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Abstract

Collaboration for groups with members who are disconnected by geography or time is convenient for many reasons, but remains a challenge due to time zone differences, network congestion, and the attenuation of nonverbal communication cues. Virtual collaborators engaging in creative work often deal with these challenges, even more so when tasked with expressing their emotions to distant partners.

This study seeks to determine the social factors and tools that impact the quality of an online creative collaboration. Members of the Kompoz.com music composition community were surveyed to solicit projects that had the potential to be optimal collaborations. Judges listened to these songs and measured how much each song prompted them to move. This measure, called groove, was used as an indication of a successful collaboration. Judges assisted in selecting one case that was an exemplar of groove, and another that urged them to move much less, to stand as an exemplar of diminished groove. The comparative case method was used to compare and contrast the tools, social practices, and skills employed in each project, and offers guidelines for the design of and participation in online creative communities.

THE PRESENCE OF GROOVE IN ONLINE SONGWRITING PROJECTS

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Dissertation

Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in
Information Science and Technology

Syracuse University

May 2017

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This document was submitted in pursuit of a degree that I did not earn with my own strength.

The sacrifices of my family members and the support of my friends provided the wherewithal to persevere through this process. I'm thankful to God for the strength to reach this point, because he acted through all of you. I thank my endlessly supportive wife for all the late nights she endured to give me the space to finish. To my mother, stepfather, and brother for driving and flying from Texas to watch my children while I worked on this document. To my mother-in-law and aunts for trips from New York and Atlanta to care for my family while I pushed to complete this document, and traveled back and forth to Syracuse. To my advisor and committee for being a constant source of encouragement and constructive feedback, while I developed as a writer and a scholar. To my brothers and sisters in the Ph.D. program, the meals, beverages, and conversations I had with you kept me going, when my belief in doing so waned. This degree isn't just for me here in Maryland, but for all those whose sturdy shoulders I leaned upon to complete this journey. To my Aunt Ruby for reminding me that the ancestors are watching, and that I CAN do this.

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Chapter 1: Introduction

Contributions

The goals of this study are threefold. First, to advance our understanding of the digital tools, related skills, and social practices that support constructive interaction amongst musicians who are collaborating online. Second, to provide guidelines to help musicians have more enjoyable online collaboration experiences. Third, to describe effective tools and collaboration practices for geographically distributed groups of creative people.

To accomplish that end the study will pursue the following research questions:

1. How can musicians achieve a successful collaboration with a song written on an online music composition website?
 - a. Specifically -- How do digital tools, related skills, and social practices amongst musicians impact the likelihood of a successful collaboration?

The following chapters detail the plan to answer the research questions and why they are important to address. Chapter 1 provides insight into the importance and motivation of studying online music collaboration, a description of the phenomenon, and description of how the study fits into the existing literature. Chapter 1 will conclude with a short discussion of the research design for the study.

Chapter 2 details current studies of music collaboration systems, their difference from face-to-face collaboration, what users must do to represent their ideas with them, and how that process may differ amongst types of users. Given these insights, we will compare group flow

and groove to other popular theoretical approaches, and discuss why they are the best fit for analyzing collaborative creative activities. The chapter will also detail the concepts in groove and group flow (amongst other collaborative theories), and use insights from the literature to describe the main factors that increase (or decrease) the chance that it will happen in a given group. Chapter 3 discusses the appropriateness of the case study method to study group flow in online music composition. It also relays the data collection methods, instruments, research site, and case selection criteria used for the study. Chapters 4 and 5 discuss how goals, and social practices affected groove in both of the cases selected for the study. Chapter 6 discusses the digital tools used in the projects and how they affect the music in each case. Chapter 7 details some of the challenges found in virtual work, the coping strategies identified in the literature, and how that aligns with the findings of this study. Chapter 8 concludes the dissertation with questions that couldn't be answered within the boundaries of the current study, and suggests future directions of the work.

Background/Motivation

The research developed is driven by the understanding that virtual work is pervasive, yet still very difficult. For example, 94% of knowledge workers who responded to an international survey conducted by Siemens Enterprise Communication indicated that they work on teams with a virtual team member, however only 44% found their interaction to be as productive as face-to-face teams (Unify, 2012). Moreover, 46% of the HR professionals surveyed by the Society of Human Resource Management reported their organizations use virtual teams.

The most popular reason for organizations (53% of respondents) to employ virtual work

arrangements is to access talent in other geographical locations (Geller, Lee, Alonso, Schmit, & Esen, 2012). Architects, engineers, scientists, scholars, and many others charged with the responsibility of creating something new (e.g. new building designs, applications of mathematics and science, or knowledge) to address problems must also deal with the challenge of teaming with other creative knowledge workers at a distance. Given the real needs of collaborating at a distance (e.g. to co-author a paper, design software, or create panels with talented colleagues in other locations) and the potential of information and communication technologies (ICT), virtual working arrangements are simply more convenient. There is a rich history of research done on virtual work to take advantage of the conveniences of remote collaboration and minimize the difficulties. Powell, Piccoli, and Ives (2004) and Martins, Gilson, and Maynard (2004) have written comprehensive literature reviews that discuss the structure of discussion on virtual work. Dube and Robey (2009) have written comprehensive literature reviews and compiled best practices found in this body of literature.

The studies within these reviews recommend training employees on using computer-mediated communication (CMC) tools for collaboration, having frequent communication with regularly scheduled meetings, and spending time out side of tasks creating relationships with collaborators. Team members should understand their roles, goals, responsibilities, and access to resources when engaging in a distributed task. Many musicians and other creative people also choose to work with people who do not live in their locality, and do so using online or distributed music composition environments.

Definition of Phenomenon

Distributed music composition environments use networked computers and other digital devices to connect musicians that do not share the same space or time, and allow them to write music together. Bryan-Kinns (2004) defines remote or distributed composition tools as those “that aim to support the creation, revision, and review of musical pieces over a longer period of time with an end product to be performed later...” (pg. 1).

