No More Milk Crates: The Importance of Music

Library Design in the Digital Age

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Abstract

Music has always been a vital part of human society, but never before has mankind seen so much media so readily available. The digital age has brought on a slew of new opportunities in the music industry and has resulted in the creation of unique ideas such as subscription streaming services and specialized high fidelity audio players for digital media. At the same time, however, this speedy evolution has precipitated a number of new concerns. Individuals have always found ways of organizing their physical music collection, no matter their favorite format. These familiar methodologies of organization are long lived and deeply ingrained in society's consumption of music, so how could it be possible to make the transition to a digital collection? Despite the presence of some sparse research into how consumers mentally represent and organize music, most digital libraries seem to guide their digital library designs via assumptions and expectations, rather than examinable research. This paper seeks to elucidate some of the research into how people conceptualize their music collections, and combines this research with the knowledge accrued in PSY 53, Engineering Psychology (Tufts University, Medford, MA) in order to critique the present digital music library options and offer a novel mobile alternative.

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Before 1984, people listened to music on vinyl records, and if you wanted keep your

collection at all organized, this meant developing a ritual of selecting a record, delicately setting

it up on the turntable, and then carefully storing it back in its rightful place. For decades,

countless people struggled to find the perfect way of organizing their collection, always

wondering whether it was better to organize albums by year, title, artists, or even more esoteric

things like color, and each time they wanted to try a new method, it would require hours of

resifting through albums. In fact, many radio stations still struggle with this very issue to this

day, and have more milk crates and shelving units than they know what to do with. Fortunately

for the common consumer, in 1984, CDs began their rapid and vicious takeover of the music

industry, driving vinyl sales to a miniscule fraction of what they once were. Still though, the

plight of physical organization persisted, albeit on a substantially smaller scale. The CD rack was

introduced, and multiple-CD disk changers became popular, but it still took substantial effort to

maintain a permanently organized collection (Hogan, 2014). CDs remained the music industry

standard until about 2004 when digital media began taking over the industry even more

aggressively than CDs had 20 years prior. Over the course of a decade, digital downloads went

from being a niche, frontier format, to being the most heavily consumed format the music

industry has ever seen. What was left was an abundance of dusty discs, heaps of irrelevant milk

crates, and endless questions about the future of music consumption (Swensson, 2014).

**Research Review**

Even though the digital music industry did not truly begin its takeover until Apple

released the iPod and iTunes in 2001 and later paired it with the powerful iTunes Music Store in

2003, (Hogan, 2014) people were already wondering how to best tackle the problem of

maintaining and browsing through a digital library of music. Cunningham, Reeves, and Britland

(2003) conducted a multipronged study in the hopes of shedding some light on the reasoning

behind people's music browsing behavior. They claimed that the digital music library programs

of their time (predating iTunes) were designed based upon anecdotal evidence of and

assumptions about user needs, rather than observed behavior and needs. The three researchers

conducted interviews and focus groups asking participants about their browsing and listening

habits, and also observed people in music store and music sections of the public library in the

hopes of identifying reliable trends in how people search for, select, and listen to music. One

trend that they noticed was that specifically searching and casually browsing tended to occur

together, despite the fact that most digital libraries at the time separated searching and browsing,

and to this day, continue to have some degree of separation between the two.

Most interestingly, the researchers shed some light on how people represent information

about music in their brain when they are searching for it. They found that when listeners were

looking for a particular item, they tended to rely on bibliographic information, namely artists

name, album name, and song title. When browsing however, people tended to rely on less

specific qualifiers to guide their search, namely era and genre. While almost every album falls

into an era based on its date (although depending on definition, it is possible that there may be

overlapping eras), classifying an album with one genre tag often feels inadequate, and is a very

difficult endeavor. Even more challenging to digital library designers, the researchers noticed

that people tended to start relying on self-defined "genres" such as study music, workout music, or rainy day music.

One last trend that was particularly interesting to the researchers was a behavior familiar to anyone who frequents a record store: deciding on a section of the store, and then devotedly flipping through each disc (vinyl or CD), one row at a time. Individuals therefore heavily preferred being able to quickly glance at the spines and covers of the discs they were examining, and they found it much easier when the discs were organized alphabetically. This promoted the most efficient means of quickly absorbing a lot of information about a lot of discs. That said, sometimes even all the external information combined was not satisfactory, and consumers wished they could have a way of reading the liner notes, which was not possible for sealed discs. Frequently, one of the biggest factors that guided an individual's response while flipping through discs was the cover art. Consumers tended to rely on cover art when quickly searching for a specific album, and when browsing for new albums, they believed that there was a lot of information held in the design of the album cover, and the researchers found that other than the music itself, cover art was perhaps the most memorable aspect of an album, and sometimes the cover seemed even more memorable than the music.

