EVOLVING THE REMIX

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ABSTRACT

This thesis proposes the design and implementation of a derivative works project that investigates the lineage of iterative remixes generated by a virtual community of remixers. By iterating the remix process, material from the source used in the derived works either persists unchanged, is transformed or fades away through the generations of remixing. By collecting and analyzing iterative remixes, this thesis aims to provide tools that can begin to answer questions such as: at what point is there a disconnect between the source and the remix? Which source materials are the most persistent? Why are some songs remixed more than others? These and other questions about the creative processes of remixing are of central importance to this work.

A virtual community of remixers was assembled to create four generations of iterative remixes starting from a single composition. By collecting metadata from the participants and keeping track of lineage, a representation of the unfolding community remix process was developed, called a remix tree. Chapter 1 introduces a short history of the remix as a creative process. Chapter 2 introduces new ways to analyze relationships between a remix and its parent(s). Chapter 3 presents new tools for visualizing relationships between derivative works. Chapter 4 describes the collection of the remix tree. Finally, Chapter 5 provides a summary of the different creative processes that were observed in the remix community; and offers insights and suggestions for future work in analysis and tool building to further support the creative processes of remixing.

ACKNOWLEDGMENTS

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1.1 Introduction to The Remix

Social media has become one of the most important and widely heralded recent developments on the World Wide Web. Social-interface driven portals, such as *Last.fm*, *Flickr* and *YouTube* have catalyzed communities of pro-active users who collectively gather, disseminate and even generate media content via the Web. The momentum of this new type of media consumer is unquestionable; in July 2006 *YouTube* was serving 100,000,000 videos a day and such sites regularly report activity in the range of hundreds of millions of users per year (Kirkpatrick, 2006). This thesis seeks to lay the foundation on which to build a community of pro-active users who are focused on the creation of music remixes.

As such, the objectives of this thesis are to:

1. Facilitate a new type of iterative remix process called the "Remix Evolution"
2. Develop a virtual community of remix artists
3. Analyze the creative process of remixing
4. Design and implement new tools for visualizing remix relationships
5. Develop a Web site to facilitate the above activities

The remix artists that participate in the activities described in this thesis span a multitude of musical backgrounds including: professional DJs, remixers and composers as well as amateur musicians and electronic music hobbyists. This thesis seeks to understand how each member in a community of remix artists approaches the task of remixing as well as to discover trends in the community.

Chapter 1 provides an overview of the art of remixing and its place in the history of derivative composition. Chapter 2 is concerned with finding ways to analyze relationships between derivative works. Chapter 3 explores the design of remix visualization techniques and remix tree presentations. Chapter 4 describes the large collection of iterative derivative works that were developed by the virtual community of remixers (using remix trees) and presents analyses using the tools discussed in Chapter

2. Chapter 5 presents a summary of the findings and offers suggestions for furthering this work.

1.2 Derivative Works

A remix is a type of derivative work. A derivative work is a composition created using another work as the primary source. In music, the work that the composition is derived from may be a field recording, studio recording, or some other musical source. A derivative work (or derivative composition), on a basic level can take the form of an orchestration or a remix. On a smaller scale a literal sampling of the original or perhaps the borrowing of a melodic line can also yield a derivative work.

Derivative works are defined in law by the US Copyright Act, 17 U.S.C. §101. It states,

> A "derivative work" is a work based upon one or more pre-existing works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgment, condensation or any other form in which a work may be recast, transformed or adapted. A work consisting of editorial revisions, annotations, elaborations or other modifications which, as a whole, represent an original work of authorship, is a "derivative work".

A literal derivative work is a work where the derivative samples the original directly. Originally this was done with analog tape, now it is usually done with digital recording and editing software. As with sampling, literal derivative works can be traced back to early tape manipulators including Pierre Schaffer and his Musique Concrète (Schaeffer, 1952). With this form of music, extra-musical recordings were edited with tape transforms to create new sonic works. These works were not remixes. They were made by taking recordings of concrete sounds and making new works of music and sonic art with them.

1.2.1 What is a Remix?

A remix is a type of literal derivative work in which the original song is sampled and transformed in some way to create a variation. A remixer uses re-arrangements of the parts, audio transformations and mixing techniques to create an alternate version of

the original track. The remix aims to be a variation of the original but not necessarily a replacement of it.

In a remix, transformations of the original song lead to new creative works that are noticeably different from the original. The changes may be subtle, but a remix is always distinguishable from the source. If one can't tell the remix from the original then nothing meaningful has been done. On the other hand, if the remix is so different that it becomes dissociated from the source then it is no longer a remix; it is still a derivative work however.

A remix shouldn't be confused with a DJ Edit, also sometimes called an "edit". An edit is not meant as a separate work, but used for promotional purposes or to give DJs tools to mix and remix the song live. An example of an edit is shortening the length of a song to make it more radio friendly. The song structure remains mostly intact yet parts have been shortened or removed to make the overall track shorter. The distinction between an edit and a remix is not always clear. Other song transformations that aren't remixes are *a cappella* and instrumental versions.

The remix was a form created for the dance floor, but as mentioned previously, literal derivative works started before that with experimental composers and engineers such as Steve Reich, Pierre Scaeffer and Pierre Henry. Today remixes are not just for dancing. Many are intended just for listening including art music remixes. One could say they have gone full circle, from art music to dance music and back.

The remixes contained within this thesis can be of any type and from any genre. These remixes are a subset of literal derivative works and include everything from art music to dance music remixes. A non-literal derivative work such as an orchestration is not addressed within this thesis.

To achieve the types of effects and edits mentioned above and fashion them into a remix any number of methods can be employed. These technical aspects of how to create a remix are covered in more depth in books like (Schloss, 2004) and (Gerrish, 2001). They are also discussed in sections 2.2 and 4.4 of this thesis.

1.3 Roots of the Remix

1.3.1 History of Dub

Around 1966 a new musical style called rocksteady began to emerge in Jamaica. It came out of the ska music popular at the time. On the simplest level it was a slowed down and laid back version of this upbeat format called ska. It was also transformed in another important way. The bass became heavier and more pronounced in the mix. The bass lines were broken and syncopated in a departure from the walking style of a ska bass line. Two years later a new form of music called reggae developed out of rocksteady. In reggae the rhythmic accent generally fell on the 3rd beat with the rhythm guitars accenting the 2nd and 4th beats (Veal, 2007).

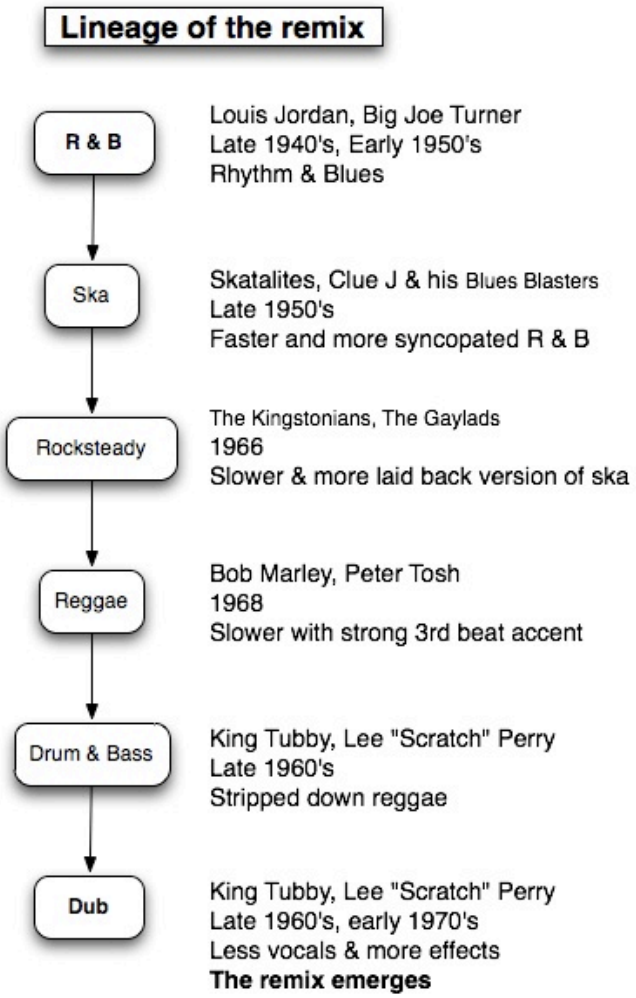

Figure 1 Lineage of the remix

Illustration of the evolution of dub music, which in turn was the beginning of the modern remix

Starting in the late sixties reggae split and began to evolve in parallel, but related, paths. One path led to roots reggae and the other to "drum and bass." "Drum and bass" was a distillation of reggae. It was the first attempt to strip it down to its raw elements, in particular the rhythm section and the bass line (as the name implies).

One of the crucial moments in the transition from drum and bass to dub was the removal of the vocals from the mix. What was left was a bass heavy instrumental with little to no vocals and few traditional melodic elements. This removal or reduction of vocals became one of the trademarks of dub music.

In many dub tracks, especially early ones, tracks were based on existing reggae recording. These transformed version of the original was called just that, "versions." For some songs there was not just one "version," but many.

In dub music we can see not just the beginnings of the remix, but also the emergence of the DJ and the Master of Ceremonies (MC), as central parts of the live musical experience. Dub was not performed live with guitars and drums. It was played by DJs mixing records. People began to "toast" the crowd on top of the records as a means to get the crowd moving. This person was later named the MC. These ingredients soon inspire young African Americans in the United States to create Hip Hop (Toop, 1984; Greenberg, 1988).

1.3.2 King Tubby & Lee "Scratch" Perry

King Tubby was born as Osbourne Ruddock in 1941 in Kingston, Jamaica and was an electrician by trade. He was to become the most prominent dub producer/engineer in Jamaica.

> "The recording console was Perry's "instrument" in the same way that the jazz orchestra was Duke Ellington's, a vessel for his most sublime and elemental thoughts." (Veal, 2007)

King Tubby created many of the techniques that became the dub vernacular. He actually created custom equipment to get the effects he needed. He was famous for dropping or hitting his spring reverb unit to get a more drastic reverberant effect. This is apparent in the song "King Dub" where one hears frequent violent reverberant effects. (Tubby, 1975)

Lee “Scratch” Perry is another prominent Dub producer, second only to King Tubby. His real name is Rainford Hugh Perry. In 1968 he formed his own label called Upsetter. As a producer he worked with many reggae greats such as Bob Marley & the Wailers, Junior Byles, & Max Romeo. Perry continues to create music and in 2004 he won a Grammy for best Reggae Album.

Lee “Scratch” Perry produced the track “Chase the Devil” by Max Romeo (Romeo, 1976). It is an excellent example of a vocal dub and Perry’s skill as a producer. The group Prodigy made the song popular again nearly two decades later. It was the central catchy loop in the 1992 hit “Out of Space” that helped to launch the group globally (Prodigy, 1992). The sampled section is so large the Prodigy’s song could be considered a remix of Lee “Scratch” Perry’s production.

Other dub luminaries were Augustus Pablo, Scientist, Yabby U, Prince Jammy, and Bunny Lee who became known for his “flying cymbal.” This was an accented 3rd beat cymbal that seemed to float away with its use of heavy reverb.

1.3.3 The Remix, from Dub to Today

> “When you double, or dub, you replicate, reinvent, make one of many versions. There is no such thing as an original mix, since music stored on a multi-track tape, floppy or hard disk, is just a collection of bits. The composition has been decomposed, already, by the technology.” (Toop, 1995)

Dub was influential in the development of hip hop. DJ Kool Herc was an immigrant from Jamaica living in the Bronx when he began to explore dub-like production techniques, applying them to funk and rock. Soon after hip hop was born (Greenberg, 1988). He took sections of the songs called breakbeats and extend them using two turntables and a mixer. Later he took disco and rock and incorporated them into these remix sets. DJ Kool Herc along with Afrika Bambaataa and Grandmaster Flash are credited as being the grandfathers of hip hop and breakbeat culture. (Universal Zulu Nation, 2008)

Disco was also directly influenced by dub. It was a dance music phenomenon that became the predominant music form of the 1970s. One of the key figures in disco was Tom Moulton. He was a famous dance music producer whom some give credit for the

remix (as a commercial format), the breakdown section, and the 12" single. When trying to extend the song “Dream World,” he ran into a problem of incompatible chords restricting him from simply looping a large section to lengthen the song. He dropped out the strings, horns and guitars and brought up the congas and bass. After playing the congas and bass for a bit, he dropped the melody back in. The song was lengthened and the breakdown was born (Lawrence, 2003).

From the mid - late 1970s record labels like Salsoul and West End Records were instrumental in popularizing the idea of the remix and of the extended dance floor versions of songs heard on the radio. Salsoul released far more 12” singles then they did full length albums. They were more interested in creating tracks and remixes for the dance floor than in making long albums.

Disco led to house music and other genres currently popular and played by today’s DJs at lounges and large clubs. In house music the remixes are often more important that the originals. I know when I DJ, I am much more likely to play my favorite remix than to play the original. This is common in DJ culture. From humble beginnings, the concept of a remix has gone from dub music to nearly every form of contemporary music.

1.4 Remixing as a Part of Music Culture

1.4.1 Remix Culture

Artists may borrow and even steal from each other. The most sampled recording artist in history is James Brown, yet he owes a large musical debt to Little Richard for ideas early in his career (Goetz, 2004). James brown took musical ideas from Little Richard and the Sex Pistols took from ABBA. Now artists like Girl Talk are making albums entirely from samples, sampling dozens of pop songs per track. He is not doing it as an artistic and counter-culture statement like John Oswald did with his Plunderphonics (Plunderphonics, 1994; Holm-Hudson, 1997), he is doing it as entertainment. Girl Talk is doing his music as a part of remix culture. He takes bits and pieces, transforms the bits and re-assembles them. Regardless of what genre one considers his music to be, his production technique follows the remix paradigm.

Within remix culture ideas are taken and appropriated. Creativity is shared, borrowed and stolen. Most importantly, remix culture allows for and encourages derivative works. Richard Koman puts it well in an interview with the lawyer Lawrence Lessig, the person who helped popularize the term remix culture,

> "What do you get when you mix P2P, inexpensive digital input devices, open source software, easy editing tools, and reasonably affordable bandwidth? Potentially, you get what Lawrence Lessig calls remix culture: a rich, diverse outpouring of creativity based on creativity." (Koman, 2005)

For more background on remixing and remix culture see (Berry, 2005; Miller, 2004). For cultural and legal background on remixes in the mashup context see (Cruger, 2003; Farber, 2006).

1.4.2 Web 2.0 and Remixing

Web 2.0 aims to enhance three things, creativity, information sharing, and collaboration. It is also referred to as the "participatory web" and the "web as platform." Tim O'Reily who is most famous for the term Web 2.0 refers to it as the former (O'Reilly, 2005).

In the realm of remixing on Web 2.0 there are at least three websites that are doing interesting and innovative things online: *Splice Music* (Splice Music, 2008), *ccMixter* (ccMixter, 2008), and *Jumpcut* (Jumpcut, 2008).

Splice Music is the most feature rich in online musical possibilities. It allows users to share songs and remix them online. Splice has an online Digital Audio Workstation (DAW), complete with a timeline and digital audio effects. The DAW allows users to rearrange samples, add new samples, and create new tracks. All of this is done in real-time similar to a desktop DAW. According to the website it has three aims, Meet, Mix, & Mash-Up. This allows users to find musicians, make online music, and mash-up music or allow their music to be mashed-up.

ccMixter is a music web community that focuses on remixes that carry Creative Commons (CC) licenses. It is sponsored and maintained by the CC organization. The goal of the website is to facilitate listening, sampling, & mash-ups. It was created by the CC to encourage derivative works and audio sharing using the CC licenses. Users can

post their work and share it with others. People are encouraged to use music from the site as soundtracks in non-commercial videos. The site also contains gigabytes of free professional quality samples that carry CC licensing. The site gained popularity when the CC sponsored the Wired Remix CD that offered songs from acts like the Beastie Boys and David Byrne. It allowed the songs to be remixed and sampled via the CC licenses (Goetz, 2004).

Jumpcut is a fully functional online video editor. Users can upload their videos and edit them online, share pre-edited videos, or remix existing *Jumpcut* video. Videos clips can be shared as samples and re-appropriated into new videos. The site allows users to import media from other websites like *Flickr* and *MySpace*. It also allows users to record video from their webcams. Unlike *YouTube* that simply hosts the video, *Jumpcut* allows you to record, remix and/or appropriate video. There are even remix buttons directly on posted videos so users can easily remix a video with one click.

1.5 Iterative Remixing

When I was in high school (circa 1993) there was a video going around that my friend acquired. It was a video remix of the Dallas Televangelist Robert Tilton. The video carefully sampled clips of the preacher talking and praising god. Anytime the preacher grimaced or gave a guilty smile, the video artists placed flatulent noises in the soundtrack. Robert Tilton's actions and the flatulence additions were perfectly synced. The video quality was good, but I could tell that it had been dubbed a few times. It was a viral video that predated the web. According to Wikipedia two unknown men created this video in 1985 (Wikipedia, 2008). It was almost 10 years after the creation of it that I saw a copy of the video at a friend's house.