To provide a better picture of this phenomenon, a hypothetical example of distributed music composition is used to explain the process and highlight the presence of issues that could be better studied using theory.

Joe, a hobbyist musician and veteran recording engineer from New York, has six months of experience playing the guitar and needs the help of other musicians (a bassist and a pianist) to finish a blues song. Joe starts a collaboration/recording session in an online music community and uploads his unfinished version of the song. Two musicians, Tsidi, a professional bassist from South Africa, and Jenny, a semi-professional pianist from China, play a sample of the song, and notify Joe that they are interested in collaborating with him.

Tsidi started playing around with her instrument and improvised while listening to Joe’s song, quickly coming up with a good bass idea. To share this idea with the group, she needs to record her part using computer software and upload it to the site. However, Tsidi isn’t experienced recording with a PC, and was unable to get the software to export a sound file (MP3 or WAV) that included her bass line. She struggled for a few days to find a solution to her recording

problem on Google, and uploaded her ideas soon after.

Jenny, after listening to the piece again took note of some adjustments Joe could make in order to improve the song. Jenny suggested that Joe change the “chord” in the “second measure” of the “bridge” to a “five flat seven” in the group’s discussion board. Joe, having only six months of experience (and no formal training), did not know what Jenny meant when she used musical notation/language to communicate her feedback. Joe took a few days to research what Jenny meant, and learned that he only needed to move one finger for two seconds while playing his guitar, to make the change Jenny suggested. All of the team members took a longer time to admit their respective problems, because they were ashamed of the perceptions from their team members. However, they were ultimately able to submit their ideas for the song to the site. Joe, an expert recording engineer, combined everyone’s individual song files, to make the final song file with the bass, piano, and guitar parts.

Joe, Tsidi, and Jenny all live in different parts of the world, do not share timezones, and cannot take advantage of being in the same physical location. Tsidi, the experienced musician, could have easily looked at Joe playing his guitar and moved his finger to play the notes Jenny suggested. This issue illustrates that music composition in online communities is distributed, and theory that focuses on analysis of issues with temporal and geographical distribution could prove helpful. Tsidi also had a problem using the recording software on her PC to capture her ideas for the song. Joe, the expert recording engineer, also could have directed Tsidi to adjust the appropriate settings easily if he was located in the same room.

Both Joe and Tsidi’s issues illustrate that distributed music composition is tool-mediated

interaction, namely computer software, hardware, and music instruments that are all interconnected. Some technologies like recording software/hardware and musical instruments are used only by individuals, while other tools (e.g. discussion boards and file repositories) are primarily utilized by groups. Any theories used to analyze this phenomenon must support a flexible level of analysis, or it may miss critical issues at either the group or individual tool use levels. The negotiation of ideas that occurred between Jenny and Joe, and the shared fear of being evaluated by other team members is evidence that this task is an example of collaborative creativity. The song does not come from one person's ideas, but rather a synthesis of their thoughts and the synergistic quality of their interactions. This phenomenon will benefit from theories that structure the analysis and description of collective activities. To sum, an ideal theory and research design would be helpful in collecting data from and analyzing a task that is collaborative, geographically/temporally distributed, creative, and rooted in computer/instrument-mediated interactions.

Why is Distributed Collaborative Composition Important to Study?

From the description of the phenomenon above, there are three issues that reflect what was learned from the literature on collaborative and computer mediated creative activity.

Distributed Collaborative Composition is Virtual Collaborative Work

Distributed collaborative composition fits quite neatly into well-accepted definitions of virtual work. Watson-Manheim, Chudoba, and Crowston (2002) define virtual work as working with other people or resources while not sharing the same time or space. The globalization of

people, talent, and resources needed to complete a task, in concert with the decreasing cost of computer hardware, has made virtual work nearly a necessity. Distributed music composition is virtual work. It's also a creative process that produces enjoyable music for its authors and their listeners.

The literature on virtual teams has much work that focuses on the role of technology and its accompanying social practices in facilitating interactions between work groups. However, music and other work done in creative contexts are typically not the focus of these studies (Jarvenpaa & Leidner, 1999; Kayworth & Leidner, 2002; Malhotra, Majchrzak, & Rosen, 2007). Of the studies that have been done in these contexts, research around collaborative writing and open-source programming have been the most frequently studied phenomena (Crowston, Wei, Howison, & Wiggins, 2010; Dourish & Bellotti, 1992; Yamamoto & Nakakoji, 2005). However, many of these studies did not focus on how virtual work arrangements impacted the creative processes of the participants.

Distributed Collaborative Composition is a Creative Task

Amabile (1983a) defines creativity as an act that "is both a novel and appropriate, useful or valuable response to the task at hand." Csikszentmihalyi's (1988) conception of creativity acknowledges that it is a social phenomenon, and that a group of people called gatekeepers judge whether or not creative works are appropriate or should be accepted as a contribution to the knowledge in the field. Novelty can be a concept that is either new to the person who has created it, or has never been created by others throughout history (Boden, 1994).

The academic literature on creativity is mostly focused on the cognitive processes it takes for an individual to create an artifact (Roozendaal, 1993; Sloboda, 1987; Wallas, 1926). There aren't many models that discuss how music composition looks amongst a group of creators. Baer (2003), in a review of creativity theories, makes the argument that there are two common features amongst creativity process theories. One common stage in many theories of the creative process is often labeled divergent thinking, or the idea generation stage, where the creator seeks out many ideas for the product or problem solution. The other common stage is labeled convergent thinking, or the idea evaluation stage, where ideas are either kept or rejected based upon their quality. The social models of creativity mostly do not tackle direct interaction between creative partners aiming to generate and evaluate creative ideas together (Amabile, 1983a; Csikszentmihalyi, 1988; Fischer, Giaccardi, Eden, Sugimoto, & Ye, 2005). Furthermore, these models also do not account for how technological mediation between creative partners either helps or harms their creative processes. The exception is a paper written by Coughlan and Johnson (2006) that models the creative process of two collocated musical composers who share a computer to collaboratively write a song.