In a follow up study, Cunningham, Jones, and Jones (2004) focused in on how individuals organize their personal libraries in order to potentially illuminate trends that could be considered in the creation of future digital libraries. The researchers again used a combination of interviews, focus groups, and observation sessions to gather data. Interestingly, this study was conducted right around when the iTunes store rose to prominence, and single tracks started becoming far more popular, however this study focused on the organization of complete, physical albums. One of the most interesting trends to emerge was that people usually segmented

their CD collections and stored them in multiple places. The researchers frequently observed that people would keep a small stack of CDs right near their player if they were regularly listening to them, and then a larger collection that was usually organized in some manner located in another spot. Additionally, many people had what the researchers called an "archive," which they qualified as a collection that was no longer of particular interest to the individual, but one that they were too reluctant to get rid of. Fortunately, the growth of digital music has meant that people no longer need to physically separate their collection of music, however there is still something to be learned from these findings. It seems that people tend to listen to the same record multiple times over a short period of time, which resulted in people keeping a small stack near the record player for predictable and easy use. This suggests that there may be some inherent value to displaying listeners with information about music that they have recently been listening to.

Other than the discovery that people segment their music collections based on logistical convenience, the researchers largely reproduced the results of Cunningham et al. (2003). Individuals primarily relied on artist name, album name, track title, release date, and genre to categorize music, with the addition of a few more idiosyncratic sorting methods such as country of origin or date of purchase. It was again found that people enjoyed browsing, even through their own collection, and often decided what to play after linearly browsing through at least a section of their collection once or twice. By and large, the way people search for new music in a store ended up closely resembling how people organize their own music collections. It appears from this research that music conceptualization tends to converge on a number of key sorting methods as well as a fair amount of unpredictable personal qualification.

## Current Technology Review

While technology has rapidly advanced since the turn of the century, digital music libraries look remarkably similar to the way that they did when iTunes was first becoming popular, which was around the time that Cunningham and her fellow researchers were making the claim that digital music library design of the time was guided by assumptions and expectations rather than on observable behavior and other research. To be fair, most services now display cover art somewhere on the screen while the initial programs did not, but most libraries are still primarily just searchable and sortable lists of metadata text. Comparing Figure 1 and Figure 2 below, it is clear that iTunes made little library design progress over the course of a decade (though it is worth noting again that Apple took made giant leaps in 2003 with the introduction of the iTunes store, this section of the paper aims to only focus on the design of an individual music library.)



*Figure 1.* iTunes 1.0, the first iteration of Apple's popular music software, released in 2001 (McNulty, 2006).
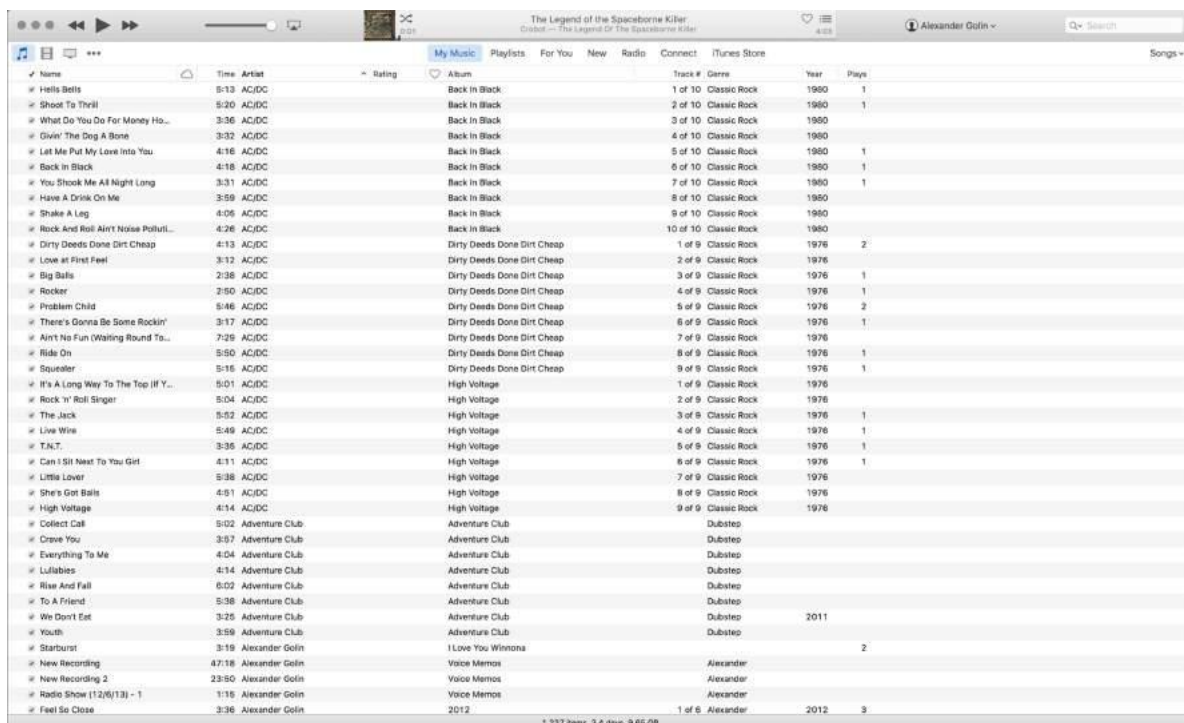
*Figure 2*. iTunes 10.0, Apple's last iteration prior to overhauling the library UI, released in 2012 (Myslewski, 2012).