The video can now be found online, but the quality is poor. It is anyone's guess how many generations of video dubs the video went through before it was digitized and put online (Unknown, 2008). Although it could be considered bathroom humor it is also social commentary on televangelism. It could even be viewed as a farce created for political reasons. Very little is known about the video, who created it, and why they made it. It is also similar to the first viral videos that appeared on the World Wide Web. Most of them were of lowbrow humor or some sort of social commentary.

This video remix example is brought up for two reasons. First of all, for the impact a viral derivative composition can have, and second the technical issue of generation. If the Robert Tilton video were to be iteratively reworked using the tools of its day (late 1980s), only a limited number of generations would be possible before the signal would degenerate into noise and become un-remixable.

Today's digital tools offer new opportunities that didn't exist when the Robert Tilton video was created. Generations are no longer a limitation. With proper use of digital storage a work can be transformed and shared indefinitely. The remixer can retain creative control since distortion is not a creative hindrance. Things could iterate potentially forever.

The next extension of the remix is to iterate the process. This is something that is already emerging in today's electronic music culture. Is expansion of the remix by iteration the next frontier?

In the recent past, the analog tape machine was the source for limitations on number of generations. High quality audio recording was expensive and in working with these machines one had to be cognizant of generation. Each successive generation introduced degradation in audio quality. This was also a reason why producers and musicians often sampled from the source. People came back to the original not just for aesthetic and artistic reasons, but also for quality reasons.

Now it is possible to share remixes in new forms. They can be shared as full quality digital audio files that can be copied indefinitely. These files could be the mixed down audio or they could be parts (multi-track recordings). The remixes can also be shared elementally, for instance a collection of all the samples and loops used in a particular song (i.e. a remix kit).

So, what if one were to facilitate and encourage derivative composition in an iterative and direct fashion? Websites like *ccMixter* and *Splice Music* touch on this idea. What I hope to achieve with this remix project is to make the process more direct, opening new branches of remix possibilities.

1.5.1 Evolution of a Remix by Creation of a Remix Tree

Given the current availability of cheap and even free software to create electronic music, it is feasible for a large number of individuals to participate in the remix process. It is also easy for an experienced producer or composer to recreate the techniques of producers like King Tubby using a humble collection of hardware and software. Someone with enough knowledge and a modern home computer can create a remix of any style.

Here are the elements to allow a large-scale iterative works projects to be created and maintained, facilitating many versions of a work in an expanding web of remixes. The focus of this thesis is to create a tree of iterative derivative works. The goal is to evolve compositions, to take source songs and let them be remixed in an iterative fashion. The source, or seed track, is remixed by a set of remixers. Then these remixes are remixed by other remixers. This process continues and a remix tree develops. The more time this process continues, the deeper the remix tree becomes.

To create the remix trees in this thesis, the remix evolution was divided into rounds, each round number representing the depth of the tree. The root of the tree is the original composition. In this fashion, for each seed composition a new tree is generated and rooted at that composition. As the number of rounds increase so does the depth of the tree (Murty, 1976).

To facilitate the remix tree a website, called *Remixin*, was created to both explain the concept and share the remix files. Its goal was to offer a means to share information, promote the idea and deliver remix files. A simple set of rules and guidelines were developed and posted.

2. Analyzing Remix Creation

2.1 Introduction

Two methods were developed to analyze the collected remixes. These methods were: collecting/analyzing metadata and automatic deconstruction of remixes using Music Information Retrieval (MIR) methods. The metadata method involves collecting important information from the remixers and then looking at the statistics. The automated remix deconstruction technique offers a way to compute how source material was transformed into a remix.

These analyses had two goals. The first was to make it possible to tabulate aggregate data from the remix collection at each round and as a whole. The second was to gain insight into the creative nature of the remix process.

Before reverse engineering a remix, it is essential to define a list of processes and transformations that describe how remixes are created. These remix processes are discussed in the following section. Subsequently, the two remix analysis techniques are explained. Results of these analyses are given in Chapter 4.

2.2 How a Remix is Created

First remix techniques are described in a historical context. Next modern remix techniques are described. Finally the software tools used in remixing are presented.

2.2.1 Traditional Remix Techniques

Dub music offers a wealth of techniques, which demonstrate how remixes are made. The first of these is Equalization (EQ); EQ involves filtering of the sound and was a central creative process in dub music. EQ was used to help remove instruments and vocals when the music was already mixed down. Low pass filters were used to accentuate the bass lines.

Reverb creates a sense of space and can be used to create imaginary rooms in which the sound exists. Using delay, the repeat of the beat could enhance the groove, elaborate the groove or de-center it violently. In dub, delays were used to fatten up the

beat or to create on and off rhythmic syncopation. Filtering was often added on top of reverb. This allowed the cutoff frequency to be swept between low and high in series with the reverb. The effect was the reduction of the spectrum of sections of the reverberated sound, creating a sort of "outer space" effect.

Mixing was another key dub technique, especially with dub "versions." Mixing uses the mixing board to vary the amplitudes of the various parts in the recording. The mute button on the mixer was frequently used, including being "played" by the engineer. This allowed parts of the track to be suddenly dropped in and out.

Sometimes extraneous or extra-musical recordings were added to the mix as well. Fake cow sounds, doorbells, sirens, even alarm clocks sometimes made their way into the mix. Sometimes extraneous sounds were not added by mixing; they were added by editing the tape itself. The recorded tape would be physically cut and the sounds would be spliced in-between. Tape edits were also performed to re-arrange a song's parts or alter the meaning of the vocals by changing the order of the lyrics.

2.2.2 Modern Remix Techniques

Modern remix techniques are too numerous to adequately describe. However there are techniques that are commonly used in modern remixes. All of the dub techniques mentioned earlier are still used. The following are remix techniques that are searched for in the remix deconstruction experiments (Section 2.4). These techniques are time stretching, time compression, reversing, pitch shifting, altering tape speed, and adding new sonic material.

As the name suggests, time stretching/compressing takes the sound and either stretches or compresses it in time. In time stretching although the length is increased, the original pitch remains constant. For time compression the sound is made shorter yet the pitch remains constant. Reversing simply takes the sound and plays it backwards. Reversing can be applied to percussive sounds to create a pull effect instead of a push effect. Pitch shifting takes the existing sound and shifts it up or down in pitch. It does so without changing the length of the audio sample. Altering the tape speed is a transformation that mimics what happens when tape player is speed up or slowed down.

When the audio is speed up or down the frequency of the sound is shifted in the same direction proportionally.

A remix often includes adding new material to the composition. This new material can be adding: beats and other rhythmic elements, new sounds to the original material, or new melodies and bass lines through the use of synthesizers.

2.2.3 Remix Tools

It is useful to consider some of the current software tools used. The software applications mentioned here are particularly important since many of them were used in the creation of the remixes in the remix evolution. Applications mentioned that did not arise in the remix evolution are mentioned for their popularity and quality.

2.2.3.1 Audio Software

There are a few categories of audio software particularly important for remixing. These types of software are organized below by the function they serve such as sequencing, recording, editing, processing, and synthesizing. They are also grouped by their means of distribution, open source (free) or commercial (available for a fee).

The most important tool in a modern studio is the Digital Audio Workstation (DAW). A DAW handles many functions. These include sequencing, recording, and audio processing. The primary component to the DAW is the ability to multi-track. This means that the software can have multiple audio or midi tracks recording and playing simultaneously. A modern DAW must also be a plug-in host for software synthesizers and effects. A plug-in is a piece of modular software that adheres to a defined format so that it can be used inside a host application. They generally do one function or a concise set of functions. Editing within a DAW can be either destructive or non-destructive to the original recordings.

An audio editor allows recordings or samples to be manipulated. A modern editor has overlap in functionality with a DAW, including recording, playback and editing (cut and paste). The main difference is that an audio editor is optimized for processing a single track (mono or stereo). Audio editors can manipulate audio by applying effects, changing audio formats, and performing tape edits. An audio editor can be used to

prepare sounds for importing into a DAW. Some audio editors serve as a mastering platform as well.

Digital effects span the types of audio software tools mentioned. They can be incorporated into a DA, audio editor or plug-in. Common digital effects include filters, equalizers, time stretching/compression, dynamics compression, noise reduction, distortion, delay and reverb.

The following is a brief overview of the software landscape. Software that was used in the remix evolution is highlighted.

2.2.3.1.1 Open Source

Open source software is named for the fact that it is distributed as a compiled application as well as the set of computer code files used to create the application. One can use the compiled application just as they would a commercial application. They may also alter or add to the code and recompile it for a specific need.

Popular open source audio editors include Audacity and Soundhack. Some important DAWs are Ardour, Wired, and Rosegarten. Although not introduced earlier there are some newer applications that do not fit any of the software paradigms previously explained. They are generally referred to as sound design tools or specialty audio software. Tapestrea and ATS are sound design tools that allow a sort of sculpting of the sound using analysis/synthesis techniques. An example of a specialty tool is MEAPsoft. This program segments the audio file and reorders the segments based on information extracted from the segments (features).

2.2.3.1.2 Commercial

There are numerous commercial DAWs on the market. Popular ones are Logic Pro, Pro-Tools, and Cubase. There is a new generation of DAWs that include all the key DAW components yet are optimized for using loops in one's workflow. These DAWs include Ableton Live, Reason and Acid. Other notable DAWs are Sonar, Garage Band, Fruity Loops, Vegas, Digital Performer, & Energy XT.

Popular and full-featured audio editors include Sound Forge, Bias Peak, Wave Lab, and Sound Booth. Bias Peak, in addition to audio editing, is well known for its mastering capabilities.

There are many soft synthesizers and effects plug-ins. Here are a few notable ones, they were used in the remix evolution. These include Battery, Absynth, & Kontakt. Battery is a drum sampler that organizes the samples in a grid. Absynth is a modular synthesizer that offers subtractive and granular synthesis. Kontakt is a multi-sample sampling synthesizer. All three of these plug-ins have filters and/or audio effects that can be applied to each sample.

2.2.3.1.3 Custom

User programmable software has become more popular over the last decade as graphical programming tools have matured and the sharing of custom modules on the web has grown. There are many different platforms available to write custom audio code within. The platforms at the very least contain interpreters/compilers for your code, audio tool kits, and a way to access your audio output device.

Max/MSP is one of the premier platforms in which to build custom audio modules. Max/MSP includes control commands, midi commands, and signal processing capabilities. The application is organized by objects and patches that can be linked together by drawing lines and writing code to tell the computer how the parts should interact. Pure Data (PD) uses the same paradigm yet it is open source. PD is full featured yet has a smaller user community sharing patches. Reaktor is another similar application. The key difference with Reaktor and Max/MSP is that the programming of modules in Reaktor is done in a more graphical and user-friendly manner.

Some programmers prefer an even more code-based approach. Tools like Supercollider, C Sound and RTcmix allow one to write object-oriented code that creates music. These tools offer conveniences like audio libraries, file read/write routines, and other audio tools to help the programmer. They give the programmer far more control over the sound than is possible with the graphical tools. These types of code based tools offer functions like for loops and even recursion, which are not possible with Max/MSP.

It is also possible to create a remix using ANSI C++. In this paradigm one would find an audio library compatible with their computer platform, sound card and compiler or write their own. In the case of the Michael Chinen remixes, he wrote his remixes using C++ and a custom DAC that he programmed.

2.3 Metadata Analysis

2.3.1 Data Collected

Data was collected from the remixer for each remix submitted. A form was submitted along with the remix, see Appendix B. The questions in the form included basic information on the remix, the remixer, and information on how the remix was made. Everyone supplied the basic information and most, but not all, people answered the production questions.

Basic Information

- Name
- The Track Remixed
- Remix Title
- Description of Your Work

Production Questions

- Did you use custom software? If so what language did you use?
- Did you use commercial software? If so which ones?
- Did you use Open Source Software? If so which ones?
- Do you consider this a remix, derivate work (but not a remix), or only inspired by the original?
- Did you enjoy making it or was it a chore?
- Would you consider making another remix in the future?

Other Information Gathered

- Remix Length
- Gender

- Connection to Dartmouth College (student, alumni, or faculty)

2.3.2 How This Data Can Be Used

This basic information provides valuable contextual data for each remix. It is crucial information to assure people are properly credited and that the remix tree can be generated. To create a remix tree each remix must be aware of its parent. The description field allows the remixer to offer any notes or comments on how they created the remix.

The production questions can be tabulated by software type and specific applications. These software types are open source, commercial and custom. The software tools are the ones referred to in section 2.2.3. The applications used are noted in the questionnaire and are tabulated to find which tools were used most often. When analyzing a remix this information can be used in addition to listening to attempt to decompose how the remixer created their piece. The last three production questions will not be presented. They were collected to get a sense of how the remixes were going. They offer no direct insight into the remix process.

Basic demographics, such as the percentage of remixers who are affiliated with Dartmouth, gender, and average remix lengths are also collected. This information can be used to get a sense of length changes per round and diversity of the remixers. In terms of the remix lengths, one can see how they change over time. If there are trends, what might these mean? Are the average duration changes per round related to the source material?

2.4 Automatic Remix Deconstruction

An alternative to purely metadata approaches to analyzing audio tracks is content-based Music Information Retrieval (MIR) (Casey et al., 2008). The goal of content-based MIR systems is to analyze and reveal relationships between audio tracks either at the level of the whole track or at the level of individual segments within a track. There are two basic paradigms for content-based MIR: exact matching, called audio fingerprinting, and approximate matching which is called audio similarity.

Querying for similarity between tracks is different from audio fingerprinting (Miller et al., 2002; Herre et al., 2002). These systems assume that some portion of the audio is an exact match and use efficient indexing, such as exact hashing, to reduce the search space. We do not expect to see exact matches in remixes; however, we do expect to find near neighbors in a set of transformations of a source track, or remix track.

Systems for computing audio similarity between tracks seek to classify audio tracks as belonging to the same class label (Tzanetakis & Cook, 2002) or to predict when two tracks will be judged similar by human listeners (Pampalk et al., 2005). Such systems use global statistical features extracted from tracks and are therefore not amenable to identifying specific audio content within a new context.

In this experiment, methods for de-constructing remixes of an original work were evaluated. The method identifies both the original audio samples used in a remix as well as the transformations applied, namely: pitch shift, time compress/expand, re-sampling and time reversal. Our sample source identification uses nearest neighbor search over a corpus of temporal features; an audio identification system. We extend the audio identification framework to retrieve sample transformations by searching a collection of transformations of the source track's features. To evaluate the methods, we performed exhaustive nearest neighbor search over a corpus of transformed features. Our results show that time stretch expand transformations are recovered more successfully than pitch shift transformations when using MFCC features. The search methods are compatible with locality sensitive hashing (LSH), therefore allowing very efficient implementations.

2.4.1 Introduction

To perform deconstruction of the remixes, a database was created consisting of features extracted from a source track and 9 decoy tracks. The database was then queried with a remix of the original track. An audio search identifies the time points at which the source track and query track best match as well as the transformation of the source that produced the best match to the remix query. To recover the transformation of the remix sample a sequence search in a tree of transformations of the original track and decoy tracks was performed; looking for those transformed sequences that produce

closest matches to the remix track. The hypothesis is that the transformations producing the closest matches in the database of transformed features correspond to the transformations applied to the original sources to produce the remix.

A set of remix feature transformations were generated from the original track's features instead of transforming the original track and then extracting features from these transformations. As well as a saving in computation, this technique is motivated by the potential to generate transformation trees from extant feature sets without re-accessing the source audio files.

We first discuss previous approaches to identifying audio material and retrieving remixes, then we present a model of remixing as a set of transformations that can be applied to Mel-frequency Cepstral Coefficients (MFCC) features (Childers et al., 1977). MFCCs are calculated by performing the following series of operations: taking the Fourier Transform (FT) of a signal, then taking the magnitude and applying Mel-frequency and log scaling to those magnitudes, and finally a discrete cosine transform (DCT) is applied. The MFCCs calculated in this thesis, use a Constant-Q Transform that is similar to the Mel frequency perceptual scaling yet is logarithmic across the spectrum as opposed to the Mel scale which is linear to 1300Hz and logarithmic thereafter. We follow with an experiment to evaluate the utility of the proposed techniques for remix deconstruction and we conclude with a discussion of the results and suggestions for further work.

2.4.2 Previous Work

Other studies used sequences to identify specific audio content in common between original and remix tracks and used counting of matches between tracks to identify when a track is a remix (Casey et. al, 2006; Casey et al., 2008). The current work considers a more detailed analysis of the similarity between matching segments between source and remix tracks, identifying the specific processes applied to an original track in order to generate the remix.

Among systems that use transformations of features to identify a transformed version of an original work are the Refraid system (Goto, 2006) which extracts structure, such as verse/chorus, from popular music and identifies common structural segments

even when they are transposed in pitch. Refraid uses pitch-class profile features (PCP) and rotates the features around the cycle of pitch classes to yield transposition invariance.

