-presentation. Where the 'weight' of a history of music listening lasting months or years can feel restricting to its owner and can carry deeper meaning for those who view it – a small, local and temporary 'working set' of music provides deniability, space for experimentation and the opportunity to craft a presentation of self for a particular audience. The contents of this working set being visible to anyone in proximity, again in the same manner as a set of CDs on top of a hi-fi, provides not only a means for self expression, but also a topic for conversation and a set of artefacts for collaboration.

Gifting
A keenly expressed lost affordance was that of gifting music, as mentioned earlier aspects of this have to do with the lack of awareness of other's collections, of how they maintain their collections on multiple formats, of an attractive and meaningful artefact that can be gifted, and we surmise the reduction in perceived value of music as the accessibility is increased and individual tracks or albums are no longer metered. The tangibility of the Sifteos mean that the act of gifting a physical object can be combined with the broad range of music available from a cloud based service. Through simply giving a cube away one can gift or loan music. In figure 3 we show also that the usual remote sending of music can be enabled by picking a playlist and using a 'share' cube to send it to one of the users' friends.

Exploration
Keeping the advantages of the vast libraries and the increased exploration of music reported by our interviewees the Pick Up and Play system allows for collaborative and tangible exploration of music. By placing cubes beside each other as seen in Figure 2 the contents can be combined into a single playlist, allowing for different people to bring their own cubes and collaboratively build a joint playlist for an event with little technical effort and to hear the results of this collaboration without having to negotiate playback control from one to the other.

However, this joint playlist can also be used as a seed for a generated radio station. So by placing together cubes representing playlists, albums or entire collections of an individual, a body of music can be build up to both bound and ground the future exploration of music in the online database. In this way the openness to exploring and experimenting with new music we have seen from our interviews is supported and in some ways enhanced by the tangibility of the Pick Up and Play devices.

DISCUSSION
This design explores different themes arising from out interviews but also attempt to bridge somewhat with the affordances lost from older media formats. It is important to emphasise the great value that the move to digital, and especially cloud based, media brings to those consuming it. Not only does it reduce the cost to access a huge range of music, it makes it simple, present at hand, of high quality, searchable, sortable, instantly shareable and bundled with artwork and biographies to name but a few of the advances. That people miss taking part in some of the practices around which they grew their love of music in general, and certain artists in particular, is an artefact of the natural troubles of the advancement of technology. Younger generations never experience the world in the same way as those who have come before, as the world is no longer the same – and this is, in general, a good thing. The problems with Pick Up and Play are self evident – the interface makes it very difficult to search, the reliance on physical objects is (in most situations where it would be used) nothing but a hindrance, and it doesn't take multiple users into account to name but a few. We have not conducted extensive evaluation of this prototype, rather our goals were to explore ways of thinking about how the cloud is interfaced with and used.

One of the biggest changes to how music is experienced through cloud services is the removal of scarcity – that for a single monthly fee more music than it is possible to listen to in a lifetime[1] changes the whole social structure around

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[1] 20 million songs on Spotify with an average length of 3 minutes equates to over 114 years listening.

music which is especially apparent for those who curated their collections before the cloud – like our interview subjects. One aspect is the weight that the scarcity gave to each acquisition for a personal music collection, while services like Last.fm attempt to fill the gap in being able to display your musical tastes to others what they display, when combined with a cloud based music service, is inherently different. Some may argue that such services reflect something closer to the 'ground truth' of a user's listening tastes by quantifying their listening instead of their purchases. However our participants keenly felt the reduction in agency and the loss of opportunities to curate. Identifying with a certain subculture through purchasing is an intermittent act, where transgressions can be easily hidden or explained away (as gifts for example) however performing the same identity work with quantified listening is an ongoing process where transgressions are (by default at least) instantly and globally visible. But this is only a problem for those who performed identity work in this manner before cloud based music services – young people will simply find other ways to perform and craft their identities.

The use of cloud media to explore each others' musical tastes can be done without quantification services – *"We were both saying, 'Oh, listen to this' and we were sending each other tracks"* – and it could be argued that this becomes a more social and interactive activity than rifling through someone's carefully curated CD collection when they have given you the task of playing music. Taking advantage of this is a ripe area for design across all digital media, however the length of (most) songs does lend itself to this more than movies for example. This also gives the opportunity to perform your intimate knowledge of another's likes and dislikes, and while the 'gift' of music may be devalued as it loses scarcity many of the other social functions such gifting encapsulates can be performed. Indeed, it is only those for whom the performance of 'present giving' in conjunction with gifting had been done through the purchase of music who feel this as a loss.

While the cloud is currently connected very much with conventional PCs and phone interfaces, these examples show how different form factors and more tangible interfaces could support different constellations of functionality. A key feature we have explored here is how the interface to the cloud could support richer co-present forms of interaction. By bringing the cloud based music service out of the personal computer or (even more personal) mobile phone onto a shared, or at least shareable, device we can provide a platform for richer co-present interaction around music. This doesn't have to be just the recreation of practices seen around physical media formats, we have the opportunity to harness the power of the cloud media services and support the interactive and personal co-exploration of musical tastes described above.

Lastly, while we have focused on mass media here it is worth considering how one might draw on these designs for cloud interfaces more generally. Photographs are one logical extension, and we could imagine versions of all of our concepts using photographs from the cloud. However the danger of falling into the trap of seeing changes in social practice in the face of new technology as a problem rather than simply as a natural evolution of social interaction to include new practices presents itself each time such change takes place.

CONCLUSIONS

The design concept here attempts to explore the results from our interviews, but also the new opportunities that cloud media provides. As we mentioned above we do not see the cloud as a loss of physicality in music media. As with the adoption of digital media files the key change was that the physicality became something encountered and managed through a interface, be that on a computer or iPod screen.

Rather than seeing the adoption of cloud media as necessarily about the increasing 'dematerialisation' of media, in contrast we explored in these concepts how new physical forms might support new uses. As Harper et al point out, the advent of cloud media is not simply a way of replicating our existing models of ownership and use. Rather it allows us to return to and think of new ways of supporting action around media, new physical forms and new use cases: "*cloud computing could enable new kinds of practices to emerge, which change ideas about how individuals relate to 'their' data, and to each other via it."* [9] Key to the design of Pick Up and Play was enriching users' experiences around cloud media – sharing and mixing music, music selection and the like. While Pick up and Play is a physical prototype, it is also possible to move the discussion in a conceptual direction.

We have identified practices surrounding the experience of media consumption which current cloud media services don't support fully. In the design exploration of *scarcity, gifting,* and *identity work* we started to map out this space. We feel that this space presents a rich and fertile ground for the development of both hardware and services, and is worthy of greater and more in-depth study both into current user practice and into future designs.

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