While it is clear that Apple took some steps to make their design sleeker and eliminate

skeumorphic aspects (such as the buttons along the bottom bar, opting instead for silhouettes of

button icons), the overall structure of iTunes remained constant; upon opening the application,

the user would be bombarded with dense textual information, placing a high cognitive workload

on the user. The basic overview of the design is consistent of a high level sidebar that allows the

user to select what the main view frame displays, and the main view frame, which is generally

consistent of a table of metadata that can be sorted by various parameters via the column

headers. The application became far more robust, as evidenced from the increased number of

sidebar items, however Apple made little to no effort to change the display of this information,

even though there is more information to process. Despite the drawbacks to this largely non-

visual design, it has become an industry standard and many of today's current services continue

to utilize this basic model at least as a foundation.

Despite the information overload of modern times, the industry is still relying heavily on the same principles that guided iTunes' design through its first decade of existence. Indeed, in 2012, Apple released a highly revamped version of iTunes and has continued to develop the design since (Figures--------------- 3 below), however the update has received mixed reviews. Figure 3 displays the "Song View" of the "My Music," and it is clear that iTunes designers still rely heavily on the table of metadata to convey information. Once again, the user is greeted with not much more than a wall of text, which for many people would result in an increased cognitive workload. That said, there were a number of new introductions in the new iTunes, the biggest of which was the ability to display your music library in a number of different ways. By selecting the dropdown menu (which only appears when in the "My Music" section of the main top bar), users can switch between "Song View" (Figure 3), "Album View" (Figure 4), "Artist View" (Figure 5), "Genre View" (Figure 6), and "Composer View" (Figure 7).