Similar techniques of feature transformation are used in (Ellis & Poliner, 2007) and (Serra & Gomez, 2007) for identification of cover songs in a corpus of popular songs. Similarly, in these works, invariance to changes in timing between versions of tracks is achieved by performing a tempo extraction and beat tracking; thereby normalizing the time lines of each track to the beats. These works seek to be insensitive to specific audio content, rather they are tuned to match high-level music content so that different recordings of the same work by different artists will match.

In contrast, in the current work we seek to produce matches between original and transformed audio samples so we want to match specific acoustic information. For this reason, our features are MFCC features. These model low-level aspects of an audio spectrum (Logan & Salomon, 2001) rather than PCP features, which are often used to model musical harmony (Bartsch & Wakefield, 2001). Our desired transformations are closely related to previous work on tempo and transposition invariance due to the analogy between time compress/expand and tempo change, and pitch shift and transposition. However, re-sampling and time reversal transformations are not addressed in the above literature but they are canonical transformations in our work.

2.4.3 Method

In order to find remix transformations we focused on the following typical transformation types used in a remix: pitch shifting, altering the tape speed (re-sampling), time stretching, & time reversal. For pitch shifting, the signal was shifted up and down 3, 6, and 9 semitones. Re-sampling was done at 0.42, 0.59, 0.84, 1.19, 1.68, & 2.38 times the original sample rate. Ratios of 2:1 were not used so as to avoid octave errors. The previously mentioned values align to the following pitch artifacts of -15, -9, -3, 3, 9 & 15 semitones. For time stretching the same factors as above were used. There is no pitch alteration with this transform so the pitch artifacts mentioned do not hold. These along with the original features were added to the database.

After creating all of these transformed features sets for the original song, "Push the Button" by the Chemical Brothers (Chemical Brothers, 2004), they were stored into an audio database. Next, 9 different songs were selected to join the original in the database. Seven of them were remixes, one was a classical composition written by Beethoven and the final piece was "Red Bird" by Trevor Wishart (Wishart, 1992). "Red Bird" was chosen since it contains no beats, but instead contains a rich sonic landscape created by numerous tape transformations. Each of these 10 tracks had 20 MFCCs extracted in 100ms windows and the 20 transformations (19 plus the original) mentioned were applied to the MFCCs. This creates a database that contains 200 feature sets from which we can query.

A two second clip of "Push the Button" was cut from the song and used as the basis for all the queries. Transformation types listed above we performed on the clip and saved as a separate file. This became the corpus from which we attempted to get data regarding the effectiveness of our deconstruction approach.

2.4.4 Transformation Techniques

2.4.4.1 Time Stretching

Since we are in the Cepstral domain in order to stretch the signal out in time while preserving pitch we simply need to resample the signal at the value of the amount wished to be stretched. This is a similar concept to the phase vocoder however in this case we have no phase information; hence we can time stretch using only interpolation.

2.4.4.2 Reversing

Reversing takes the indices from the original MFCCs and stores them in descending instead of ascending order.

The Transformation Tree below visually represents how the transformations were computed and how they relate to the original MFCCs.

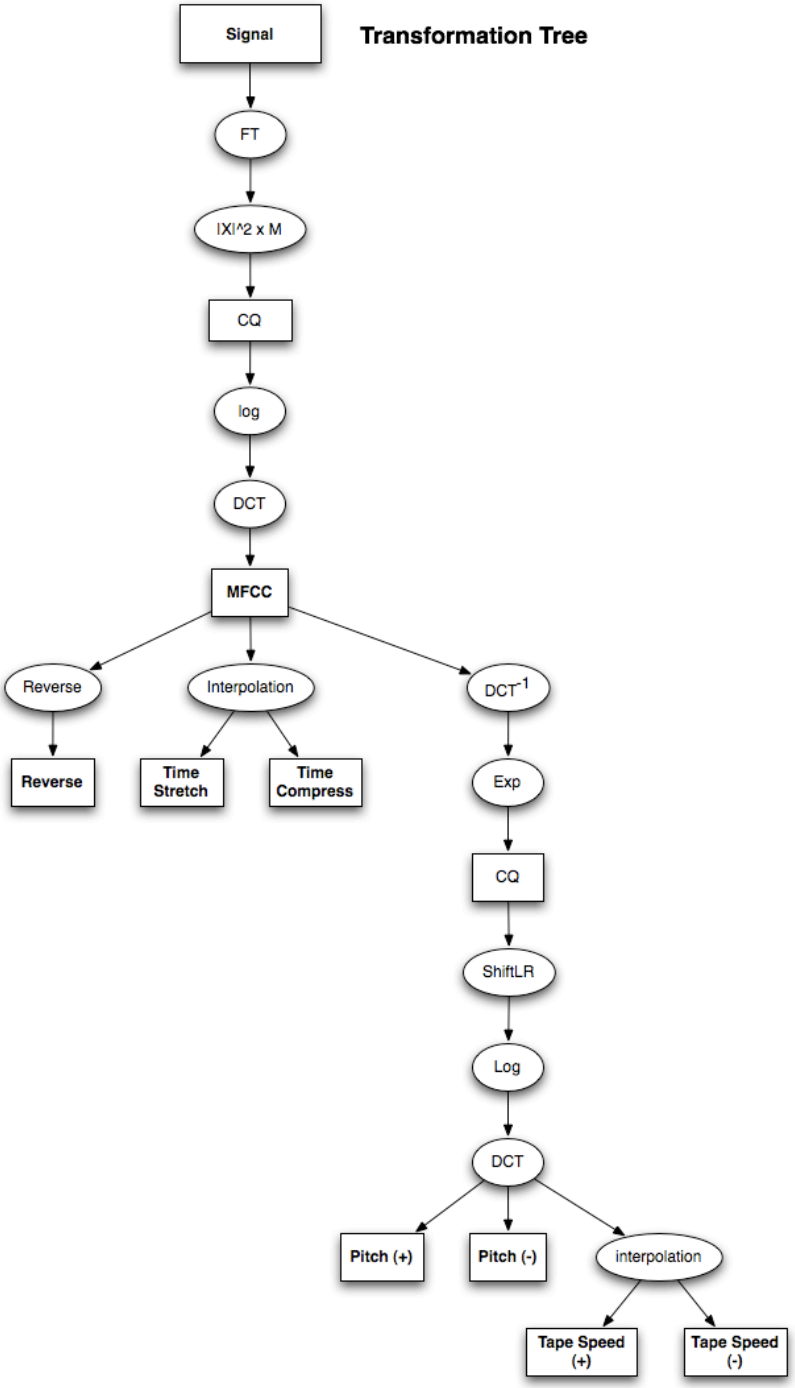

Figure 2 Transformation Tree

The tree demonstrates how each transformation (leaf nodes) is computed from the source signal. The feature extraction chain consists of a Fourier Transform (FT) to convert time-domain signals to the frequency domain, a Mel-frequency Constant-Q transform (CQ) to yield a perceptually weighted frequency transform, and a logarithm and discrete cosine transform (DCT) to yield decorrelated Cepstral features.

2.4.4.3 Pitch Shifting

Since the signal is in the Cepstral domain it is necessary to move to a space where there is access to the spectrum. To attain the spectrum we take the features, multiply by a DCT matrix and exponentiate. This yields our S matrix.

The 83 dimensions of the S matrix are equivalent to roughly one semitone. To pitch shift up, rows of the S matrix are shifted up the same number of indices as the number of semitones. To pitch down the opposite is done, the rows are shifted down the number of semitones requested.

After this transform the pitch has been shifted however the signal is no longer a cepstrum. To move the features back to the common Cepstral space the log of the S Matrix is multiply by the transpose of the DCT matrix.

2.4.4.4 Tape Transform

This is a classic transformation and mimics what happens when tape player is speed up or slowed down. When the audio material is speed up or down the pitch is shifted in that same direction proportionally.

In the time domain this is easily handled by re-sampling at the factor at which you wish to speed up or slow down the tape. In order to implement this for an MFCC we combined two of our previous transform functions. The features were first pitch shifted by the speed up or slow down amount. For instance to speed up to twice as fast, we pitch up 12 semitone. After this we time stretch to the altered speed amount. In that same case of doubling the speed we would time stretch by a factor of 2.

2.4.5 Results

We had 20 feature sets, based on 4 transformation classes; this includes 19 transformed features sets plus the original MFCC feature set. The database contained 10 songs each with the 20 transformed MFCC features. This database of 200 feature sets was used to query against.

The query itself was a 2 second clip of audio taken from the original track. This clip was then transformed using an audio editor to perform all of the transformation types

that we were testing for with the MFCCs. Each one of these samples was queried against the 200 feature sets in our database.

For each of the transformed 2 second clips an exhaustive sequence search of length 10 time segments was performed. The results were analyzed to find in what position the correct MFCC transform was returned. For instance if the pitch shifted by 6 semitones version of the 2 second clip was the query, we would look to see where the MFCC pitch shift +6 result was in the result list. If this result happened to be the second strongest match then it would be labeled as having a rank of 2 and a precision of 0.500. Our measure of precision was 1/rank. With a database of 200 feature sets the lowest precision possible was 0.005 and the highest 1.000.

Table 1 Precision Results

For each class the specific transformation is listed and the precision noted. Our measure of precision was 1/rank, which has a range of 0.005 to 1.000

Class	Transformation	Precision
Base Case	Un-transformed	**1.000**
Pitch Shift	pitch -3	1.000
	pitch +3	0.167
	pitch -6	0.125
	pitch +6	0.023
	pitch -9	0.012
	pitch +9	0.026
	Average	**0.225**
Reverse	**Average**	**0.063**
Time Stretch	stretch 2.3784 x	0.200
	stretch 0.4205 x	1.000
	stretch 1.1892 x	0.200
	stretch 0.8409 x	0.333
	stretch 1.6818 x	0.500
	stretch 0.5946 x	0.016
	Average	**0.375**
Tape Speed	speed 2.3784 x	0.006
	speed 0.4205 x	0.025
	speed 1.1892 x	0.042
	speed 0.8409 x	0.012
	speed 1.6818 x	0.006
	speed 0.5946 x	0.014
	Average	**0.017**

After running the experiments only two transforms had a precision of 1. These two were Pitch shift by -3 semitones and time compression by 15 semitones (time stretch of factor 0.421 x).

The results have been organized by transform class with their precision noted. Time stretching was the most robust of the transformation classes, with an average precision of 0.375. The worst performing class was the tape speed transform, which had an average precision of 0.017.

For the case of the tape speed transform, it was at significant disadvantage since it was computed using two different transforms. First it was pitch shifted and then it was time stretched. This was necessary to get the speed up or slow down effect attained from an analog tape player. Each one of these two sub transforms introduces Cepstral distortion. This compounded distortion considerably affected the precision of this transform.

2.4.6 Conclusions

A methodology for deconstructing a remix and a means for evaluating this deconstruction process has been created. With this, a framework has been laid, upon which, comparison of future remix decomposition techniques is possible. This leads to future work to improve the results.

The overall precision of our method was low. We are however fairly confident that we can increase this precision, if only by humble amounts, by appropriately altering some parameters within the method. By adjusting the window and hop size used during the MFCC calculation, for instance, we may be able to decrease some of the transform distortion as seen by the audio database.

We have noticed that the comparisons addressed at this sort of micro scale do not fare well with some of the settings chosen. They were chosen for their robustness in finding relationships on a slightly larger scale. In the case of this remix deconstruction task it is necessary to readdress some of our assumptions.

2.4.7 Improving results

In order to improve the results from the previous section it is necessary to address how the MFCCs were calculated. The hypothesis stated earlier is that the settings used in the experiment are not optimal, and thus, not yielding the desired results. An experiment needs to be created to alter both the window length and hop size in small increments and compute the distance on a ground truth test case. The values of these two settings that yield the closest distance (best match) would empirically be the optimum MFCC setting. This optimal setting would then need to be used in a recreation of the previous remix deconstruction experiment. Such an experiment is out of the scope of this thesis.

3. Visualization and Presentation Design

Two experimental remix visualization schemes and four web presentation schemes were explored. The visualization design experiments showed how the parts of a remix relate to its parent and how these relationships can be relayed to the user in a meaningful manner. The goal of the presentation design was to provide the listener or potential remixer a visual representation of the remix tree that is both informative and intuitive.

3.1 Remix Visualization

3.1.1 Process

There were two types of remix experiments. The first experiment was to see which kind of remix relationships can be found and how well they perform. This is similar to the deconstruction experiments in chapter 2, yet from a different perspective. These experiments were focused on finding relationships of transformed data in an untransformed database (the database in Chapter 2 contained transformed features). The second part involved relaying the remix relationship information in visual forms.

Test remixes were created using a single transformation or a combination of these basic transformations. These remixes were all based on the song, “Galvanize” by the Chemical Brothers. The song was segmented by hand into roughly two beat segments with the following transforms applied. These were time stretching, time compression, reordering, and reverse. Each remix used only one of the transforms listed above except in two cases where multiple transforms were used. In the multiple transform cases were used effects were applied to one; the other had no effects.

The feature extraction of these songs used equally spaced time segments of 100ms each. For each time segment 20 Mel Frequency Cepstral Coefficients (MFCC) were computed. These 20 values were used as the features per time segment stored in the audio database. The database contained the features of every time segment per track. This database could be searched by supplying a set of features to match. This allowed for a single frame match or any N number of time segments chained together as a sequence. (Casey & Slaney, 2006)

This experiment was primarily concerned with getting a sense for which transforms were easiest to find when searching the audio database. This gives insight into what kind of relationships might be found when comparing "real" remixes. Something considered easy to find would be a search result that was low. The range of the search results was from 0 to 2, representing multidimensional Euclidian distance.

Picking the proper sequence length is domain specific, e.g. if L is below an optimal value then the results may not be as perceptually meaningful. If the sequence is too long it may result in poor distance metrics, since it is trying to find relationships that are too long for the given context. The experiment was to see which sequence length was more effective for the given song by ordering the distance results. The experiment used two sequence lengths, L=10 and L=30. These sequence lengths represent 1 and 3 seconds respectively.

3.1.2 Search Results

The best performing transform was time stretching. The top match for length, L=10, was the Micro Remix. The segment of this remix that matched was a time stretched event. The worst performing transform was the random reordering plus effects. The effects used were heavy reverb and distortion. For detailed results, see Appendix A. For a summary of the results see Table 2 below.

Table 2 Table of Top Results, Ordered from Closest to Farthest Match

The top match result from each remix were collected and ordered from closest to furthest match. For length, L = 30, the best match was within the Simple Reorder remix. For L = 10, the Micro Remix was the best match.

Length, **L=30**				Length, **L=10**		
Simple Reorder	Query	Match		Micro Remix	Query	Match
0.776653	230	253		0.389137	0	33
Time Stretch				Time Stretch		
0.788196	170	268		0.512002	11	18
Time Compress				Time Compress		
0.802414	240	226		0.535863	254	240
Micro Remix				Time Stretch		
0.805115	265	266		0.585013	254	347
Time Stretch				Simple Reorder		
0.872595	235	336		0.616282	254	127
Time Compress				Time Compress		

Half				Half		
0.92606	258	45		0.663998	253	64
Reverse				Reverse		
1.06669	116	115		0.866876	256	255
Reorder				Reorder		
1.34641	42	146		0.972949	300	358
Reorder FX				Reorder FX		
1.60501	281	235		1.07908	0	76

Some reasonable comparison results using 20 MFCCs were possible. A sequence length of 10 yielded lower distance metrics than that of 30 (lower means a closer match). In some cases these relationships were half the distance in the L=10 searches. This effectively means the segment relationships were twice as strong. Sequence matches were audibly similar.

3.1.3 Visualizations

From the remix relationship data two different visualization schemes were explored. The first displays the features next to each other for visual inspection using MATLAB. The other shows remix relationships as they relate in time using Adobe Flash and Actionscript 3.0.

3.1.3.1 Matlab

For the Matlab visualization the audio database was searched and the top feature vectors from each query were displayed. Examples of 15 time segments are shown in Figures 3 and 4. For each image, the left is the original and the right is the remix. A solid color band and black line separate the two feature sets. The color of this separation band is the color that represents the lowest value in the features. In addition to the original vectors a version where the difference subtracted was created. This was calculated by subtracting the remix MFCCs from the original MFCCs, then subtracting that matrix from both feature sets. It was an attempt to get further clarity in the MFCC relationships.