Much of the literature that discusses interaction among musicians often happens in education literature, where the main point of discussion is effectively teaching music composition and, as a result, typically does not have adult (either expert or novice) musicians as subjects for their studies (Hewitt, 2008; Miell & MacDonald, 2000; Seddon & O'Neill, 2001).

Many of the articles that discuss digital tools as they are used in music composition and production have focused on how to create environments that can connect musicians, to have

jam sessions or compose music, while minimizing delays in the audio. However many of these articles do not deeply investigate facilitating interaction between these musicians to optimize the experience of the group (Barbosa, 2003; Blaine & Perkis, 2000; Burk, 2000; Jeon, 2010).

Distributed Collaborative Composition is Flow Inducing

Flow is a concept created by Mihaly Csikszentmihalyi (1990) to describe an experience where an actor, in doing some set of tasks or activities, experiences joy, loses perception of the passage of time, and is completely immersed in the activity. Designers of e-commerce websites, mobile applications, and other pieces of software all aim for their users to enjoy their product so much that hours pass by, and their experiences become flow-like.

Clearly this is relevant to music: Musicians want to enjoy playing and exchanging musical ideas with bandmates, so much that they feel challenged, joyful, stimulated, and would rather do nothing else. However, the first kind of flow research focuses on individual flow and typically discusses what an individual or a designer's actions can do to maximize the chances of experiencing flow (Fang, Zhang, & Chan, 2013; Procci, Singer, Levy, & Bowers, 2012; Procci & Bowers, 2011).

Musicians are mainly interested in jamming or clicking with other musicians, which can be described as group flow. This kind of flow results from the quality and type of interactions between group members engaged in the same activity (Berliner, 1994; Sawyer, 2007). Groups having a collective or shared flow experience tend to be more satisfied, perform at their peak, and make better creative products as a result (Sawyer, 2003; Sawyer, 2007; Eisenberg, 1999).

This noted, there are very few studies that have investigated the concept of group flow and how the tools and social practices supporting interaction between participants in a creative task either contribute to or hinder a group flow experience (Armstrong, 2008). Similarly, there are a lack of studies that investigate the role of tools and social practices amongst creative groups that rely on digitally-mediated interactions (Luther & Bruckman, 2008; Luther & Bruckman, 2010; Phalip, Edmonds, & Jean, 2009). Though there aren't a great deal of studies in this area, the authors have taken care to document a number of best practices used to improve the outcomes of distributed creative collaboration.

Best Practices in Online Creative Collaboration Research Studies

Table 1: Summary of Best Practices

Study	Best practices
Luther, Caine Ziegler & Bruckman (2010)	Groups with more activity and communication around the group task are more likely to be successful. Groups that properly structure and guide collaborations have more successful projects.
Nemiro (2002)	Idea evaluation is a tough task for electronic media (it should leverage face-to-face communication), and must be supported by social practices if it's to be successful.
Ocker (2005)	Dominant team members, imbalances in domain knowledge, and making idea revision too formalized and structured negatively influences creativity. A collaborative environment where all group members contribute, having a clear, agreed upon definition of the problem (or goal of the collaboration) and the approach to solving it increases creativity.
Bryan Kinns & Hamilton (2012)	Annotation and authorship tools increase the quality of collaboratively created work. Allowing all group members to modify ideas doesn't make for better interaction.

Phalip,Edmonds & Jean,2009)	Providing technological support to provide feedback on musical ideas is critical when working with partners who may not be trained in music. The director had a difficult time clearly stating where a musical change should occur in a movie, and describing what about the music should be changed.
(Rice, Davidson, Dannenhoffer & Gay, 2007)	Chat is helpful for allowing the maximum number of ideas to be generated and captured during the idea generation stage of the creative process. A social practice like a voting procedure helps groups take on unstructured tasks like evaluating a creative idea. The authors found that meetings on CMC tools had to be supported with an agenda to be effective.
Coughlan and Johnson (2006)	You should allow musicians to capture ideas with as many methods as possible, making sure that the technology makes the barriers to capturing these ideas as low as possible.
Miell and MacDonald (2001)	Compositions where collaborators engage in transactive communication, not just generating ideas, but building upon and revising previously evaluated ideas yield higher quality pieces of music.
Seddon (2006)	Seddon's (2006) research on students composing a song by trading recordings over email showed that novices were less critical in their feedback on pieces of music than students with formal training. Groups with students that did not have formal training were unable to critique ideas as effectively as groups with training, because they couldn't give feedback using musical language (or notation) via e-mail.

Luther, Cain, Ziegler, and Bruckman (2010) found, in a study of online collaborations to create Flash animations, that a certain amount of structure and guidance was needed to make collaborations successful. For instance, leaders of these online collaborations have to establish technical constraints like frame rates and the dimensions of an animation, to make sure the contributions can be smoothly integrated into a finished whole. They also found that animation projects with more communication and activity were more likely to be successful. Other studies focused on tools and social practices that were helpful to different phases of the creative process. Seddon (2006) found, in a research study where pairs of composers used

email to compose music despite being in different countries, that those with a good musical vocabulary were better able to critique a musical idea in the evaluation phase of the creative process. Study participants who didn't have formal music training were not as equipped to offer a deep meaningful critique of musical ideas proposed by their composing partner. However, Bryan Kinns (2011) found that, amongst pairs of composers, functions allowing composers to directly edit each other's ideas, rather than trying to describe proposed changes, did not lead to a higher quality of interaction between composing partners. Functions that gave composers the ability to annotate and take ownership of their ideas did increase the quality of creative ideas. Phalip, Edmonds, and Jean (2009) came to a similar conclusion in a study of collaboration with a filmmaker without music training and composer creating a film score. Evaluating a musical idea was a task that was quite difficult for the filmmaker, and required some tool support and explicit social practices to be successful. Providing a function in the software that allowed the filmmaker to attach his/her feedback to the timeline of the music made the task of evaluating the composer's ideas easier. Nemiro (2002) concluded that unstructured, conversation heavy tasks like those that occur during the evaluation stage of the creative process are difficult using computer mediated collaboration tools. Both groups engaging in a creative task opted to evaluate ideas in a face-to-face meeting, rather than using digital media.