*Figure 3*. Song View of My Music in iTunes 12.3, the most updated version of the software.
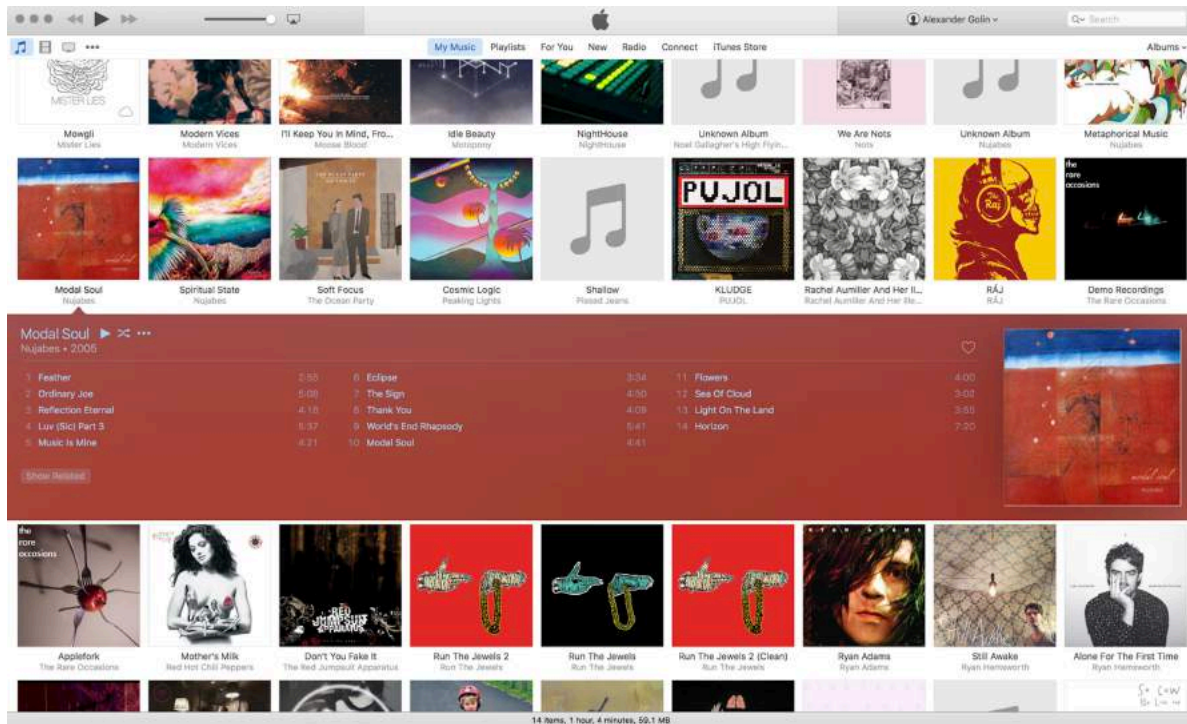
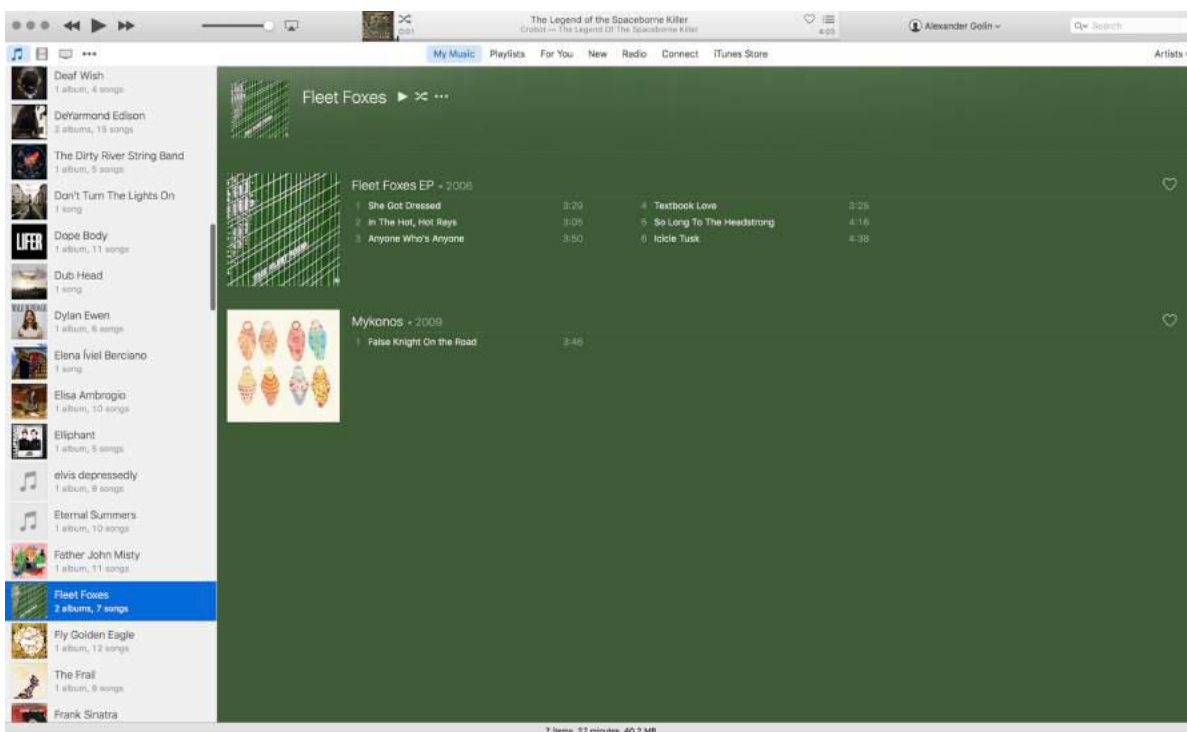*Figure 4.* Album View of My Music in iTunes 12.3, the most updated version of the software.