Original Vs Simple Reorder	Difference Subtracted

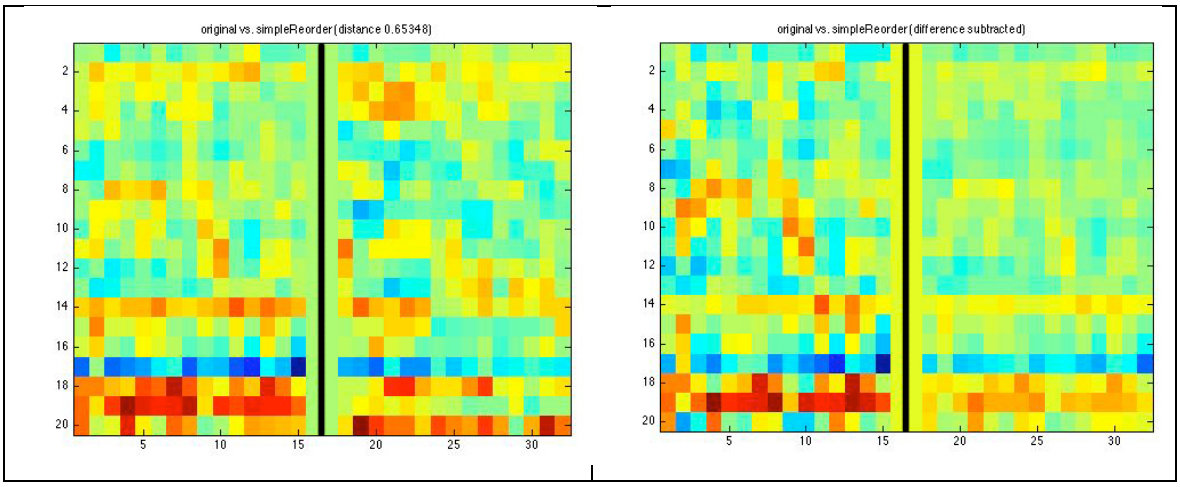

Figure 3 Matlab Visualization of the Simple Reorder remix

Left image shows the visualization of 15 time segments, right image shows the difference subtracted visualization of those same features. The search distance was 0.65438.

Original vs. Time Stretched (2X)	Difference Subtracted

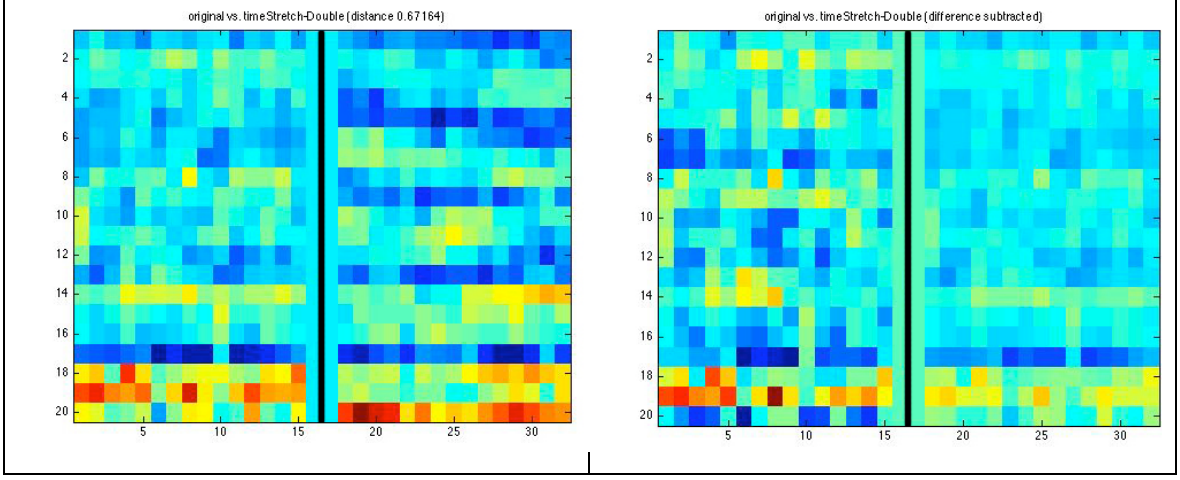

Figure 4 Matlab Visualization of the Time Stretched remix

Left image shows the visualization of 15 time segments, right image shows the difference subtracted visualization of those same features. The search distance was 0.67164.

These images show what is being returned from the audio database as the closest matches between the remix and the original. This type of visualization is useful for getting an idea of what is being matched assuming one has experience in looking at spectral data. For the general public a visualization scheme in this vein would convey little meaning. This limitation led to the next visualization experiment.

3.1.3.2 Actionscript 3.0

This visualization was intended to be of a more interactive nature. One advantage of using Actionscript is that the compiled flash movie can be run from the desktop or within a web browser.

The waveform of the original is displayed at the top. The line at the bottom represents the timeline of the remix. Lines from the original to the remix represent where the top sequence matches were found. This gives a sense of how samples from the original were reordered in the remix. When the user clicks on the line they hear the original segment, a short pause, and then the remix segment. This is to help give auditory reinforcement of the matches found.

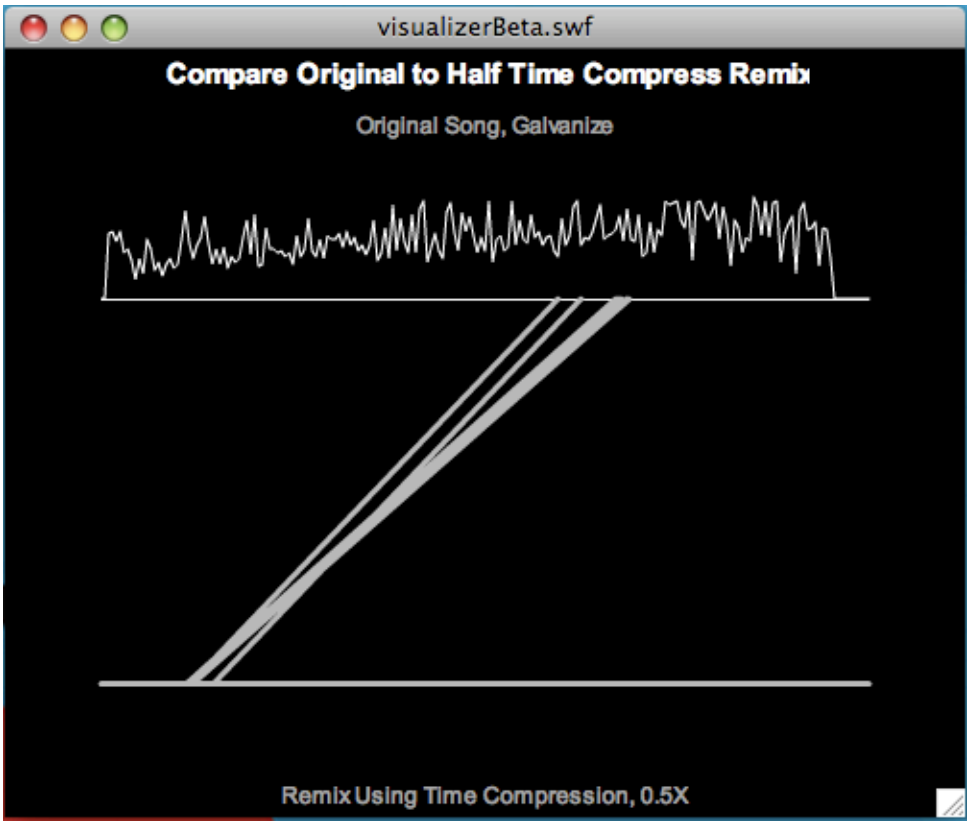

Figure 5 Screenshot of Flash Visualizer

The top waveform is the original song. The bottom line is the timeline of the remix. The diagonal lines represent where the highest matches are and where they relate to each other in time. By clicking the line one hears the two matching segments one after another. The example above shows 30 seconds of each song.

3.1.4 Visualization Summary

The Matlab visualization scheme was an important first step in trying to make sense of the feature data being matched between the remix and the seed composition. It fell short as an effective tool for displaying remix associations to a broader demographic. The Actionscript visualization was the best visualization scheme of the two.

The Actionscript 3.0 visualization offers numerous possibilities for further exploration. Items such as sequence length and number of matches could be made parametric and updateable though the GUI. This would allow the user to experiment with the interface and potentially find some meaning in how the remix they are looking at is structured.

A subsequent direction to take this visualizer is to integrate it with the remix deconstruction techniques from Chapter 2. Assuming the results from the deconstruction process improve with further research, these search results could be used to inform the Actionscript visualizer. This would effectively lead to an interactive visual remix deconstruction tool.

3.2 Remix Tree Presentation

To present the remix tree data back to the remix community, the remix data was stored in a MySQL database. To store a tree structure in a relational database a modified preorder tree traversal was used (Tulder, 2003). Once the data was stored in the database, it was possible to create PHP and Cascading Style Sheet (CSS) code to query the database and present the data on the website.

3.2.1 Hierarchical Remix Trees

Presentation 1 displays the remix tree to the user by using indentation to show the parent child relationship. The name of the remix, the remixer, and a play button is shown for each remix. The indentation increases at each remix round.

Figure 6 Presentation 1 Remix Tree for En La Selva Mvt. III.

This hierarchical view presents the listener a simple yet effective way to view the remix tree. Each round of the remix tree is indented to show the parent to child relationship. See Appendix E.

Presentation 1 offers a clean representation of the remix tree and allows the user to listen to any of the remixes. It is a simple yet informative presentation. This representation does however have a big limitation. It can only handle 6 or 7 rounds (depending on the font size) of remixes before there is no more space left. This cap will eventually be an issue since the idea of the remix evolution is that there is no artificial cap. A remix tree should be able to grow indefinitely.

Presentation 2 was designed using bands of varying color to help highlight the parent child relationship. As opposed to Presentation 1, this presentation is optimized for showing the Round 3 remixes that are available for remixing in Round 4. This presentation scheme can scale to the length of Presentation 1, although to make this possible a rule for color changes in the bands would need to be devised. This is not a trivial task since haphazard color use would confuse the viewer instead of elucidating the relationships.

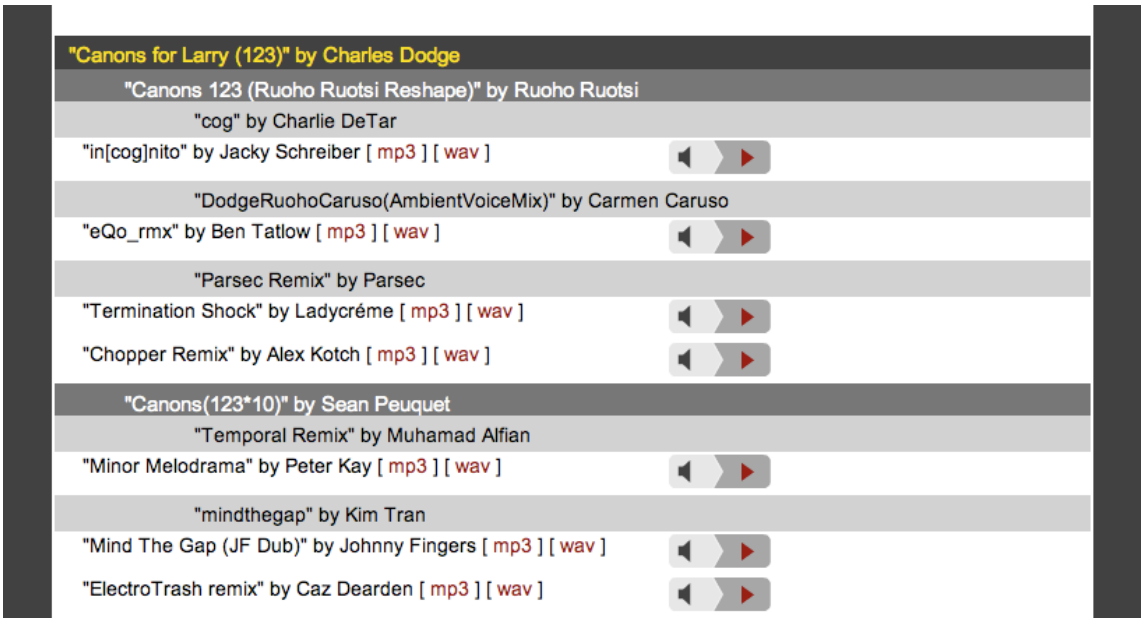

Figure 7 Presentation 2 Remix Tree for Canons for Larry

This hierarchical view uses color bands to help delineate parent from child. In this presentation, only the tracks currently available for remixing have links for listening and downloading.

3.2.2 Remix Tree Graph

Presentations 3 and 4 are graph views. These presentation schemes place remixes on a directed graph. Each node of the graph represents a remix. Theses presentations are not yet interactive; however how they would be used interactively is mentioned.

Presentation 3 has the root of the tree placed in the center at the bottom. When the user hovers over a node it glows red and the details of that remix are displayed to the user. The remix name and the artist's name are presented within a grey dialog box. The remix name is a hyperlink to play the remix. If the remix is currently available for remixing a remix link populates the dialog box as well. With Presentation 3 (and 4) the tree analogy of the remix tree takes on a more literal meaning.

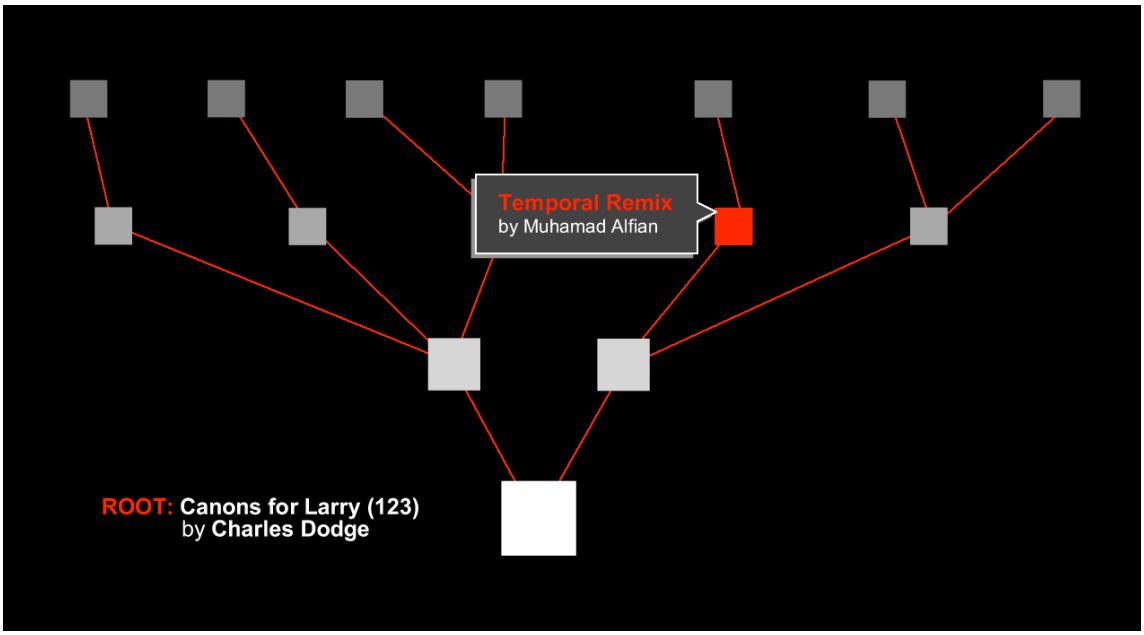

Figure 8 Presentation 3, Remix Tree Graph for "Canons for Larry (123)"

In this presentation all the remixes branch out from the seed song in the center. Only the highlighted node has its information revealed.

Presentation 4 is a graph similar to Presentation 3 except that it is aligned vertically instead of horizontally. In this presentation all the nodes have call out boxes that state which remix is at the node and who created it. The spacing of the nodes is partially determined by the call out boxes so overlaps can be avoided. This scheme is useful for smaller trees. It has the advantage that all the remix names can be seen at once.

The graph representation scheme offers the most promise in presenting the remix trees to the user in a scalable format. Presentation 3 and 4 have higher potential for interactivity than do Presentation 1 and 2. Presentation 3, in particular, seems to have the most potential to properly scale. The graph presentations could be made in Actionscript 3.0 and designed to allow for zooming as well as spinning of the graph to help isolate nodes of interest. This feature is particularly useful when the trees become large.