Ocker (2005) studied groups using asynchronous communication technology to accomplish a creative task and discovered a number of factors amongst the teams that positively and negatively influenced creativity. An imbalance of domain knowledge can stifle creativity, as the less knowledgeable team members may feel that they have to acquiesce to the more knowledgeable team members. The influence of a dominant team member also had the most

frequent negative influence on the creativity of groups in this study. On the other hand, a collaborative environment, where all team members feel welcome to contribute to the group effort and have a hand in the final project, increased the creativity of groups in the study. Having a clear and common definition of the problem to be solved in the group (or the guiding goal), and coming to an agreement on how it will be solved, was another factor occurring in groups judged to be more creative.

Virtual team researchers have been tackling the issue of facilitating work amongst group members located and working in different places and times. Though the tasks in this area of the literature are seldom creative, the issues that occur in virtual teamwork as a result of distributed time and space are well documented in a number of reviews (Dube & Robey, 2009; Piccoli & Ives, 2004), and are likely to occur in online music collaboration efforts. These challenges are listed in the table below, and are further discussed in the conclusion of this study, to illustrate how musicians confronted these obstacles in their projects. Each challenge is framed as a paradox that is unique to the conditions posed by virtual work.

Table 2: Paradoxes (Challenges) of Virtual Work

Paradox	Description	Coping Strategy
Virtual teams require physical presence	Virtual teams are geographically distributed, and members work independently of time and space. Yet virtual teams require the physical presence of other members.	Hold a mandatory face-to-face kick-off meeting. Match media with tasks. Keep the rhythm (via web or face-to-face meetings)
Flexibility of teamwork is	Virtual teamwork is flexible. Yet flexibility is	Define clear objectives and prepare detailed plans, but maintain flexibility.

by structure	supported by structural mechanisms that coordinate team efforts.	Maintain a shared team calendar Standardize communication and documentation processes, but leave open the possibility of adapting them. Select team members carefully.
Interdependent work in virtual teams is accomplished by members' independent contributions.	Teamwork implies interdependence among members towards common goals. Yet most work is divided into subtasks that are actually accomplished by individuals.	Hold face-to-face meetings for critical tasks. Use ICT to get all members' inputs Establish a collaborative culture.
Task-oriented virtual teamwork succeeds through social interactions.	Virtual teams are task-oriented because of their reliance on ICTs. Yet they depend on social interactions to succeed.	Learn to develop relationships through ICTs. Organize regular face-to-face meetings
Mistrust is instrumental to establishing trust among virtual members.	Trust is necessary in virtual teams. Yet mistrust is a condition that leads members to establish trustworthiness.	Build trust based on culture/profession/position/experience. Design team activities. Implement control mechanisms.

from (Dube & Robey, 2009, p. 9)

Research Problem

To borrow one of Dube and Robey's paradoxes, virtual music collaboration is also difficult because it requires (or is facilitated by) a "physical presence" (pg 9). The lack of shared space and time makes the exchange of emotion-laden and other subjective content a challenge. In face-to-face arrangements, this becomes a bit less difficult, because musicians can use non-verbal (e.g. gesturing/signaling, body positioning, and movement) communication to get messages across, and coordinate their playing with other group members (Daft & Lengel, 1986; Davidson & Good, 2002; Rocco, 1998; Seddon, 2005).

The task of transferring audio to a distant collaborator is also bandwidth and time-intensive. For

example, a single four-minute track of audio at CD quality uses 31 MB of space, which renders most e-mail services a poor vehicle for sharing (as most have attachment limits lower than 25 MB). When even small compositions have more than 20 tracks, the storage and transfer of revised and finished audio contributions quickly becomes an issue.

Moreover, before a musician sends the audio file, it has to be saved sometimes with a separate file per track. The receiver then has to download the files, mix them back together, and open the composed file in order to hear it. The transfer of this content takes a significant amount of time. However, immediate feedback is an important factor that helps artists to get lost in a flow state while enjoying a creative activity. There are entire communities of musicians who create songs together despite the challenges listed above, and continue to do so because they enjoy the experience. Over 820,000 musicians participate in online music collaboration communities at IndabaMusic.com, and more than 200,000 musical tracks have been generated on these sites. These sites continue to grow because people enjoy developing unfinished ideas into beautiful compositions, and crave the feeling of producing art with distributed collaborators. The study developed first seeks to determine the attributes or characteristics of successful collaborations in creative online communities. Second, the study investigates how digital music tools, related skills, and social practices helped or hindered collaboration.

To answer those questions, a multiple case study research design was developed to collect, analyze, and triangulate multiple types of data from online musical collaborations. Projects in online music communities will have musical recordings that can be analyzed, text data from discussions between team members about the project (drawn from project bulletin boards),

and survey/interview data from group members.

The following chapter introduces the current musical collaboration systems, what users must do to represent their ideas using them, and how that process may differ amongst types of users.

Chapter 2: Literature and Theoretical Perspectives

Chapter 2 presents a survey of the online music collaboration systems t in the academic literature, and briefly describes how groups of these systems can be categorized. It then highlights literature that helps understand how online music collaboration is different than face-to-face collaboration. It closes with a discussion of the literature on what musicians must do to represent musical ideas using these systems, and how that process may look different for different types of musicians.

Current Studies of Online Music Composition Systems – Virtual Music Making

Distributed music composition environments use networked computers to connect musicians that do not share the same space or time, and allow them to write music together. Although this practice requires participants to connect over computer networks, not many studies have been done that detail the collaboration practices of virtual creative teams and the issues imposed by computer mediation (Luther & Bruckman, 2008). Many of the studies on virtual music collaboration focused on four types of approaches Server, Shaper, Bridge, and Construction Kit systems take to supporting the task (Weinberg, 2005).