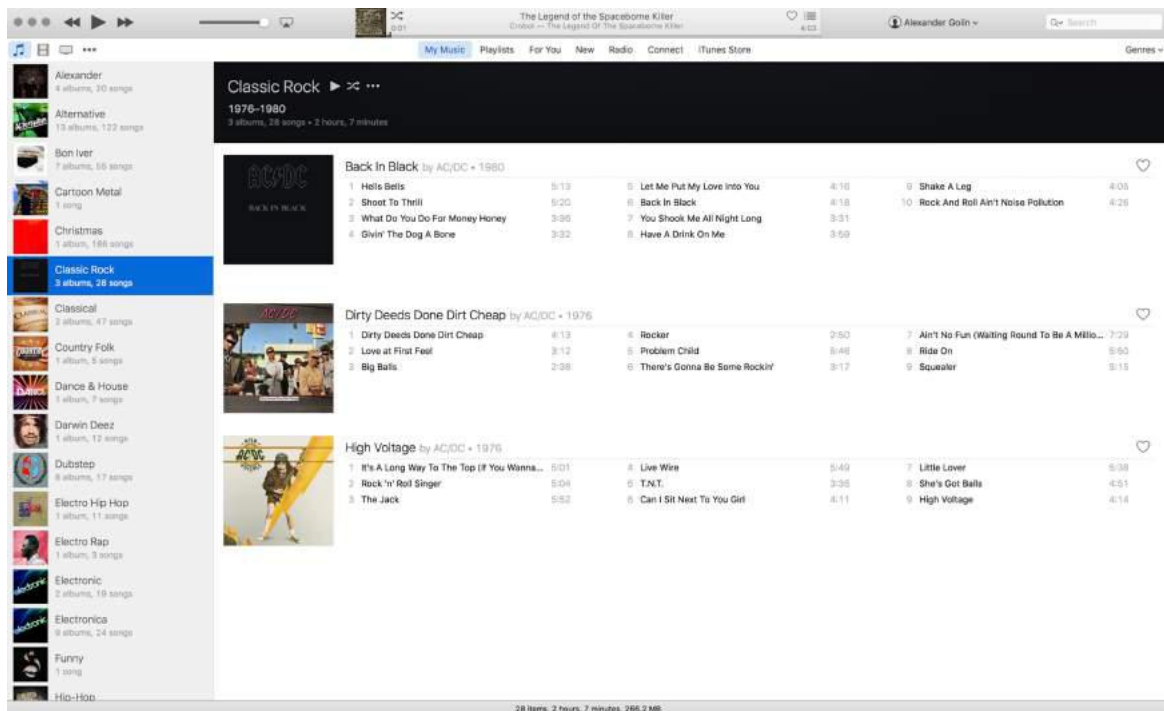*Figure 5.* Artist View of My Music in iTunes 12.3, the most updated version of the software.

*Figure 6.* Genre View of My Music in iTunes 12.3, the most updated version of the software.



*Figure 7.* Composer View of My Music in iTunes 12.3, the most updated version of the software.

At long last it seemed as though iTunes was trying to break new ground and move away from their stagnating table-of-metadata design. It seemed that digital music library browsing could finally be about more than just reading lines of text. In today's iTunes, users have the ability to select their favorite view of their music, and can even view it purely as album artwork, so it seems as though iTunes has indeed been trying to incorporate many of the findings of Cunningham and her co-researchers. The program incorporates a better system of visual browsing and allows users to organize their music based on some of the bibliographic information that the researchers found most vital such as artist name, song title, or genre. So then why has iTunes been met with criticism over their new design (Wright, 2015)? While some people have enjoyed the updates to the application, it seems that many people have found it difficult to adjust to the changes (McElhearn, 2012). Despite having the ability to choose how to view their music, having such diverse options makes it difficult for individuals to grasp exactly how their library is organized. While iTunes designers made some significant steps in reducing the cognitive workload of a text filled screen, they also eliminated their longstanding model of what a digital music library looks like. As the standard for music library software during the digital revolution, iTunes' list-like model has become a standard in industry as well as in consumers' brains. Consumers have a mental model that their library can exist in one state, which can be attributed to both the logistical necessities of organizing a physical collection as well as to the long lived trends in digital library representation. When iTunes decided to introduce five separate views, all of which display different information in the main view frame and may or may not have various types of sidebars, they eliminated the user's ability to enter the application with a coherent and firm mental model of how to browse their library.