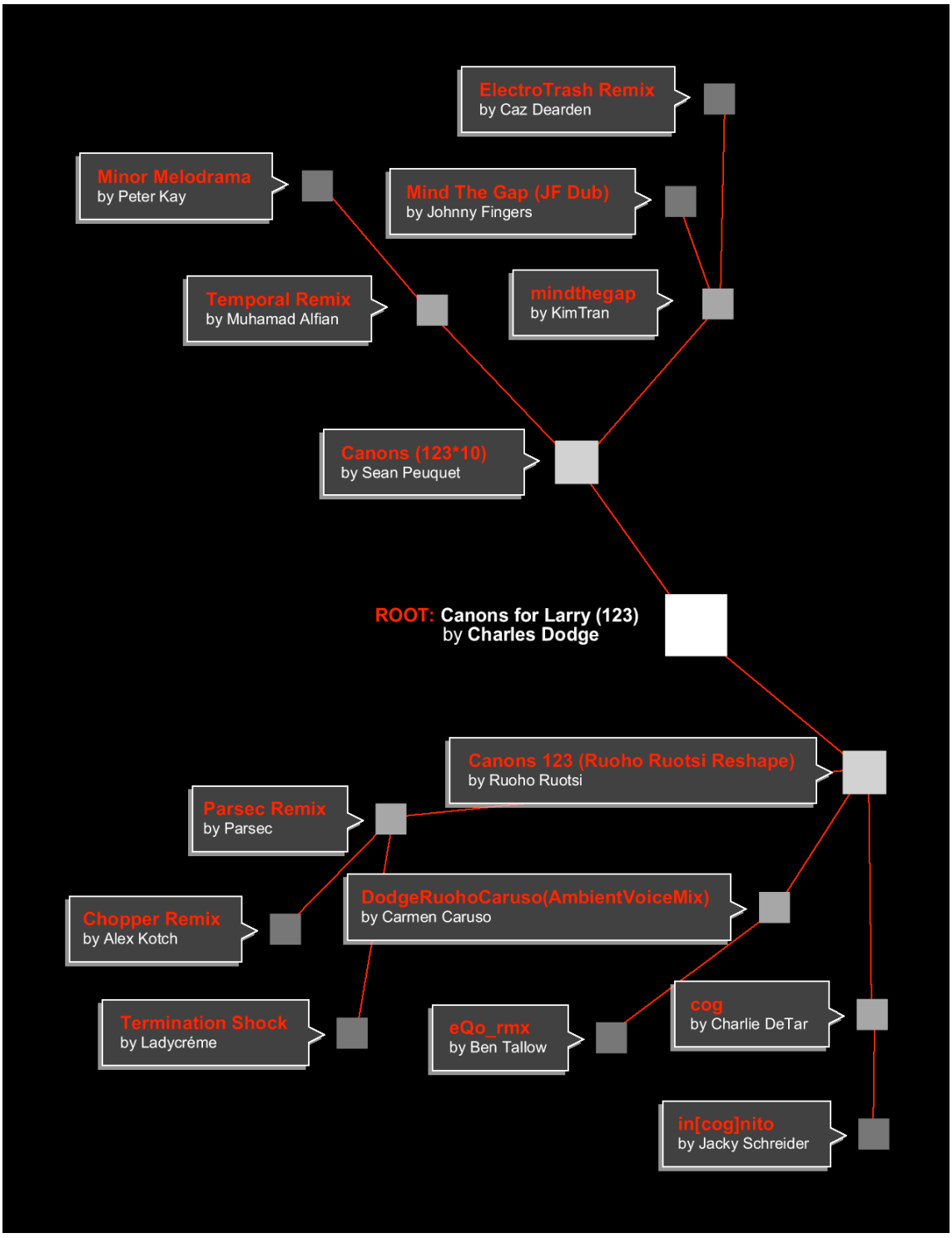

Figure 9 Presentation 4, Remix Tree Graph for "Canons for Larry (123)"

This presentation scheme shows how a remix tree would look like with dialog boxes on each node.

4. Evolution of a Remix

4.1 The Seed Compositions

Three compositions evolved in this thesis. Each composition resulted in its own remix tree of depth four. The pieces to be evolved were chosen primarily for richness of their sonic material. Each had a different form from the other and had unique timbral qualities. I used electro-acoustic music because I felt that it might offer interesting possibilities to the remixers. Beat- or pulse-oriented tracks are often too stylized and lead to remixes that retain much of the original beat style. Another reason for selecting electro-acoustic works was out of respect for the graduate program I am in. The three compositions are described below.

4.1.1 "Canons for Larry (123)" by Charles Dodge

This piece is from a series of works referred to as "Canons for Larry (123)."[1] The Larry in the title is Larry Polansky. As the title suggests, the form is canonic. The piece consists of steps of varying moving ratios. The melodic pacing remains constant but at each iteration of the canon the relationship between successive notes changes. The piece is 2:42 long, monaural.

The piece's form is based on simple integer ratios. Starting with 5:4 (Major 3rd) pitches rise and then fall. The pitches rise and then fall. The sequence of ratios are: 5:4, 11:8, 3:2, 13:8, 7:4. These ratios approximate the 12 tone intervals (just intonation tuning): M3rd (-14¢), TT (-49¢), P5th (+2¢), M6th (-43¢), m7th (-31¢).

4.1.2 "En la Selva Mvt. II", by John Arroyo

"En la Selva" (2007) is a journey through a mythical, fantastic jungle. It was composed using manipulated field recordings and sound effects libraries. The piece has been performed at Dartmouth and as part of a modern dance piece choreographed by

[1] I wish to add a special thank to Charles Dodge for donating this piece to the project so that it could be evolved.

Stephanie Sleeper. It premiered in Hartford Connecticut and was recently restaged in Brooklyn, NY.

The focus of this movement is on the elephant and the hyena. The hyena samples were used primarily as pitched rhythmic material. The elephant was used as a "trumpet." The original hyena recordings were stretched and manipulated to impose a pulse using their natural vocalizations. A dialog between the two animals develops as the piece progresses. Drastic tempo shifts in the second half of the piece help to create drama. Other sounds used in the piece are buzzing flies and field recordings of people walking.

4.1.3 "En la Selva Mvt. III", by John Arroyo

I was working with Rhesus Macaque recordings in a research capacity and was inspired one day to use them in a musical composition. These samples were and still are primarily intended for research purposes.[2]

"Warbles", "Harmonic Arches", and "Chirps" signify high-quality food while "Grunts" and "Coos" represent lower-quality or common food (Hauser, 1993). "Warbles" and "Harmonic Arches" are acoustically different yet mean the same thing. Grunts and Coos are also different yet both signify low quality food. The distinction is not based on pitch or even by temporal spacing. More importantly this sonic material is simply fascinating from a compositional viewpoint.

The third movement was originally called "Good Food, Bad Food." The name was a description of the concept, which is a four channel cacophonous dialog of Macaque vocalizations. The left two channels contain bad food calls and the right two channels contain good food calls. The piece was later mixed down from 4 channels to 2.

The piece infers rhythms by manipulating the grunts of the monkeys. Melodies and complimentary rhythms are created by manipulation of the more pitched vocalizations such as the Harmonic Arch.

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[2] I wish to add a special thanks to Marc Hauser for allowing me to use his samples in my composition.

4.2 Brief Introduction to Creative Commons

The Creative Commons[3] (CC) is a not for profit corporation, 501 (c)(3), launched in 2001. It was founded to facilitate making creative works available to others while not giving up ones rights to the work and still being able to generally dictate how the work may or may not be used. The Creative Commons intention is to facilitate the sharing of information by avoiding problems in the current copyright laws (Creative Commons, 2008). Thus it is a convenient way to allow distribution of music online and allow remixes.

US Copyright laws are complicated and restrictive, as are those of other countries. CC allows the artist to specify a set of usage constraints by answering a few questions on their website and generating a license. With CC licenses one can make works available to others, encouraging proliferation through file sharing and adaptation.

> "Creative Commons defines the spectrum of possibilities between full copyright — all rights reserved — and the public domain — no rights reserved. Our licenses help you keep your copyright while inviting certain uses of your work — a "some rights reserved" copyright." (Creative Commons, 2008)

Figure 10 Copyright Spectrum

The Image shows where the Creative Commons licenses fit between the full copyright and the public domain.

At one extreme there is conventional copyright ©. At the other end is the public domain (pd). In the public domain everyone has the right to use, distribute and transform the content however they wish including for public consumption. Creative Commons licenses fall somewhere in the middle. These offer options to specify how ones information (intellectual property, creative works, etc) can and cannot be used.

The remixes created for this thesis carry the Sampling Plus 1.0 Creative Commons license, allowing the licensed work to be remixed for non-commercial purposes. This

[3] Creative Commons was founded by the lawyer Lawrence Lessig

license allows individuals to share works by copying and distributing them freely. To distribute commercially, permission must be attained from the CC copyright holder.

Table 3 Sampling Plus License Overview (Creative Commons Licenses, 2008)

Works with this type of license can be shared, remixed, and used noncommercially.

	You Are Free:
	to Share — to copy, distribute and transmit the work
	to Remix — to adapt the work
	Under the Following Conditions:
	Noncommercial. You may not use this work for commercial purposes.
	• For any reuse or distribution, you must make clear to others the license terms of this work. The best way to do this is with a link to this web page. • Any of the above conditions can be waived if you get permission from the copyright holder. • Nothing in this license impairs or restricts the author's moral rights.

4.3 Collection Process of the Remixes

Attempting to get a large number of remixes from a diverse group of people is a difficult task. Collecting these remixes involved creating a website, encouraging participation, promotion, and creating a submission process. Starting with 3 compositions 37 remixes were created by 33 remixers. The methods used are described below.

4.3.1 The Website

The website was the "home" for the remixes. It is a central place to present important information and share all the remix files. The URL of my website is www.remixin.org/project, referred to here on out as *Remixin*. The website has a detailed description of the project, a separate page for each round, a description of how to remix, and other important information. Later on a dedicated listen page was created to allow visitors to see the remix trees and hear every remix created, not just the ones currently available for remixing. *Remixin* is my personal website yet it is also the current host of the remix evolution.

All of the mp3 and wav files were delivered from a linux server set up in the electro-acoustic music department called electronica.dartmouth.edu. The electronica server also served as a virtual laboratory when it came to the remix analysis mentioned in chapter 2 and the visualization experiments in chapter 3. All of the feature extraction and audio matching was done using this server.

4.3.2 Submission Process

When a remix was completed it was emailed to me or a link to where it could be downloaded on the web was emailed to me. The preferred submission format was a wav file. Theses files can be large so the remixer would either upload the wav to their personal website or use one of the many file sharing services available. The most popular service was *YouSendIt* (YouSendIt, 2008). Remixers were asked to submit a remix form along with their remix file. This form included basic information about the person, how they created their work and an agreement that their remix would be posted on the website with a Creative Commons license (see Appendix B).

After the remixes were submitted an mp3 was generated from the wav file and both files were uploaded to electronica.dartmouth.edu. Then the name of the remix, the remixer's name and the audio file links were added to the next rounds remix page. At this point the remixes were ready to be remixed when the new round started.

4.3.3 Attracting Remixers

4.3.3.1 Contacting Friends and Colleagues

Initially, personally contacting friends and colleagues was the only means of getting remixers (Round 1). Emails were sent to individuals personally asking for their time and effort to create a remix for this project. In some cases phone calls were made to entice the potential remixer. This method is effective for attaining a small numbers of contributors but it does not scale. One can quickly run out of personal contacts that have the free time for an endeavor such as this. This led to utilizing various other methods to get participation.

4.3.3.2 Web Posting

Starting with Round 2 of the remix evolution a call for works document was created for each round. This was initially emailed to friends and colleagues and then was used when posting on the web. When posting to a bulletin board, an overview of the project was written and the call placed underneath. For an example call see Appendix D.

Starting with Round 3 bulletin boards and websites were heavily posted on. The primary bulletin boards used were *MySpace*, *Facebook*, and *EMF*. Each of these led to a few remixes. On *Facebook* the posts were on the bulletin boards of few different groups, such as sound art and Chicago house.

A *Remixin* group was created on *Facebook*. This became another place to post the calls and special announcements about the remix project. As of May 17th, 2008 there were 143 members of this group.

For Round 3 About 40 *MySpace* messages were sent to various musicians and producers trying to entice them to create a remix. This effort resulted in a few remixes but was time consuming. To do this effectively one must browse through numerous pages to find potential remixers who have adequate music skills and who may be willing to contribute.

4.3.3.3 Printed Publicity

In order to advertise the project and get more visitors to the website printed materials were created. In addition, a news story about the remix project was printed in The Dartmouth (the college newspaper) (Sacks, 2008).

The printed materials created were flyers. They offered a simple means to help spread the word about the remix project. Stacks of the flyers were left at record stores and select shops. They were also given out after performances. Since the primary methods of publicizing the remix evolution were electronic, the flyers offered a physical means to spread the word.

These promotional flyers were business card size and showed in words and graphics a small window into the project. The layout was created to be concise and incite interest for the project. The flyers contained important information, like URLs, in a compact form that people can easily fit in their pocket. See Appendix C for images of the printed materials.

4.3.3.4 Blogs

The remix project has been featured on two popular remix blogs, Laptop Rockers (Laptop Rockers, 2008) and Reeemix (Reeemix, 2008). In the case of Laptop Rockers they created a nice illustration connecting the classic Darwin image of the progression of man with the *Remixin* logo[4].

Figure 11 Laptop Rockers Promotional Graphic

This image was created by Laptop Rockers to accompany their blog post regarding *Remixin*.

[4] The designer Enrique Sacasa created the logo. It was a remix of the mixin logo created by Vincent Montelongo. Mixin was my old DJ crew in New York City.

UV Scene is an upper valley website catering to young people in the area. They wrote a short article about the remix project for Round 4. This will hopefully get more upper valley residents involved in the music remix creation. Posts were also made on blogs of friends of mine which described the remix evolution and added links to the *Remixin* website.

4.3.4 Results

This was quite an elaborate effort to get a large collection of remixes. The main obstacle in this remix collection task was to get four rounds of quality remixes in a short amount of time. How does one spread the word and get participation in a short period of time?

Using the methods previously described the task of generating a remix tree was accomplished and a diverse mix of remixes were received. Getting the word out on this project and getting participation was successful. During the entire process quality remained a key concern. There were methods that could have been deployed to get a larger number of remixes but that would have led to lower quality remixes. Doing things like heavily posting to dozens of amateur sites that cater to high school kids and bedroom DJs could have potentially led to more remixes. However, it is doubtful that the music attained would have been of a high caliber. Poor quality remixes would not make for an interesting remix evolution project.

4.4 My Remixes

This section is dedicated to the works I created for each round. My motivation and compositional techniques are described for each remix. I created the first remix as a DJ would and decided to add a heavy pulse to the work. Since the other remixes in Round 1 were primarily electro-acoustic I decided to make my subsequent remixes beat oriented. These pieces were written under my pseudonym Johnny Fingers. That is the alter ego I go by when I DJ at a dance club or release a dance music track. All remixes were created using Ableton Live (primary DAW). Some of my remixes also used Audacity and MEAPsoft.

4.4.1 Round 1

For Round 1 I remixed “En la Selva Mvt. II.” The concept was to take the original and accentuate some of the loops and rhythms already present. A laid-back breakbeat with heavy drums was created, a thick bassline was added, and then the previously mentioned loops were added.

I called this remix the “Micro Mix.” I gave it this name because I was only looking at a few moments of the original, zooming in on certain ideas, altering them and then repeating them. About two minutes into the piece there is a subtle break down, then about 20 seconds later a new distinct melodic rhythm arises and takes over the piece. The musical ideas were created much like they were in the original. Time stretching, time compression and distortion were used on a more micro level.

4.4.2 Round 2

The “Finger Bang Mix” started with a slow rock beat and then gradually more rhythmic events and complimentary beats were added. As this is going on the original remix (“En el Circo” by Kimmie Kruge) is heard in the background slowly swelling. Swells continue but before they reach a climax the sound fades away into the background. This continues till about 3/5ths of the way into the track where one of the swells is finally allowed to reach a climax. Immediately after, the piece becomes tame for two measures and then an electro beat is added. This gives the remix a subtle 1980s feel to it. The distorted animal sounds from the Kimmie Kruge remix roll in and out, sometimes in a drastic manner.

4.4.3 Round 3

The piece began as a house remix, but midway through the process I changed my creative direction. I decided to incorporate some of the dub ideas and aesthetic into it. I was inspired by the previous dub research. I got rid of many of the initial ideas I was developing, slowed the tempo, and began to transform the piece into a dub remix. I called it the Johnny Fingers Dub.

This remix was based on Kim Tran’s remix called “Mind the Gap”. The lineage is as follows: "Canons for Larry (123)" by Charles Dodge -> "Canons (123x10)" by Sean

Peuquet -> "mind the gap" by Kim Tran -> "Johnny Fingers Dub" by Johnny Fingers. The remix utilizes a heavy down beat on the 1st and 3rd beats (4/4 time) and uses delay times of 3 x 16th notes for the left channel and 6 x 16th notes in the right channel. This creates an undulating stereo groove. To further create the dub aesthetic I took samples from the Kim Tran track to create melodic accents on beats 2 and 4. Beat three has a highly reverberant snare drum. The bass is heavy and distorted with somewhat of a dub bass timbre to it, but the bass progression is not typical of dub. Parts of the original Tran remix (which utilizes no beats) occupy three tracks of the DAW. Each one uses a few bars of the original remix but has a different effects chain on it. These tracks are inter-dispersed throughout the remix and then by the end are all playing together.

4.4.4 Round 4

"Canons for Lisa" was written in honor of my cousin Lisa Castro. I asked her for a style of music and she said "indie rock"; she also mentioned the indie band Dressy Bessie. The lineage of this piece is: "Canons for Larry (123)" by Charles Dodge -> "Canons 123 (Ruoho Ruotsi Reshape)" by Ruoho Ruotsi -> "Parsec Remix" by Parsec -> "Termination Shock" by Ladycréme.

In creating this remix I wanted to incorporate the ideas of the parent track, re-introduce a canon, and add elements that resemble the style of Dressy Bessie. I manipulated the electro beat from the parent and made it more indie rock sounding. I did this by adding a new drum track to the existing one that uses samples from a real drum kit. The canon was created from a sample of the parent's melody that was the most evocative of Dressy Bessie. I then made a canon in two by taking this sampled melody and transforming it to make it sound like it came from a different synthesizer. The original plays and then the altered version; this repeats a few times to make the canon. Midway through the remix I begin to pitch shift the two melodies using the same intervals as in the original dodge piece. The remix ends when all the intervals have been used.