The Bridge Approach (Simulated FTF Interaction)

The bridge approach attempts to connect two players so that they feel they are playing together in the same room. These systems often try to compress the size of the music data being sent over the network or use algorithms to reduce delays caused by latency. This

approach mirrors the attempts made by early CSCW researchers (Bly, Harrison, & Irwin, 1993) to facilitate virtual communication, by allowing collaborators to hear each other and see each other's cues (both verbal and nonverbal).

The fluid exchange of emotion-laden communication and content is an obstacle that confronted online musicians and early CSCW researchers alike. Audio tends to generate large amounts of data that strain even the fastest internet connections, and the human ear is extremely sensitive to delays (Barbosa, 2003). If a user does not have enough bandwidth to transfer all of the audio at once, delays will occur to allow it to reach a distant collaborator. The human ear can detect delays in audio as small as 25 ms. Performers cannot effectively play with others when experiencing inconsistent delays (Alexandraki & Akoumianakis, 2010).

Much of the research on online music collaboration systems has been devoted to finding solutions to the bandwidth and latency problems presented by streaming audio. Seeing images of a partner via streaming video, proves to be more challenging, as video consumes more storage and bandwidth than audio. Having a smooth, delay free conversation with a distant friend or colleague via Skype is a rare experience. Currently, there are three approaches to alleviating bandwidth problems: Realistic Network Music Performance [Realistic NMP], Non-Realistic Network Music Performance [Non Realistic NMP], and Construction Kit Systems (asynchronous or blended collaboration environments) (Alexandraki&Akoumanakis, 2010).

Realistic NMP systems work to reduce delays until they are less than 25ms, which is beyond the range of human perception. Most systems like Jacktrip

(<https://ccrma.stanford.edu/groups/soundwire/software/jacktrip/>), and Distributed Innovative Performance are effective, yet require users to be on a high bandwidth local network rather than an Internet connection to ensure a smooth feed with delays under the threshold (Alexandraki&Akoumanakis,2010).

Non-Realistic NMP solutions do not guarantee that delays will be less than a certain threshold. Instead, they ensure that everyone will experience the same delay. These systems (e.g. Ninjam [<http://www.ninjam.com>] and eJamming [<http://www.ejamming.com>]) do this because musicians cannot tolerate an inconsistent, wavering delay. Ninjam uses an algorithm to compress the size of the streamed music, and calculates the latency of each collaborator (i.e. the time it takes for audio to travel electronically between two points), in order to maintain synchronization between players (Mills, 2010).

Although latency is decreasing, it is still difficult to have a fluid performance experience with a distributed collaborator over the Internet. When CSCW scholars encountered the problem of choppy video and audio in distributed collaborative environments, Stornetta and Hollan (1992) argued that new solutions should stop trying to replicate reality, and use the power of networked computing to fulfill unmet needs in face-to-face collaboration. Computer music researchers such as Braasch (2009, p. 3) agree that approximations colocation with a collaborator “will always be viewed as a flawed image of the real world,” and do not fully take advantage of the benefits of computing (Braasch, 2008; Braasch, 2009).

Construction Kit Approach (Asynchronous Collaboration)

The Construction Kit approach follows Stornetta and Braasch's recommendations by providing an infrastructure for users to share and trade recordings of their musical ideas on a server. This form of collaboration gives people time to upload large music files, and allows their collaborators to download them and listen on their individual computers. Since the recording is downloaded to a computer before it's played (rather than being streamed from the source) it effectively eliminates any delays imposed by a shortage of bandwidth. Upon joining an online music composition community, such as Indaba (<http://www.Indaba-music.com>) or Kompoz (<http://www.Kompoz.com>), members publicize their musical skill(s) (e.g. bassist, violinist, singer) and level of expertise (e.g. amateur, semi-pro, professional), along with a sample of music in their profile. After creating a profile, members often use software to record themselves, and upload a piece of music (called a stem) that requires the talents or skills of others to be finished. They can then search for other musicians to cultivate their ideas, sorting by their level of experience, musical skill(s), and listening to musical samples on profiles.

Although users of these communities can upload profiles, musical samples, and ideas that can be experienced without delays or pauses, they must also deal with a plethora of other social and technical issues. Coughlan and Johnson (2006) noted that even collocated pairs of musicians could not use the technology to communicate and edit ideas in a way that felt natural to them. They called for researchers to resolve further problems that could be introduced when these groups enter into distributed working arrangements.

Once a musician (termed a session leader) uploads an unfinished piece of music called a "stem," he/she must express how the music should sound, and recruit musicians that would work with

him/her to do so. Session leaders must tell the contributing musician whether or not their submission fits what he/she needed, and what modifications can be made if the submission does not fit. If the submission fits, the session leader must merge the idea of the contributing musician into the original music file. In other words, session leaders must keep track of the progress of the task, ensure that collaborators do not duplicate each other's efforts, construct explicit or implicit criteria for evaluating the quality and fit of a contribution, and reallocate responsibilities once an established member leaves the team or a new member joins. Online music communities do not offer much support in managing critical social and task-based awareness information. Both Indaba music and Kompoz only offer a place to store music files, discussion board, and internal instant messaging system. Luther et al. (2010) note that failing to structure the allocation of a shared task and communicate the progress on a project in online animation communities can contribute to the failure of a project.

Differences between Face-to-Face and Distributed Music Collaboration

In a physically collocated musical performance, members use verbal communication and musical "statements," (playing their instrument to show how something should be played), while nonverbal communication is used to build and maintain coordination during a performance. This is done to the point where group members can create their own spontaneous reinterpretation of the written music. This type of musical creativity is the starting (and sometimes the ending) point of many original compositions, and is the goal of many jam sessions between musicians that may be lost when the task is ported to virtual environment.