To an extent, it could be argued that iTunes' new optionality follows from the findings of Cunningham et al. (2003) that individuals differ in how they prefer to organize their music. That said, iTunes only offers a superficial ability to select your organization. Surely, you can decide to view albums by genre, but what if you want to view all the album art of all the music you have in the punk genre? iTunes does not support that. Instead, you can choose to view the album artwork of all of your music, or you can view the punk genre as a list (though the list does contain album artwork, which is a nice visual addition). More importantly, iTunes introduced optionality at the expense of application coherence, which has resulted in a serious impediment to user ability to properly formulate a robust mental model of the software.

### Introduction to Novel Product Design

(Disclaimer: to promote legibility and flow, I will be using first person in all future sections, despite the fact that proper APA format requires third person. I hope this is acceptable, since this paper has definitely started to breach the traditional boundaries of a standard APA paper or study.)

It is clear that digital music library design is still a developing field. With major design overhauls only beginning to happen in the last five years, it seems that now is the time to explore user needs and expectations and attempt to create something novel and unique, even if just to shed some light on how people interact with music software. With this motivation in mind, I have attempted to create a mobile digital music library interface that integrates the research described in this paper with the information accrued in PSY 53, Engineering Psychology, at Tufts University in Medford, MA. When designing the application, I primarily concerned myself with three concepts from lecture: cognitive workload, mental models, and Fitts' Law.

The application is premised around the organizational methodologies that were popular during the vinyl era. The reason I chose to focus on this era is twofold. I partly chose this because of how well established vinyl sorting practices have become in society. It is a format that has lived an entire lifespan over the course of nearly a century, so I believe there is a wealth

of knowledge to be gleaned from vinyl sorting habits due to their long standing nature. My other reason for selecting this era is because of an interesting fact I've noticed, paired with some of the findings of Cunningham and her co-researchers. Despite the prevalence of digital media and the fact that we no longer need to represent works of music as albums, the vast majority of the music industry still chooses to release new content in the form of albums. Even though songs are no longer anything more than signals in a computer, something about the human mental model of music continues to lead us to stringing a full album together, complete with a square image for album artwork and track listings. Combining this realization with the research suggesting that individuals heavily rely on visual stimulation when browsing through and searching for music, I settled on trying to design an application that would help promote conceptualizing music as physical albums, particularly emphasizing cover art. I hope that this decision helps to promote a mental model of the application that easily aligns with individuals' preexisting mental models about music libraries.

**Novel Product Design**

My app design is called Milkcrate, and it is meant to be an alternative means of browsing through and listening to a personal library. When the users start the app, they will be greeted with a home screen displaying up to eight milk crates at a time (Figures 8 and 9). By default, these crates will be sorted alphabetically by artist, and the app will automatically determine optimal ranges for the milk crates. For example, if an individual has no artists whose names begin with P, then there would be a crate devoted to the letter N-Q. This application is still in the design stages, and determining the optimal average number of items per crate would require more experimentation and research, so I will leave this description as a qualitative one.
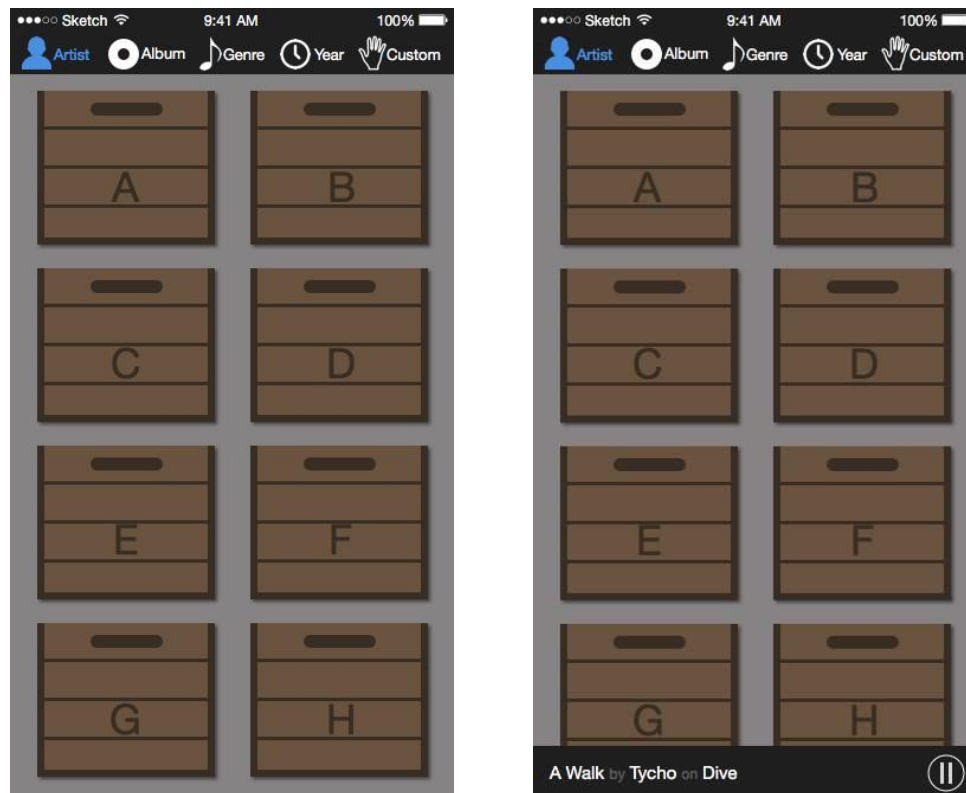
*Figures 8 and 9.* Design of Milkcrate's home page. The image on the right displays the home page view when there is a song currently playing.