4.5 Analysis of the Remix Trees

To offer an analysis of the collected remix trees the metadata analysis from Chapter 2 is used. In addition, at least one piece in each tree is described in terms of its musicality and technique. See Appendix E to view all of the remix trees.

The remix deconstruction described in chapter two is not yet a robust enough system to analyze the final remix trees. The deconstruction technique has a lot of potential, but is not ready for practical use yet. In order to keep the remix tree analysis meaningful the focus is going to be on the metadata and human analysis results.

To help make the tables easier to read they have been color-coded by round. The following table shows the color-coding used.

Table 4 Color Key

Each color in this key refers to a round or the cumulative of all the rounds. The table shows which color is representative of each round. Yellow represents cumulative data.

Color Key	
Round 1	Sample Text
Round 2	Sample Text
Round 3	Sample Text

4.5.1 Canons for Larry

A notable piece from this remix tree is "Canons (123*10)" by Sean Puequet. His remix is constructed as a meta-canon. Peuquet samples the first line of the Dodge canon. Then by changing the sample rate the sampled sequence is shifted up in pitch by a major third. As an artifact of this transformation the tempo increases. This sample rate change is repeated 8 times with successive iterations becoming higher in pitch as well as faster. Midway through the iterations the original airy tone becomes a clanging bell sound. By the last iteration the sequence of major thirds becomes a sparkling, glissando like sound.

The piece starts out in mono panned hard left. Each successive major third is heard in alternating channels. The panning begins to center as the piece progresses. By the end of the piece the sound is equally distributed between the two channels. The remix was created using Max/MSP, Logic and Bias Peak.

Table 5 Remix Tree Results for "Canons for Larry (123)"

Top portion of the table shows the remix name, duration, and the types of software used to create it. The number 1 represents that the software category was used, 0 represents not used. The bottom portion shows the number of remixers per round and the averages durations.

name	time	open source	commercial	custom
Canons for Larry (123)	0:02:42			
Canons 123 (Ruoho Ruotsi Reshape)	0:03:13	0	1	1
Canons (123*10)	0:02:48	0	1	1
cog	0:04:13	1	1	0
Ambient Voice Mix	0:03:18	0	1	0
Parsec Remix	0:01:47	1	1	0
Temporal Remix	0:04:30	0	0	0
mind the gap	0:02:52	0	1	0
in[cog]nito	0:07:00	0	1	0
eQo_rmx	0:01:20	0	1	0
Termination Shock	0:04:00	0	1	0
Chopper Remix	0:06:10	1	1	1
Minor Melodrama	0:04:48	0	1	0
Mind The Gap (JF Dub)	0:04:05	0	1	0
Salva Me Parma Sound Spot Mix	0:04:14	1	0	1
Electro Trash Remix	0:03:27	0	1	0
Totals		**4**	**13**	**4**
Percentages		**28.57%**	**92.86%**	**28.57%**

	Ave Time	# of remixers
Round 1	**3:00**	**2**
Round 2	**3:20**	**5**
Round 3	**4:23**	**8**
Overall Time	**3:51**	**15**

"Canons for Larry (123)" was the most popular of the three seed compositions. It was remixed a total of 15 times. The remixes for this track relied heavily on commercial software. 92.86% of the remixes used at least one commercial application in the creation process.

The duration of the remixes monotonically increased at each round. The original song duration was 2:42, by Round 3 the average duration was 4:23. The overall average remix time is 3:51. The increasing remix length is a strong trend in this remix tree.

About half of the remixers added rhythms to their remixes. Five of these have a heavy pulse to them. Of the heavily rhythmic remixes, four were created at Round 3. One of the rhythmic remixes, "Termination Shock" by the Brooklyn duo Ladycréme, took the previous remix ("Parsec Remix" by Parsec) and created a sample kit from this track. These samples and new material were used to create a remix that was more of a new song than a remix. This remix is notable because very little of the original Dodge piece is left in this remix. There are subtle references only. This is a case where the remix has become disjoint from the original seed track.

4.5.2 En la Selva Mvt. II

"Magnaflow Catalytic Converter" by Michael Chinen is a Round 2 remix of "En la Selva Mvt. II." It was generated using custom C++ code and a Nintendo wii controller. The remix begins with a few distorted loops from the original remix, setting a laid back mood. This relaxed nature quickly fades away as the chopping begins to be more hectic and the pacing increases. Ringing distorted clips are now interjected into the piece.

By the middle of the piece the samples become so short and repetitive the song fades into a wash of sound. The wash does not create a sense of solitude; it generates a sense of tension. The sample lengths gradually get longer, the sounds louder. About five minutes in, a two measure loop from the original comes in. For a moment the listener is treated with a rhythmic groove from the parent track. Just as the groove begins to set in the sound begins to self-destruct. The piece continues to fall apart until only little clips are heard. These clips are increasingly spread further apart as the piece fades out.

Table 6 Remix Tree Results for "En la Selva Mvt. II"

Top portion of the table shows the remix name, duration, and the types of software used to create it. The number 1 represents that the software category was used, 0 represents not used. The bottom portion shows the number of remixers per round and the averages durations.

name	time	open source	commercial	custom
En La Selva Mvt. II	0:02:57	1	1	0
En El Circo	0:03:11	1	1	0
Johnny Fingers Micro Mix	0:03:10	1	1	0

Fingers Bang Mix	0:04:48	0	1	0
Bossing of the skull [5]	0:03:38	1	1	1
Magnaflow Catalytic Converter	0:07:33	1	0	1
Finger In Your Teacher's Bed	0:03:14	0	0	0
Scottie B Mix	0:05:02	0	0	0
En La Selva Mvt. II (Remix)	0:02:42	0	1	0
Ben Fields remix	0:05:01	0	0	0
Totals		**4**	**5**	**2**
Percentages		**66.67%**	**83.33%**	**33.33%**

	Average Time	**# of remixers**
Round 1	**3:10**	**2**
Round 2	**5:19**	**3**
Round 3	**3:59**	**4**
Average Time	**4:15**	**9**

Average remix length increases from Round 1 up to Round 2 and then drops considerably in Round 3. This is unique to this remix tree and is due, at least in part, by the Michael Chinen remix which is 7:33. The software types used are more evenly spread out than with the "Canons for Larry (123)" tree. 2/3 of the remixers use open source applications and commercial applications are used more than 4/5 of the time. This tree was the smallest of the three. It had only nine remixes.

The two Round 3 remixes of my "Finger Bang Mix" are two good examples of how later generations relate back to the seed composition. The first remix, is "Finger in Your Teacher's Bed" by Lucky Strike. It's a stuttering breakbeat track that frequently uses the animal loops that are still present in the "Finger Bang Mix." It sounds like a remix of it's parent, but also still has strong ties to the seed track. The second remix of the "Finger Bang Mix", the "Scottie B Mix" by Scottie B, is a tech house remix that could be played at a club or lounge in New York City. His track is a true remix of its parent, but the relationship to the seed composition is indeed disjoint. The few samples that relate to the seed are so faint that they are no longer read as being from the seed track. In fact one of the samples that used to sound like an animal now sounds like a distorted human.

[5] The remix "Bossing of the skull resulting in heaped up in the form of bosses or ridges resembling those ascribed to Keep Your Eyes Open TUESDAY For News From" is referred to as "Bossing of the skull" in this thesis and on Remixin

Only someone intimate with all the versions would know that this was a transformed sample from the original.

4.5.3 En la Selva Mvt. III

"Tango en la Selva" by Courtney Brown is a Round 1 (and Round 2) remix created using custom code written using Supercollider. The remix chops up little bits of the original creating rhythm but no well-defined pulse. There are no drum samples introduced. Taking small samples of the grunts and coos contained in the original piece, beats are created. The clipping of the underlying samples induces accents. In many places, the clipping acts almost like a cymbal. Its hard to tell how much of the clipping as creative material is intentional and how much is an artifact.

The monkeys can be heard very prominently. A third of the way into the piece sampled strings are introduced. The strings attempt to play a melodic line but they are instead chopped up along with the monkey samples. As the piece moves along more of the melodic line is revealed and the listener is now able to hear the direct tango references.

Table 7 Remix Tree Results for "En la Selva Mvt. III"

Top portion of the table shows the remix name, duration, and the types of software used to create it. The number 1 represents that the software category was used, 0 represents not used. The bottom portion shows the number of remixers per round and the averages durations.

name	time	open source	commercial	custom
En La Selva Mvt. III	0:03:31	1	1	0
Enrique Sacasa Remix	0:06:31	0	1	0
Pressure Reducer Relief Valve	0:04:42	0	0	0
Tango En La Selva	0:03:00	1	0	1
25th and St. Paul	0:03:04	1	0	0
En La Selva Mvt. III (Monolith + Club Mix)	0:03:51	0	1	1
En La Selva Mvt. III (Diluted with Dilaudid Mix)	0:03:27	0	0	0
Sydney_Bmore_Somewhere	0:02:37	1	1	0
Tej Gill's F1 Remix	0:05:40	0	1	0
Arroyo's Bad Beau Remix	0:05:10	1	1	0
Evil Ever After Mix	0:03:12	0	0	0
Eleventh Hour Remix	0:04:25	1	1	0
Tango Vega	0:03:37	1	1	0

Crusty	0:05:44	0	0	0
Totals		**6**	**7**	**2**
Percentages		**66.67%**	**77.78%**	**33.33%**

	Average Time	**# of remixers**
Round 1	**4:44**	**3**
Round 2	**3:27**	**3**
Round 3	**4:20**	**7**
Average Time	**4:13**	**13**

The average remix time in this tree is different from the other two remix trees. The average times increase in Round 1, like the other two remix tress, however in Round 2 the length decreases considerably. The average length of Round 2 is actually less than the original song length. At Round 3 the average remix length increases by almost a minute. The types of software used are nearly identical to that of Mvt. II.

The remixes of "Tango en la Selva" by Courtney Brown are good examples of the diversity one remix can inspire. These diverse remixes were "Eleventh Hour Remix" by FERALCATSCAN, "Tango Vega" by Mantris, and "Crusty" by Panray. The "Eleventh Hour Remix" is an ambient remix that turns the tango into washes of sound. Monkeys are heard peaking their heads through the wash. They sound like distant calls of the jungle in an undulating blanket of sound. The next is "Tango Vega" which is one of my personal favorites of the remix evolution. In this track Mantris builds upon some of the tango rhythms and melody created by Courtney Brown but also adds new melodic elements and bursts of bass. The bass sounds like a gust of compressed air. The piece has a pulse, but it is not a dance track; the pacing fluctuates organically through the remix. The final remix is “Crusty.” This remix is a tech house track that builds on the melodic elements of “Tango en la Selva” but also turns the scratchy loops from the parent track into a consistent backing beat. Synthesizer swells and a heavy house beat are added to create a track that is enjoyable on and off the dance floor. From the Brown remix three very different remixes were created in three different genres; ambient, electronica and tech house.

4.5.4 Overall Results

The remix evolution yielded 37 remixes from three remix trees. There were 33 remixers from around the United States as well as foreign nations. There were remixes from India, Malaysia, England and Germany. Based on the feedback from the remixers they enjoyed the remix process (over 90%) and noted that they would be willing to create another remix in the future.

Exactly 1/3 of the remixers were students, alumni or faculty of Dartmouth College. Of these 4 were women. Overall, 18% of the remixers were women. "Canons for Larry (123)" had the most women remixers.

For each remix tree the relationship between round and average remix duration varied. When the duration data is aggregated across all remixes in each round there is a definite trend however. Remix length monotonically increased at each round. The length of the average seed song was 3:03. By Round 3 the average remix length was 4:17. The overall average remix time was 4:04. The longest average round duration was Round 2 of "En La Selva Mvt. II" (5:19).

Table 8 Average Remix Durations

Shows the changes in duration over the course of the remix evolution.

	Number of remixes	Average Song Length
Seed Compositions	N/A	3:03
Round 1	7	3:47
Round 2	11	3:54
Round 3	19	4:17
Overall	**37**	**4:04**

The software used within the remix evolution was aggregated and displayed below. Just over half of the remixers used an open source application in their remix creation process. 85% of the population used at least one commercial application. Almost 1/3 of the remixers used custom software. This was the only category that was consistent amongst the remix trees.

Table 9 Percentages of Software Types Used

About half of the remixers used Open Source software, but only roughly a third used any custom software.

	Software Types Used		
	Open Source	**Commercial**	**Custom**
Canons for Larry	28.57%	92.86%	28.57%
En La Selva Mvt. II	66.67%	83.33%	33.33%
En La Selva Mvt. III	66.67%	77.78%	33.33%
Average	**53.97%**	**84.66%**	**31.75%**

Amongst all trees the most common software type used was commercial. In particular the top two applications were Ableton Live and Apple's Logic. The most popular open source applications used were Audacity and Soundhack. Audacity was also the most used application overall. The most popular custom software platforms were Max/MSP and Reaktor.

Table 10 Top Software

Top two software applications used for each type of software category. Audacity was the most used software.

Top Two Tools in Each Software Category	
Open Source	
Audacity	10
Soundhack	3
Commercial	
Ableton Live	8
Logic	7
Custom	
Max/MSP	4
Reaktor	3

4.5.5 Musical Analysis of Five Remixes

The following musical analyses contain an in-depth look at five different remixes. The analyses discuss how the remixes were made and how they relate to their source compositions. The method highlights time-location relationships between the remix and the parent, notes from the remixers' submission forms, and explanation of the transformations applied to the samples. The time-point analyses constitute a manual remix deconstruction. As the automatic deconstruction technique develops, analyses like the following, or in some case better, may be possible without manual intervention.

4.5.5.1 "cog" by Charlie DeTar

"cog" by Charlie DeTar is a remix of "Canons 123 (Ruoho Ruotsi Reshape)" by Ruoho Ruotsi which is a remix of "Canons for Larry (123)" by Charles Dodge. DeTar is a composer and media researcher currently studying at MIT's Media Lab. He described his remix as having,

> "droning, [an] ambient beginning, disturbing samples, [and a] thrashing ending."

"cog" takes the whole parent track and time stretches it. The remixer then convolves this with other music and sounds. These convolved sources are unknown; they cannot be recovered by listening. By the time point 0:32 the "Ruoho Ruotsi Reshape" can be heard in the background, but it is subtle. There is a drone in the foreground; one must listen carefully to hear the parent track. One minute into the piece the clanging melody from the parent becomes more prominent, but the relationship is still relegated to subtle reference.

At 1:53 a sample that starts with the words, "Children of god," is mixed in. It's hard to distinguish the actual words after that, but it resembles a preacher. The chosen preacher samples begin to add a mysterious quality to the texture. At 2:20 a sample of a girl screaming is added that increases the pacing on a disturbed trajectory. At 2:30 more distortion is added; it continues throughout the piece.

Starting at 3:11 another sample from the parent is introduced. This is the only clearly recognizable sample used in the remix. The sample is from the timepoint 2:40 of the Ruoho Ruotsi remix. It is a narrow-band pitched noise sweep sound, created from the original Dodge piece. It sounds as if created by a digital turntable effect, like the original canon was slowly being "scratched" in a swooping motion. At 3:30 these swooshes become more noticeable as being from the parent composition.

The deconstruction tool introduced in Chapter 2 would not find many relationships between "cog" and the parent remix. Based on the automatic analysis results, the narrow-band pitched noise sweeps from 3:30-3:50 are the most likely candidates for the deconstruction tool to find. The Euclidean distance from these searches would be large because of the added distortion, but I postulate that some could be identified. In this remix, the process is primarily concerned with transformation of the original work into

an evolving texture; specific references to the original material are difficult to discern. The original is instead used as a basis for creating an entirely new musical work.

4.5.5.2 "En La Selva Mvt. II (Remix)" by Arabb

"En La Selva Mvt. II (Remix)" by Arabb comes from the following lineage, "En La Selva Mvt. II" by John Arroyo -> "Johnny Fingers Micro Mix" by Johnny Fingers -> "Bossing of the skull" by Chris Peck. His real name is Stephen M. Chabassol; he is a web designer and an aspiring musician. When describing his remix he states,

> "All of the sounds came from "Bossing of the skull..." by Chris Peck except for the bass line, which is MIDI piano. The remix is 10 tracks in Sony ACID Pro 6.0, and I used M-Audio BX8a studio monitors to write and engineer the remix."

The drum loops from the first 4 seconds of the Chris Peck remix were chopped up beat by beat and re-arranged into a new beat. The rhythmic style changed from drum and bass to trip hop as the piece progressed. As he stated in the submission from, the only added synthesized sound was the bassline. The samples used in most of the remix are only tenuously heard as related to the parent; one can't quite place which time locations in the parent track they came from. This is due to extensive processing of the samples blurring the relationships between the parent track's samples and their use in the child composition.

The region from the start of the remix to time point 0:32 has samples that could have been sampled from 2:00 of the parent track or, alternatively, from somewhere after 3:00. Once the beat kicks in, it becomes clear where the samples are taken from in the parent; their identity is revealed. The melody is created from a sample of the parent at 3:10. Following the melody is a noise sample that comes from 3:20. The Arabb remix uses this new melody and noise motif repeatedly though the remix.