Davidson and Good (2002) also noted that, in their study of a string quartet, musicians used

nonverbal communication devices to coordinate the performance of the group. Players used arm movements to signal when other members should start playing, and head movements to signal how loudly or softly a section of music should be played. Members of the group would also sway their body with the rhythm of the music to signal the pace at which the group should be playing. Group members in the study also maintained eye contact with each other's body language to play together, and receive cues on tempo, dynamics and entrances (when to start and stop playing). In the virtual environment, especially asynchronous ones that require users to upload musical recordings to collaborate, instant nonverbal communication and feedback is replaced with written or verbal communication and musical recordings.

Schober (2006) conducted a pilot study to investigate the effects of video and audio mediation, using cameras and speakers rather than being in the same room, on the performance of a musical piece. The author discusses audio and visual cues available to performing musicians when they are present in the same room. The score is often a visual tool that keeps both performers playing or performing the rhythms and pitches that the piece requires. However, audio and visual cues can often be used to coordinate tempo (pace of music), entrances (when musicians are to start playing), and dynamics (how loud or soft a passage of music should be played). A pianist can determine when a singer will begin to sing by paying attention to when he/she will take a breath or body movement, such as raising or lowering a hand as a conductor would. These "conductor arm movements" can also be used to control rhythm (differences in time between arm movements), tempo, and dynamics. Being in the same room also allows a singer and musician to look at the score to agree on the passages they will practice during a rehearsal, and as a visual tool for determining where they will start.

Schober (2006) tested for the effects of audio and video mediation using two sound proof rooms equipped with video cameras, microphones, and speakers. A piano player and singer were given 10 minutes to rehearse songs by themselves, then 10 minutes to rehearse with one another in the same room. After the collocated rehearsal, they had to perform the entire piece in rooms with three different conditions. One condition allowed them to perform in the same room, another allowed them to see and hear each other with video monitors and speakers, and the final placed them in different rooms where they were not allowed to hear each other.

The results indicated that the participants often sought visual cues when it was evident that they were not on the same page with tempo, rhythm, or a starting point in the piece. For instance, when the pianist started playing, yet the singer failed to start, they both looked at the score and pointed to the word and note that the singer should use when the pianist begins.

Although all cues were available when the pianist and singer were in the same room, signals were missed, because the participants may not have been positioned such that their signals were visible. In one of the pairs, the singer would use arm movements to demonstrate the tempo at which he wanted the pianist to play, and also counted out the rhythm with his voice to reiterate the tempo. Although the singer used body movements to signal tempo, the singer at one point was behind the pianist, making it impossible to see his visual cues. In all mediated conditions, participants indicated that the lack of cues was not absolutely detrimental to their performance and they were interested in using remote collaboration tools for making music.

In an online music collaboration system, where musicians do not have the luxury of meeting at the same time, they must create shareable digital representation of their musical idea

(Coughlan & Johnson, 2006). Computer technologies that allow musicians to create, manipulate, and share representations of their music and their associated conveniences and disadvantages are discussed in the following sections.

Representations of Music in Computer Music Systems

Bryan-Kinns (2004; 2007; 2011) created a collaborative music-making tool called Daisyphone to provide a more easily understood representation of looped music for beginning composers and musicians. The Daisyphone consists of columns of 12 bubbles that are arranged in a circle. Each bubble represents one of the twelve distinct notes found on a keyboard, and the intensity with which the bubble is colored is representative of the volume of the note.

Each column of the 48 in the circle represents a beat in the music. Multiple notes can be played at once if more than one bubble is filled in for a column. The rotating play head spins to touch each of the 48 columns sequentially, and simultaneously plays all notes in a column once it is touched. Each user of the Daisyphone is assigned a color to identify themselves, rather than a username. They are able to draw or scribble around the grid of notes to communicate with their colleagues. Daisyphone users all share the same screen and are able to collaborate by directly modifying their partners' ideas, erasing bubbles, adding them, or changing the volume of selected notes. Participants in Bryan Kinns' studies (mostly experiments with adults in higher education) often used the annotation feature to give feedback on musical ideas or claim ownership over portions of the composition, to keep partners from making undesired changes to their ideas. Although the Daisyphone software provides an easy way for collaborators to refine each other's ideas and discuss changes with the annotation features, potential users

must use the four instruments furnished by Daisyphone and cannot use their own physical or virtual instruments.

Coughlan and Johnson (2006) conducted a two-phase study exploring the types of representations in collaborative music composition, and how these representations of music ideas are used during song creation. The authors recruited a group of ten professional composers, and another group of five musicians with varying levels of composing experience to participate in the first phase of the study. In this phase, the authors interviewed the professional composers about their composition methods and observed them in meetings for five months. The authors observed the second group musicians completed a composition task, mostly unaided by computer support. Three of the musicians were asked to compose another song using Hyperscore software and the Fruity Loops Digital Audio Workstation, over a 1.5-hour period. One of the musicians was asked to compose the piece alone, while the remaining two musicians were asked to compose a song together. Through these separate observations, Coughlan and Johnson were able to provide evidence of the types of musical representations used in composition, how these representations were used, and which of them were unsupported by the software.

Coughlan and Johnson determined that the study participants used the following methods to represent their musical ideas. The first type representation was play, where the composer uses an instrument to play their rough idea to a colleague. The second idea representation is recording, where the composer performs the piece in front of a microphone or recording device, rather than writing the idea with musical notation. Composers also used play gestures

as a representation by tapping out a tempo or rhythm. This feature was found to be unsupported by both pieces of software used in the study. When composers did not have access to an instrument to play their ideas, they would use vocalizations, to “scat” their idea, or imitate the way the idea would sound coming from their instrument. When negotiating or explaining how an idea would be played, some composers would also use an artifact gesture, by pointing to a visual representation of the music, like a written score. During these moments of negotiation and discussion, musicians would also use verbal communication without leveraging visual aids.