On the top of the home page, users can select from one of four predesigned organization patterns: artist, album, genre, or year. These four organization patterns were selected due to the findings of Cunningham et al. (2003) and Cunningham et al. (2004) that people tended to most heavily rely on these four aspects of bibliographic data. One last option is available to users on the top bar, which is custom mode. This allows users to manually sort their collection of albums into crates which they can label however they like. Users can then save their custom organization to view at a later date, and can save multiple custom configurations. No matter which organization pattern is selected however, the main page will always look relatively the same, and will always be an array of crates with labels. I tried to keep the home page as simple and consistent as possible in the effort of maintaining a low cognitive workload for users while also facilitating the development of a robust mental model. Also worth noting, I chose to design the

crates rather large, and minimize the distance between them as much as possible without

squeezing them together too much. This was in an effort to conform to Fitts' Law in the hope of

minimizing the number of times users would accidentally tap a non-reactive portion of the

background. Also in accordance with Fitts' Law, the now playing bar on the bottom was

designed with the play/pause button on the right hand side since most people are right handed,

and this location is easier to tap with the right thumb than the left side of the screen.

When users settle on an organization method, they can then begin browsing a crate by

tapping on it. The user will then be taken to the browsing view (Figures 10 and 11). The crate

will move to the bottom of the screen and will rotate around the horizontal axis to simulate

getting a birds-eye-view of the crate. This animation will be short and very clean to minimize

any distracting effects or unnecessary wait time, but I believe that an animation would

dramatically help users understand how the app works and what they are looking at, to ultimately

facilitate a better development of a mental model. The goal of the browsing page is to simulate

the feeling of leafing through a stack of records at a shop or in a home collection. Users can

either scroll or walk their fingers within the birds-eye-view of the crate in order to sift through

albums. I think the app should support both gestures because the scrolling gesture is highly

common to many mobile applications, but the walking motion could be a more unique addition,

and I believe it better emulates the feeling of rifling through records.

As the user leafs through the albums, the top down view of the crate will update to show

the user exactly where they are in the stack, to mimic the visual feedback that can be obtained in

a record store. Each time the user scrolls or walks to another album, its art will be displayed very

largely in the top portion of the screen along with the artist, album, and release year, since these

four items tended to be some of the most reliable and highly used bibliographic information

when searching for or browsing through music. I chose to not include any other information to reduce cognitive workload and visual noise, however if users desire to see a track listing or back cover, they may double tap on the album artwork and it will flip over. The top down view of the crate is designed in accordance with Fitts' law, as I have maximized the horizontal target area and placed the target as close as possible to the home position of the thumb should the user choose to scroll through the stack. I actively chose to devote a large amount of space to the cover art and metadata since it was repeatedly reported in prior research that this information is vital to users as they search through or browse a collection.



*Figures 10 and 11*. Design of Milkcrate's browsing view. The image on the right displays the browsing view when there is a song currently playing.