There are some noise samples introduced at 2:12 that are used as a descending melodic line that then stutters. This sound could have come from multiple places in "Bossing of the Skull." After multiple listens it is still hard to tell exactly where it comes from. It is clear that it is from the parent, but unclear from where. The remixer cleverly used samples from the parent track. It would seem that if the source track is textural in nature then it is difficult to discern the precise sample relationships between

the source and the remix; this remix takes parent and treats it as a sound source, a sonic palette to grab from.

4.5.5.3 Branches of "En La Selva Mvt. III" by John Arroyo

This section analyzes an entire traversal of one branch of the remix tree for “En La Selva Mvt. III” by John Arroyo. From the seed track the lineage is as follows: “Enrique Sacasa Remix” by Enrique Sacasa -> “25th and St. Paul” by Brendan Howell -> “Tej Gill’s F1 Remix” by Tej Gill. The analysis begins with the Sacasa Remix and continues in sequential order by remix round number.

4.5.5.3.1 "Enrique Sacasa Remix" by Enrique Sacasa

Enrique Sacasa is a professional graphic designer with a serious hobby as an electronic musician. His "Enrique Sacasa Remix" was created entirely from samples from the parent song, "En La Selva Mvt. III." The melody and bassline were played using the Native Instruments sample synthesizers: Kontakt and Battery. The synthesized sound he created from parent samples are too manipulated to identify their sources in the parent track. A probable source sample for the melody is time-point 2:10 in the parent.

The piece starts out with a metallic clang with panned delay. From the beginning to 0:17 it is the only sound. The bassline and the first monkey loop come in at 0:17. The monkey loop sounds like a slightly manipulated version of the parent sampled at 0:20. At 0:35 a second monkey loop is introduced. This loop is from the parent song at 0:13. A simple melody also begins at the same time. The remix uses the sounds and loops mentioned throughout the piece. It doesn’t follow the flow of the original song; it instead uses the new melody and bassline to move the remix along.

A few of the monkey “Coos” are interspersed throughout the piece and used as accents. At 2:45 one of the “Coo” accents is sampled from the parent track at 0:22. The other “Coos” are most likely sampled from within the first 30 seconds of the parent track.

At 4:20 there is a breakdown section making the remix temporarily mellow. It is a recapitulation of the introductory bassline section. At 4:52 the rhythmic elements and melody come back in as they were before the breakdown. Near minute 6, the remix

begins to quiet its pace; at 6:00 only a high-pitched melody exists. It plays for 30 seconds, and then the song ends.

This remix takes the original in new directions yet still relies heavily on quotation of clearly identifiable material from the source. It also takes samples from the parent and heavily alters them to create new melodic lines. This further distinguishes the piece from the parent, yet it is still a remix.

4.5.5.3.2 "25th and St. Paul" by Brendan Howell

Brendan Howell is a visual and sound artist (former DJ) currently living in Berlin, Germany. His remix, "25th and St. Paul," is a remix of the "Enrique Sacasa Remix." The piece was made primarily with Audacity using LADSPA plug-ins. LADSPA is an open source plug-in format that is supported by many open source applications.

His remix starts out with a sample of the parent track at taken from 0:00. Mixed in with this is a field recording he made. The recording plays unedited throughout the entire remix. The recording was made in Baltimore, Maryland on the corner of 25th and St. Paul. Cars are heard coming in and out of the scene with a man singing, in an almost chant fashion, in the foreground. I cannot make out what he is chanting about, but I would guess that it was a homeless man of diminished mental capacity and that the singing doesn't have much meaning to anyone but himself.

As previously mentioned the Howell remix begins wih a sample from the beginning of the parent track (sampled from 0:00 – 0:31). When the sample finishes only the field recording remains. At 0:41 a small loop from the parent (at 0:00) is played with delay added. It continues to be looped and at 0:56 a larger loop from the Sacasa remix is added. It is a loop that includes the bassline (sampled at 0:17). This second loop has heavy delay added and perhaps even a low pass filter. This plays until 1:12. At this point only the field recording is playing. At 1:28 the remix fades in the same loop from before (0:17), but is now processed and delayed. It is a slow fade taking 10 seconds to complete. This loop plays until 1:51, where only the field recording remains. At 2:00 the loop comes back in a third time and continues till the end of the piece at 2:15. This time the loop has even more delay and effects added to it.

This remix takes a large quotation of the parent but then through manipulation over time turns the quotation into sound texture that interplays with the new material introduced (the field recording). I would not consider this remix a quotation based remix because the textural elements are too strong. Like the "cog" remix I would consider this a remix based on textural transformation.

4.5.5.3.3 "Tej Gill's F1 Remix" by Tej Gill

Tej Gill works for *audioMIDI* and is both a DJ and producer in Los Angeles. He is currently working on his second CD. When replying to question 5 of the Remix Submission Form, "Did you enjoy making it or was it a chore?" He states,

> "I always enjoy making music and this was no exception. I think I really enjoyed the fact that there were no real guidelines of what the remix should be, so I sort of just did what I felt."

This remix is a remix of the Brendan Howell remix. It begins with a field recording of rain that Gill recorded. The rain remains constant throughout the entire piece. At 0:18 a tabla loop is introduced. At 0:39 the table is joined by the echoing metallic clang from the parent track (sampled from 0:04). This sound was originally created in the "Enrique Sacasa Remix."

Starting at 0:52 the bassline and singing from the parent track is added (sampled from 0:24-1:34). The sample from the Howell remix was slightly time stretched to make various segments fit in time with the rhythms. This was done in Ableton Live. Large sections of the Howell remix are used as a backdrop or "as a bed" according to Tej Gill. This continues through out most of the remix. The Gill remix is close to twice as long as the Howell remix so large sections of the parent track are added multiple times. For instance at 4:04 the remix samples a large segment of the parent (sampled at 1:12).

"Tej Gill's F1 Remix" is a pulse oriented remix. At 1:27 a synthesized bassline is added as well as a heavy beat. The beat has a dancehall feel to it with an accented 3rd beat. At 3:02 the echoing metallic clang part comes back again (sampled from 0:04). It is used a few times and then at 3:35 the tabla comes back this time with a flanger applied to it. At 4:30 there is a ten second breakdown then the beat comes back in. When the beat re-enters it is a little funkier. The piece continues for another minute with the parts

discussed earlier coming in and out. The beat ends abruptly at 5:31 with only the rain remaining. At the 5:37 a three second fadeout begins.

This remix takes large sections of the Howell remix and creates a layer of sound on top of which to work. This textural landscape is time stretched to help align the ideas with the rhythms but not much more processing is done. Mixing is used to bring this texture in and out of the foreground.

5. Conclusions

5.1 Summary

The remix evolution contains three complete rounds of remixes and one round that ends after this thesis is complete. Quantitative and metadata remix analysis techniques were proposed, visualization of remix trees explored and musical analyses presented for a range of remix examples. Chapter 1 presented a summary of the history of remixing and how a remix is created. It also showed, in the case of dub music, that by using the tools of the day and expanding them in clever ways new forms of musical expression were possible. Using today's technology the remix evolution also aims to facilitate new musical possibilities.

In genres such as dub, techno, and house there is no definitive version of a song. In a remix tree there is also no unique version of a song. Through remixing the songs continue to evolve. The remix evolution takes the remix idea to an extreme where the remixes can branch off from the original to the point that one can no longer meaningfully associate the remix with the seed composition.

5.2 The Remix Tree Collection

5.2.1 Observations

As discussed in Chapter 4, every remix is noticeably associated to its parent. However, this relationship varies. In fact the remixes were somewhere between two extremes; those that resemble the original and those that do not. In the first extreme; the remixes respect the original and rely on using the parent song for quotation. They keep certain themes and motifs by using remix techniques that respect the original. In the latter category, the parent song is used as abstract source material.

Remixes generally do not fall at the extremes. Instead they fall within the spectrum of these two remix types. Inside this spectrum is the type of remix that uses the original as a bed of sound on top of which to create their remix. These types of remixes are textural transformations of the original. The original is manipulated and then used as a base layer. In this type of remix the remixer may drastically alter the textural layer as in

“cog” or may use it with very little manipulation as in the Tej Gill remix. Remixers that use this type of remix scheme make the parent track their own by how they manipulate the base layer and how much material is added on top.

The following three categories are proposed as a topology of remixes. Between any two adjacent categories many variations are possible, a wide creative spectrum of possibilities. These remixing relationship categories are:

- Category 1: Sound Source Remix
- Category 2: Textural Remix
- Category 3: Quotation Remix

Most of the remixes tended towards Category 3, Quotation. This is category most often associated with a traditional or commercial remix. Based on my own analysis of the 37 remixes submitted I found the following: Category 1 had 4 remixes, Category 2 had 11 remixes, and Category 3 had 22 remixes. The category distinction is rough for some remixes. The “Johnny Fingers Dub” is on the boundary between Textural and Quotation. The Peter Kay remix is on the boundary between Quotation and Textural. An example of Category 1 is "En La Selva Mvt. II (Remix) " by Arabb. "Mind The Gap (JF Dub)" by Johnny Fingers is a Category 2 remix. Examples of Category 3 are "Canons(123*10)" by Sean Peuquet, "Enrique Sacasa Remix" by Enrique Sacasa, and "Tango En La Selva" by Courtney Brown.

All of the Quotation Remixes are easily heard as a remix of the original. Some Sound Source Remixes and Textural Remixes are not easily heard as remixes of their parent. In these cases the transformations were so extreme that its relationship to its parent was tenuous. Examples of these remixes are "Termination Shock" by Ladycréme and "Bossing of the Skull" by Chris Peck. With these examples it is possible in some places to discern the presence of the parent track yet they are understood largely as new works. The Chris Peck piece, for example, creates a remix through the use of heavy distortion that makes it barely recognizable as related to its parent.

In addition to remix categories it is informative to look at how later generations relate to the seed composition. Generally speaking it wasn’t until Round 3 that the remixes began to be heard as independent from the seed composition. In Round 2 it was

rare that the remix failed to reflect its seed in some way. In Round 2 remixes that disassociate with their seeds are the "Bossing of the Skull" by Chris Peck, "cog" by Charlie DeTar, and "25th and St. Paul" by Brendan Howell. "Termination Shock," is not completely disassociated with its seed track, however it contains only a few subtle resemblances to it.

Not all Round 3 remixes lose their connections to the seed composition. The remixes by Panray and Ben Fields are good examples of retention of musical material from the seed. In the case of “Crusty” by Panray, the remix is very different from the seed track but one of the monkey vocalizations from the seed is clearly heard in alternating measures. In the Ben Fields remix a distorted version of the “trumpet” melody from the seed composition is present. This direct quotation has survived through the generations.

Even at Round 4 there can be connections to the seed composition. "Complexion" by Mantris, is a Round 4 remix that still retains part of the elephant “trumpet” melody from “En la Selva Mvt. II.” It is used faintly in the first half of the remix and then fades away. It comes back again near the end, this time stronger. This is the only element from the seed that remains, but it is distinctive enough to be clearly heard as relating to the seed. I consider declaring “Complexion” a remix of “En la Selva Mvt. II” tenuous, yet it is clearly contains ideas derivative of the seed composition. The “trumpet” sample may or may not be used in the next round or the round after that. It would be my guess that many of the “Complexion” remixes will become completely disjoint from the seed composition in Round 5.

There is only one remix that does not resemble the original. It is an algorithmic mashup that violates the rules of *Remixin* since it has multiple parents. The piece is "Salva Me Parma Sound Spot Mix" by Michael Casey. It is a Category 1 remix that creates a database of sounds from multiple “Canons or Larry (123)” remixes, including "Ambient Voice Mix" by Carmen Caruso and "cog" by Charlie DeTar. It then uses this audio database to recreate one of his compositions using the best match of each time segment with one in the database. The remix trees on Remixin cannot handle multiple parents so I had to decide which remix to mark as its parent. I placed it under "Ambient Voice Mix" by Carmen Caruso because by inspection it had the most associations to that

track than the other in the database. There is one audible quotation from "cog"; the sample of the screaming woman is heard.

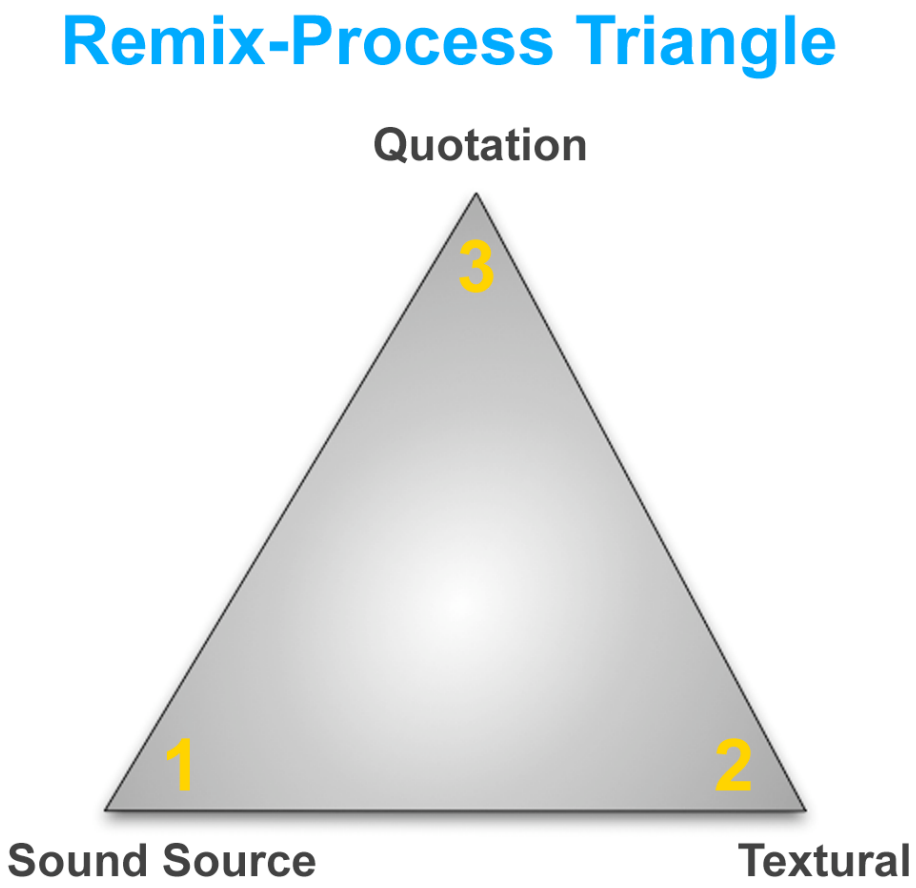


Figure 12 Remix-Process Triangle

Remixes tend toward one of the three categories above: 1. Sound Source, 2. Textural, and 3. Quotation. The remixes in the remix evolution were varied but tended to stay on the perimeter of the triangle.

5.2.2 Metadata Results Summary

There were 33 Remixers, 27 of whom supplied their Production Details. According to this data, Audacity was the most commonly used software application; it was used 34% of the time. 28% used Ableton Live and 14% used Max/MSP.

Using a DAW was the most popular platform for creating remixes. The next most popular method was using an audio editor. Most responders used more than one piece of software to create their remixes. There were only two who used every software type in

the making their remix. An example is "Bossing the Skull" by Chris Peck, he used Audacity, Digital Performer, and custom Max/MSP patches.

Table 11 Top Remix Software

From the 29 replies to the remix submission form, the table shows the top software application used for each category.

Top Software in Each Category

Software Type	Name	Number	Percent
Open Source	Audacity	10	34.48%
Commercial	Ableton Live	8	27.59%
Custom	Max/MSP	4	13.79%

The overall trend of the remixes was for the length of the song to increase at each round. The average lengths show a monotonic increase from the original to Round 3 of the remixes. It is unclear why this occurs or how long this trend will continue. If it does continue, what is the upper bound?

5.3 Project in Context

5.3.1 How this Work Relates to Other Work

There are many albums, records, and websites dedicated solely to remixes. Remixes in music are now ubiquitous. Even iterative remixes are beginning to becoming prominent. An example of this would be when a DJ remixes a remix of a pop song and then mixes it into his set at a club.

The remix evolution and the related website, *Remixin*, aim to facilitate iterative remixes in a direct and scalable manner. They offer ways to visualize remix relationships and presentation schemes for remix trees. How do the remix evolution and the concepts developed in this thesis compare to the websites introduced in section 1.4.2 Web 2.0 and Remixing.

5.3.1.1 Existing websites

Splice Music offers a great online DAW. Users can create a song within the web browser and allow others to remix it. There are some important differences between *Remixin* and *Splice Music*. In *Splice Music* one cannot view the whole remix tree at

once however in *Remixin* this is possible. *Splice Music* is limited to viewing a single tree depth at a time. *Splice Music* does not have any deconstruction tools nor does it offer any means to visualize relationships between remixes. This lack of visualization and presentation is a limitation of the site.