Coughlan and Johnson concluded from their observations that representations were used in the following ways:

- Retention of an idea / the current state of the composition.
- Facilitating the evaluation of an idea / how to use it in the composition.
- Creating shared understanding of the idea and its possible uses.
- Instructing a collaborator how or where to play the idea (p. 534)

Using their categorization of the types and uses of representations, Coughlan and Johnson created a composition support tool called Sonic Sketchpad. Sonic Sketchpad allows users to record ideas, and asks them to draw a visual representation of it, which will be used as a graphical icon for the recording. Artists can draw links between the ideas that are to be played one after another. Since this software prototype is premised on the linking of recorded performances rather than triggering built-in sounds, composers were easily able to use their own instruments when composing with this tool. While two composers were able to use this

tool to collaborate via a shared screen, Coughlan and Johnson called for researchers in collaborative work to study how to facilitate distributed music collaboration with software.

Duignan, Noble, and Biddle (2010) conducted interviews with professional music producers/engineers to describe the way musical ideas were represented in Digital Audio Workstations (DAW), and provide insight on how those representations conflict with their work. There were three types of musical abstractions or representations that producers used in DAW's that will be relevant to this study: voice, time, and (audio) process representations.

Voice Representations are the visualizations provided by digital audio workstations that refer to sections of recorded audio from voices or instruments. These pieces of audio are often represented as wave graphics. Wave representations of sound show how far a speaker is pushed away from its resting state over the time the audio is played. One of the issues often expressed by the composers in the study was that it's often difficult to reflect detail while showing context, when voices are represented as a wave graphic. Songs are composed of many parts, some harmonized. Although the ear may hear one piece of audio, the idea is composed of two or more voices, up to the number of tracks the CPU can handle. Each of these voices is represented on their own individual line or track in the DAW.

There are two issues with this type of representation. First, if the musical idea to be represented is less than the song length, the track must take up all of the space in the representation. The second issue is that, although the producers might know one idea was harmonized and could contain two or more related voices, showing that those voices are related to one part is extremely difficult.

This finding about the way audio is represented is important to the study being developed here, because music producers/composers often must send audio in a format where information on the voices that constitute a part may be lost. If one part consists of four voices and instruments that are played simultaneously, it may become difficult to isolate what must be revised, even if a collaborator mentions a specific time (e.g. 2minutes and 53 second after the start), because there are 8 different events happening at the same time.

Representations of audio processing also posed issues for music producers and composers in Digital Audio Workstations. Audio processing changes the dynamics (range of sound from softness to loudness) and tone (description of the feel as smooth, warm, or shrill) of a sound, by applying mathematical operations to the user's audio. These audio manipulations are applied when producers run the audio through plugins with user-selected parameters. However preserving the information that captures what audio transformations and parameters are used causes a heavy drain on CPU resources, because it must do the mathematical calculations to transform the audio every time it's played. Once the audio is rendered, the transformations are permanent, and it's represented as a wave graphic, which does not show what changes were made to the audio. Since wave audio does very little to indicate how audio has been processed, collaborators may have to listen to the audio and determine how it has been processed, based upon their experiences listening to similarly-processed sounds. If the collaborator can't identify how audio has been processed by ear, it could become more difficult to determine what should be revised.

Creating representations of rhythm and feel (time) also posed problems for producers in

Duignan, Noble, and Biddle's (2010) study. Producers mentioned that creating a representation of rhythm in the digital audio workstation that matched with their idea of a satisfactory rhythm or groove was quite difficult. Producers must repeatedly adjust where audio segments land in time, by positioning the audio on a grid that represents the way one would count along to the song (e.g. 1,2,3,4, 1,2,3,4 for many tunes).



Figure 1. Creating rhythm and harmony representations.

One of the producers in the study summed up the difficulty of this task as follows:

Interviewer: Do you find yourself fine-tuning timings?

Participant: It is important for creating a groove, and the way that certain beats fall on the bar. The grid is exactly divided, but to get a good groove you often need to move certain elements of the track slightly ahead or behind of the beat.

That is a huge part of music production. It is probably the most time-consuming part of music production, and it is not necessarily a good thing. (Duignan, Noble & Biddle, 2010, p. 27)

Since it can be difficult to create a pleasing representation of a rhythm that can be shared with colleagues, it may be difficult for others to precisely communicate how the rhythm should be

revised. In summary, the challenges of music representations in digital audio workstations are as follows:

- Hard to specify/represent “good” rhythm easily.
- Hard to isolate musical ideas when voices are harmonized or happening simultaneously.
- Hard to visualize and communicate transformations to the texture or tone of sound.
- Difficulties representing these concepts may make it harder to use representations to debate how musical ideas can be revised.

MIDI as a Music Representation in Computer Music Systems

Chen (2012) conducted a study to explore how three composers (professional musicians in higher education), used Sonar sequencing software and Finale notation software to compose an original song. The author found that the composers’ creative processes often mirrored the stages in Wallas' (1926) theory of creativity. All study participants used the sequencing software to more easily evaluate and refine elements of their composition compared to a pen, paper, and instrument.

Sonar, used in Chen's (2012) study, is considered to be a digital audio workstation. This class of computer music software fulfills many of the functions of a real music studio, and gives users the ability to sequence or arrange musical ideas, record these ideas using physical instruments (e.g. guitars, drums, voice, piano etc), or synthesized software instruments (sometimes called virtual studio technology Instruments), and manipulate those sounds with virtual audio plugins, much like image filters in Instagram or Photoshop, or wave audio editors. Wave audio is a

representation of music that graphs how far music moves a speaker cone from its resting state over time. This representation provides a very clear indicator of how loud a piece of music is over time, but does not clearly demonstrate the pitch and duration of the individual notes that make up the music. Once music is recorded into a wave representation, it is typically manipulated with virtual audio plugins, software representations of hardware machines found in physical studios, equalizers, and reverb.