Finally, when the user selects an album to play, they may tap on the album cover and the screen will change to the now playing view (Figure 12). The now playing view is the view that is least radical, and it takes a great deal of influence from another prominent mobile music player,

Spotify (Figure 13), however I made some key changes that I think sum to make a noticeable

difference.
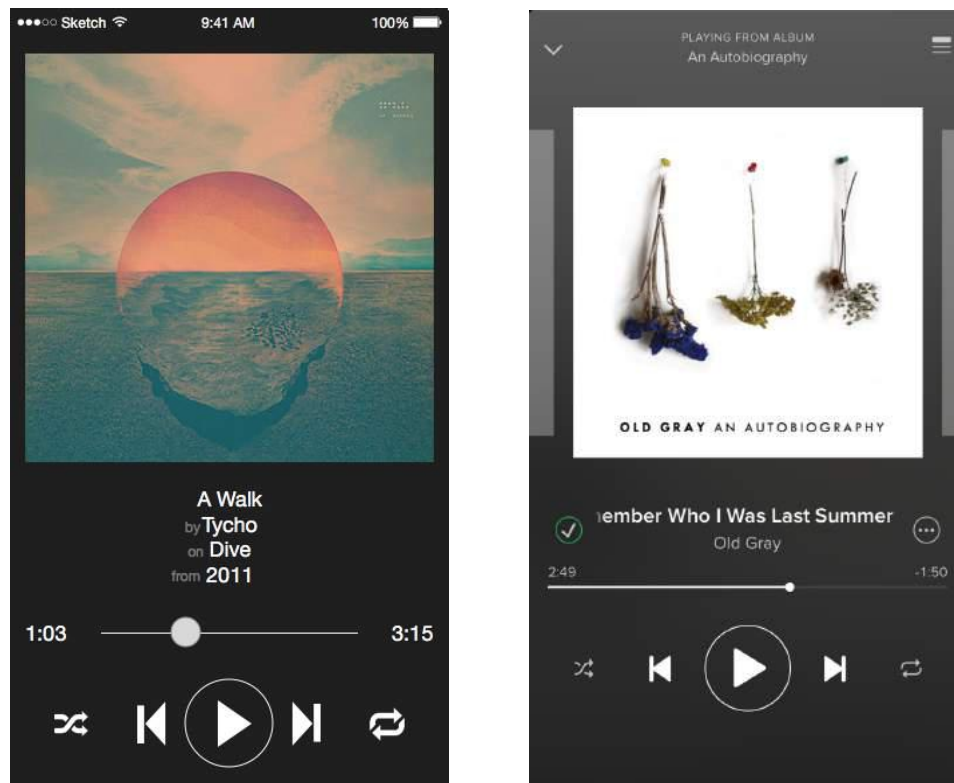


*Figures 12 and 13.* Design of Milkcrate's now playing view on the left. On the right is a view of
Spotify's now playing view for comparison.

While the two designs above may look rather similar, I believe that I have made some

changes to Milkcrate's design that make it more accessible and user friendly than Spotify's

solution. Firstly, I increased the size of the album art and eliminated the previews of future and

past album art. I think that this better highlights the album art by reducing visual noise. I also

moved the control buttons to the bottom of the screen, enlarged them all, and increased their

contrast with the background. Fitts' Law supports this decision since the controls will be closer

to the home button and the thumb. Additionally, the increased target sizes should reduce

accidental clicks of non-responsive background space. I also increased the size of the times as

well as the scrubber used to skip through the song. It is very difficult to read the time on

Spotify's design, and it is also very difficult to accurately grab the scrubber since it is so small. I also eliminated several superfluous icons. While I understand their importance in a more robust application such as Spotify, one of my main goals in designing Milkcrate was simplicity and trying to refrain from inducing unnecessary cognitive workload. The last change I made was to the display of metadata. Instead of sharing a line with other icons and requiring scrolling (as visible in the image of Spotify above), each facet of the metadata gets its own full line to facilitate maximum expansion for long titles. Additionally, I included the prepositions *by*, *on*, and *from* in order to be more clear about which metadata is the artist, which is the album, and which is the song title, as these can frequently be confused without proper context.

Thus far, this is the state of my budding application. A few more notes to make about navigation are that users can go back to the previous screen at any time by swiping from the left edge towards the right, and can pull up the now playing view at any time by swiping from the right edge towards the left. A future addition I would like to include is the ability to swipe from the bottom edge up to pull up a display of a user's most recently played albums, as this too seemed to be an important factor in how individuals organized their collections (Cunningham, Jones, & Jones, 2004). While this application certainly is not as robust as services such as iTunes and Spotify, they have had years to develop, and I believe that with more time and effort, Milkcrate could be a very interesting alternative to standard organizations of digital music libraries.

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