Another important distinction is the quality of the music. Many songs on *Splice Music* tend towards a lower caliber of music, to the point being amateurish. The websites advantages are also its downfalls. Users can easily create online and see their work published immediately. This seems to encourage hastily made compositions and remixes. There are some great pieces on the site yet most compositions and remixes feel hurried and unprofessional. Some remixes on the site are only simple edits and not creative remixes. *Jumpcut* has the same shortfalls as *Splice Music* since it is essentially a video version of *Splice Music*.

ccMixter is the website closest to the work represented by *Remixin*. This site does not suffer from the quality issue the other two have. *ccMixter* is, however, sample centric and *Remixin* is remix centric. On *ccMixter* users cannot view the remix trees. For each song the website only shows who has sampled from it. This may be a small sample or an elaborate remix, there is no distinction made. Browsing is confusing because a user can only browse up one node at a time and there are no tree branches to follow. This means there is no easy way to get a picture of how any given work has been transformed. Also in *ccMixter* there are no deconstruction or remix visualization tools.

A distinction that is shared amongst with all of the websites examined in this thesis is what can and cannot be remixed is temporal. In the web 2.0 sites examined the sites are not only remix tools, they are repositories. This is in contrast to *Remixin* where the focus is principally on iterative remixing. *Remixin* encourages people to create new pieces and to stop going back to the source (seed composition). By collectively building new music out of existing music, I believe more interesting collaborative and compositional prospects are possible with *Remixin*.

5.3.2 Towards a New Musical Experience on the Web

The goal of this work is to encourage a new web community based on the ideas of sharing and exploration with new online remix tools. *Remixin* encourages people to openly share musical ideas and encourage their work to be remixed by others. With *Remixin*, users are allowed to remix tracks that are professionally created as well as works made by amateurs. Soon users will be able to upload their own original compositions and have the community remix them.

As this Collection of remixes and subsequent remix trees grow, there becomes a great potential for interesting ways for a listener to interact with the music on the site. Chapter 3 explains early experiments with visualization, presentation and interaction with the music. More media rich visualization and presentation of the remixes and their trees are possible; for example rich animated flash or AJAX browsing schemes could be created. With a published API, the remixes themselves could be opened up to developers for them to create their own methods for visualization and interaction with the remix trees.

Websites like *ccMixter* are popular with music creators, but not with music listeners. What if one could mashup the features of *Remixin* with *last.fm* and then incorporate MIR sophistication? A rich environment for music creation, listening, collaboration and exploration would be possible.

By further developing the remix deconstruction techniques another branch of opportunities arise for music on Web 2.0. With a more robust deconstruction and visualization scheme listeners and remixers could compare how a remix is related to its parent, the original or one of its peer remixes (a remix that occurred during the same round). This would offer the user insight into how their music is different from another piece on a structural level. This could be both entertaining as well as informative. Young remixers could learn allot by exploring structural relationships amongst the remixes they enjoy. This could also lead to ways of developing automated remix schemes for computer generated remixes. The website could then deliver both human and computer generated remixes. Eventually, with techniques like this, a user could even request a particular song to be remixed in the style of one of their favorite remixers in the community.

5.4 Next Steps

The remix evolution is an ongoing process. The three remix trees created for this thesis will continue to grow. It is the hope that they continue to evolve indefinitely. New remix trees have been created for the indie pop band Filligar and the Dorkbot theme songs (Repetto, 2008). These remix trees will help to expand the user base of the remix community and offer more variation for listeners to enjoy.

A consistently desired feature for this project was to have more than the mixed-down version of the song available for remixing. Remixers experienced in the remix process desired either separated parts or remix kits. A standardized way to submit and deliver remix kits needs to be developed. These alternative delivery methods can potentially create very different remix trees. They facilitate a different mode of creating a remix and I hypothesize this will be evident in the remixes.

Other alternative ways to grow a remix tree would be to share DAW session files. Perhaps even the code used in custom software remixes could be shared. In this case, at each round the new altered code would be shared in addition to the mixed down audio. Both of these methods would also affect the types of remix trees possible.

The final important next step is to further develop the remix analysis tools from chapter 2. As mentioned previously these deconstruction tools will be important for creating interactive web applications that allow users to explore and learn from peeking into the remix creation process.

APPENDIX A
Visualization Tool Search Results

L represents the length of the sequence being matched. The first column lists the remix followed by the 10 best matches in ascending distance. The Query column represents the time segment in the supplied query and Match represents the time segment that it matched in the audio database. The Query and Match numbers represent time points in the respective songs in 1/10 second intervals.

L=30

Time Stretch	Query	Match
0.788196	170	268
0.789696	204	267
0.79107	199	269
0.791203	239	250
0.791512	202	264
0.792341	202	265
0.792569	204	266
0.79357	170	267
0.793655	169	267
0.794304	240	251
Simple Reorder		
0.776653	230	253
0.782658	231	254
0.795836	229	252
0.80194	227	250
0.803905	228	251
0.806515	232	255
0.810634	233	256
0.825571	239	251
0.830365	226	249
0.83105	237	249
Time Compress		
0.802414	240	226
0.804874	241	227
0.806924	239	225
0.808076	238	224
0.812281	237	223
0.819246	236	222
0.83094	263	226
0.840341	262	225
0.842088	235	221
0.842994	264	227
Micro Remix		
0.805115	265	266
0.805333	264	265
0.813329	266	267

L=10

Micro Remix	Query	Match
0.389137	0	33
0.456515	1	34
0.520372	126	132
0.534186	244	246
0.556274	289	289
0.55817	127	133
0.559403	245	247
0.561167	243	245
0.561724	242	244
0.562575	128	134
Time Stretch		
0.512002	11	18
0.516117	10	17
0.522871	12	19
0.522997	11	17
0.536899	11	19
0.544756	12	18
0.545477	10	16
0.547487	12	17
0.548966	9	17
0.550623	10	18
Time Compress		
0.535863	254	240
0.545745	253	239
0.565447	185	240
0.57556	186	241
0.589131	255	241
0.593588	245	242
0.594818	184	239
0.596955	255	240
0.600142	256	241
0.602846	256	242
Simple Reorder		
0.616282	254	127
0.619613	254	266
0.620612	255	267

0.813876	267	268		0.624351	255	128
0.814761	268	269		0.624619	256	268
0.826183	263	264		0.630925	186	267
0.830668	262	263		0.640181	185	266
0.835866	269	270		0.644111	187	268
0.839553	128	134		0.655885	253	126
0.842602	127	133		0.655948	254	265
Time Stretch				Time Stretch		
0.872595	235	336		0.585013	254	347
0.873166	236	337		0.614339	256	349
0.874934	234	335		0.62423	255	348
0.881078	233	334		0.633028	253	346
0.882175	229	330		0.648626	254	348
0.887924	237	338		0.652706	257	350
0.889165	234	150		0.653592	252	345
0.890375	238	339		0.66541	256	350
0.89125	235	150		0.667136	253	347
0.891982	232	333		0.668558	255	349
Time Compress				Time Compress		
0.92606	258	45		0.663998	253	64
0.926977	259	46		0.664441	249	63
0.927411	257	45		0.664858	179	63
0.932606	256	43		0.666214	248	62
0.934556	256	44		0.675559	184	64
0.938528	257	44		0.67882	180	63
0.940676	261	45		0.6799	184	63
0.941587	227	45		0.682659	214	63
0.941797	262	46		0.685494	254	63
0.943764	239	56		0.686243	254	65
Reverse				Reverse		
1.06669	116	115		0.866876	256	255
1.06987	114	114		0.874138	255	254
1.07048	115	114		0.892806	117	116
1.07183	115	115		0.897605	254	253
1.08233	114	113		0.903529	117	115
1.08269	113	113		0.90553	253	252
1.08308	116	116		0.907749	116	115
1.08317	117	116		0.913147	118	115
1.08643	113	112		0.916315	184	252
1.08733	113	115		0.916717	186	254
Reorder				Reorder		
1.34641	42	146		0.972949	300	358
1.3503	43	147		0.985703	299	357
1.3527	84	153		0.992731	301	359
1.35711	85	154		1.01628	0	76
1.35938	41	145		1.06107	0	77
1.35965	34	138		1.07077	1	77
1.36296	42	150		1.0709	298	356
1.36806	33	137		1.08456	100	169

1.36906	40	144		1.09096	101	170
1.37118	44	148		1.11407	302	360
Reorder FX				Reorder FX		
1.60501	281	235		1.07908	0	76
1.61295	33	146		1.15055	1	77
1.61431	42	150		1.15594	0	362
1.61505	36	153		1.15931	0	77
1.61629	41	154		1.17479	0	75
1.61848	35	152		1.17891	1	244
1.61934	285	204		1.18353	0	82
1.62091	42	155		1.19596	0	243
1.621	126	165		1.20136	105	104
1.62116	37	154		1.20208	0	363

APPENDIX B
Submission Form

Name:

The Track Remixed:

Your Remix Title: (example "Your Name Remix")

Description of Your Work:

Email:

Website:

Required Questions

1. Can I post this song to my upcoming website called remixin? The Website will allow users to listen to the tracks as well as remix them.

2. Can I add a composer profile of you to attach to your song? This will be on the remixin website and have your name and song information. If you allow the simple profile to exist you can leave it as is or request a password and update it as you wish. This same user/password will allow you access to all member areas on the site.

3. Can I add your email to the mailing list? Emails will generally be no more than once a month and you can opt out at any time. Initially the emails will announce when key aspects of the site are ready and when people can start to visualize the remixes.

Optional Questions

1. Did you use custom software? If so what language did you use? This includes custom Max/PD/Reaktor patches.

2. Did you use commercial software? If so which ones? This includes apps like Logic, Live, & Reason.

3. Did you use Open Source Software? If so which ones? This includes apps like Audacity, Ardour & Rosegarten.

4. Do you consider this a remix, derivate work (but not a remix), or only inspired by the original?

5. Did you enjoy making it or was it a chore?

6. would you consider making another remix in the future?

* None of the works will be sold or released on recording media (CDs, Records, etc) without expressed written consent from the original artist and the remixer (you). The remix will be distributed for free digitally via the web using a creative commons license. Works will be available to remixers for remixing purposes and available to general listeners via streaming.

Thank You so much for all your help!!!

APPENDIX C
Printed Promotional Material

Business Card Front Side

Business Card Back Side

APPENDIX D
Call For Works

Remixin, Call for Round 3 Remix Participation

Hello All,

We are putting out a call for remixes for a derivative works project called remixin. The first two rounds went really well. We are now starting Round 3. We are looking for people willing to remix one of the available tracks. You can listen to the songs that are available for remixing here, http://remixin.org/project/round3.html

The key idea of this project is a never ending web of remixes. Someone remixes one track, another person remixes that remix, then another person remixes that remix and so on. What you end up with is ongoing chain of related works.

The remix can be in any style or tradition you wish. Round 1 was anywhere from electro-acoustic/art music to something bordering minimal techno. Round 2 had some electronica & glitch. Maybe we'll have some hip hop and house in Round 3? It's all up to the remixers. All styles of remixes are encouraged.

For more information on the remix project including basic rules of the remix go to http://remixin.org/project/index.html

I hope many of you will consider making a remix, I think it's going to be a very interesting project in the end. Round 3 ends April 18th. If you are interested but cannot do round 3, please consider signing up for round 4 which starts April 21st and ends May 12th. The original compositions were by the composers Charles Dodge and John Arroyo.

All of the remixes will be available online for people to listen to as well as animated flash browsing of the tracks and their relationships for users to stream and download the music. It's a web 2.0 site that will be in beta this summer. If you interested or have any questions please don't hesitate to email us.

For those wanting to make a remix please email us at info@remixin.org

Thank you,
-remixin

www.remixin.org

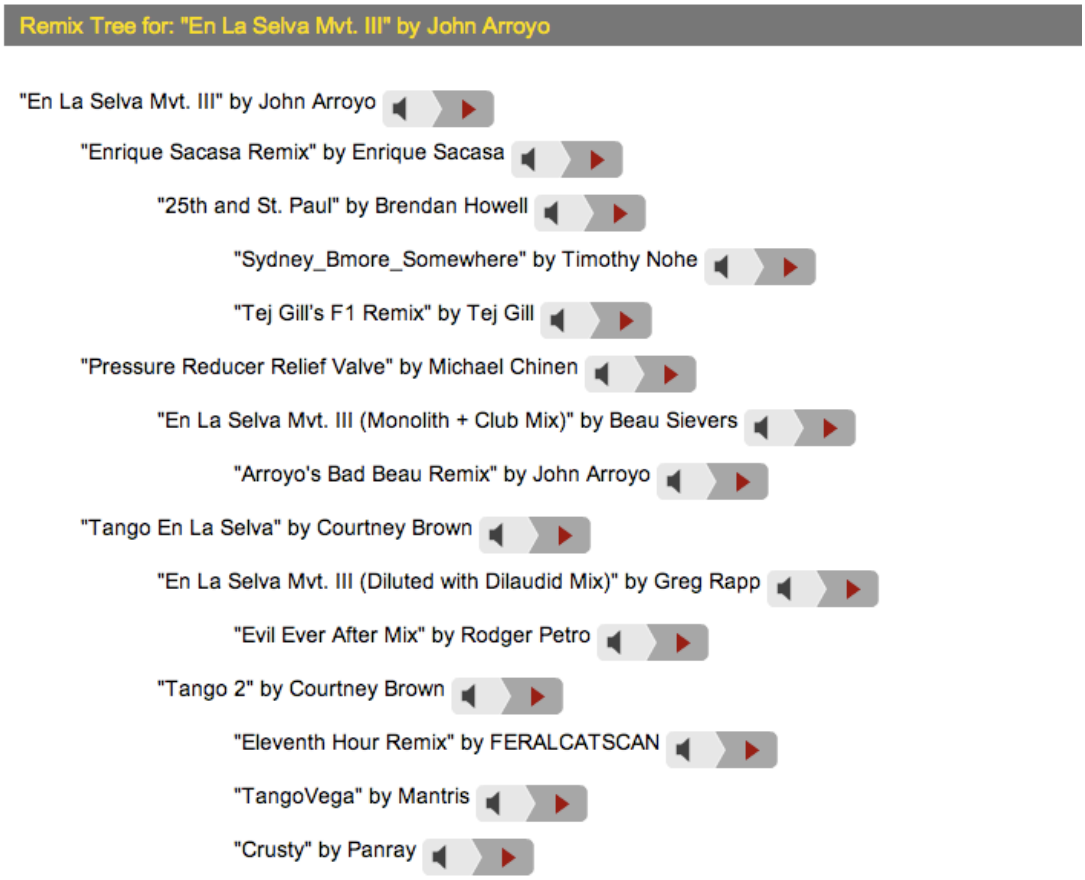
APPENDIX E
Remix Trees

Remix Tree for: "Canons for Larry (123)" by Charles Dodge

"Canons for Larry (123)" by Charles Dodge
- "Canons 123 (Ruoho Ruotsi Reshape)" by Ruoho Ruotsi
  - "cog" by Charlie DeTar
    - "in[cog]nito" by Jacky Schreiber
    - "DodgeRuohoCaruso(AmbientVoiceMix)" by Carmen Caruso
      - "eQo_rmx" by Ben Tatlow
    - "Parsec Remix" by Parsec
      - "Termination Shock" by Ladycréme
      - "Chopper Remix" by Alex Kotch
- "Canons(123*10)" by Sean Peuquet
  - "Temporal Remix" by Muhamad Alfian
    - "Minor Melodrama" by Peter Kay
  - "mindthegap" by Kim Tran
    - "Mind The Gap (JF Dub)" by Johnny Fingers
    - "ElectroTrash remix" by Caz Dearden

Remix Tree for: "En La Selva Mvt. II" by John Arroyo

"En La Selva Mvt. II" by John Arroyo
- "En El Circo" by Kimberly Kruge
  - "Fingers Bang Mix" by Johnny Fingers
    - "Finger In Your Teacher's Bed" by Lucky Strike
    - "Scottie B Mix" by Scottie B
  - "Johnny Fingers Micro Mix" by Johnny Fingers
    - "Bossing of the skull" by Chris Peck
      - "En La Selva Mvt. II (Remix) " by Arabb
      - "Magnaflow Catalytic Converter" by Michael Chinen
      - "Ben Fields remix" by Ben Fields


Remix Tree for: "En La Selva Mvt. III" by John Arroyo
"En La Selva Mvt. III" by John Arroyo
"Enrique Sacasa Remix" by Enrique Sacasa
"25th and St. Paul" by Brendan Howell
"Sydney_Bmore_Somewhere" by Timothy Nohe
"Tej Gill's F1 Remix" by Tej Gill
"Pressure Reducer Relief Valve" by Michael Chinen
"En La Selva Mvt. III (Monolith + Club Mix)" by Beau Sievers
"Arroyo's Bad Beau Remix" by John Arroyo
"Tango En La Selva" by Courtney Brown
"En La Selva Mvt. III (Diluted with Dilaudid Mix)" by Greg Rapp
"Evil Ever After Mix" by Rodger Petro
"Tango 2" by Courtney Brown
"Eleventh Hour Remix" by FERALCATSCAN
"TangoVega" by Mantris
"Crusty" by Panray

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