Virtual Instruments are usually controlled using a technology called MIDI, which was developed as a compact technology to communicate music in a digital, computer-readable format (http://www.indiana.edu/~emusic/etext/MIDI/chapter3_MIDI.shtml). Virtual instruments are controlled by physical MIDI controllers (e.g. keyboards, guitars, drums) that send out at least three values each time a note is played, ranging from 0 to 128, and measure a note's velocity (the loudness), duration (how long it is played), and pitch (the frequency of the note, with each number corresponding to a piano key). This is relatively important, because the software interfaces in DAW's that control MIDI or virtual instruments presents an alternate representation of music that does not require users to use musical notation in order to write music. Many of these use a tool called a "piano roll," a grid with pitch represented on the y-axis and time represented on the x-axis. Rather than reading notes on a musical staff, musical ideas are represented as bar graphs, where users can create a bar, move it up a note to a higher pitch, or make the bar narrower, to shorten the note. One of the important features that MIDI provides is that users can specify information about rhythm, duration, and loudness, without specifying the instrument that will play the music. Once this information is provided to the piano roll, a user can assign it to be played by any virtual instrument.



Figure 2. A piano roll in the Fruity Loops DAW.

Composers in the study readily used the MIDI tool and interface to experiment with unfamiliar instruments and test what they might sound like, without having to know how to manipulate and play the instrument itself. Other participants used the tool in order to determine the rhythm and melody of the instruments without having to decide what instruments should play certain sections of the music. Once the participants have recorded their rhythms, they often used the quantize function (which takes the notes in an improvised performance and "corrects" them to fall "on rhythm") of the software to test and refine those rhythms. Chen observed that one of the most useful functions the computer provided to all composers was the ability to immediately hear and refine musical ideas, rather than having to sketch it on paper and imagine what it may sound like.

Music (and Representation)-Making Processes for Expert and Novice Musicians

Seddon and O'Neill (2003) asked study participants (48 participants ages 15 and 16) to make a

song following two 30-minute training sessions on using a Yamaha MIDI keyboard and a Cubase Score composition program. Each participant was asked to save changes to their work using the “Save As” command to preserve prior versions. However, Seddon and O'Neill also video recorded all on-screen actions to capture any explorations or ideas that could have been written and deleted without being saved. Capturing this data also allowed the authors to link the videotape data to changes made in the MIDI files.

Seddon commented that experienced instrumentalists explore less with the technology, and simply use it to arrange ideas, while novices use the computer to experiment with sounds, textures, melodies, and harmonies. They use it as an integral tool throughout the composition process. While the authors noted the differences between novice and experienced composers, they cited previous research from Younker and Smith (1996) and Folkestad et al. (1998) to argue that there “...is not necessarily a link between instrumental skills and composition skills” (Seddon & O'Neill, 2003, p. 133).

Folkestad, Hargreaves, and Lindstrom (1998) used 15 and 16 year-olds as participants in a three-year study, to describe the computer-mediated composition process. The authors concluded that two types of patterns were visible in the compositional processes of the participants. More experienced composers used the computer after they developed the parts of the song on their instruments, as a tool to record these parts and arrange them into a pleasing order. This style, called horizontal, separates the act of composition (making parts of a song) and arranging those parts. Horizontal composers were also found to use the computer as a tool to accompany their own playing, also recording the results. For instance, if a song is to

have piano and drums, a composer may record the drum part for the entire song and save it. The composer would then make the computer play the recorded drum part, and improvise a piano part to go with it. The authors also noted that, after recording a part, composers are constantly listening to and evaluating it to see if modifications must be made to make the contribution satisfactory.

Vertical composers, who may be less experienced, will work on a composition one element at a time, not knowing what the following elements will look like, or how it may fit into the vision of the entire composition. In this style, composers are more likely to use the computer to experiment with melodies, harmonies, rhythms, and sounds to compose and arrange music.

Kennedy (1999) compared the composition processes of a high-school senior and graduate student for composition, and found that there are quite a few similarities between their respective workflows. Both composers sat down at the keyboard to generate ideas for compositions, although the adult composer only used improvisation to begin. Both composers also hummed or sang to get ideas for their pieces. The high-school and graduate composers also both saw the need to revise and refine their compositions. However, one difference between them caused their pieces to differ qualitatively. The graduate composer had more knowledge of the musical devices and tools she could use to revise existing ideas and develop new ones. Professional composers judged both pieces, and found each of them to have impressive elements. The author noted that younger composers can and should engage in composition, using their voice to generate ideas when they can't do so efficiently with an instrument. They should also use a tape recorder to save ideas if they are not comfortable with

musical notation. Both composers noted that notation was not fun, and used computer programs to aid with the transcription of their music.

Differences in the styles of their compositions also caused the investigator to see parallels between their results and those of Younker and Smith (1996), who reported that there is a gradual progression from novice composers creating their songs note by note, to adult composers creating each part of their composition with respect to the whole. The high-school composer created a song that was quite atonal, while the author stated the following about the graduate composer's piece: "...the listener's attention is focused on formal relationships and expressive character, which are fused together in an impressive, coherent, and original musical statement, made with commitment" (Kennedy, 1999, p. 8).

Summary of Literature Discussion

The literature is helpful when determining what systems have been used in the past to support online music collaboration efforts. Construction Kit systems, like many online music composition communities, are one type of online music collaboration system. These systems allow users to collaborate by uploading the constituent parts of a recording so that one collaborator can mix them together into a finished musical piece. Converting musical ideas into these constituent parts, called idea representations, add a layer of complexity and time that is not present in face-to-face. These representations can be recorded with microphones and saved as an audio file, or programmed into the computer using MIDI technology then exported to a digital audio file. Other than missing physical cues not present in face-to-face musical collaboration, the process of making a shareable representation of music is the difference between mediated and

unmediated music composition. The process of creating these ideas will differ based upon ones expertise with music and computer recording/production technology. The following section discusses how group flow is the theoretical approach best fit for analyzing the tools and social practices that make online music collaboration successful.

Theoretical Perspective: Group Flow versus Other Popular Theories Used in Virtual Work Studies

Given the aforementioned descriptions of distributed collaborative music compositions, the work pursued here draws on Csikszentmihalyi's theory of flow (1990, 1996), specifically the concept of group flow as developed in Sawyer (2003, 2007). Group flow is developed and presented relative to three viable theoretical approaches (situated action, distributed cognition, and activity theory) for analyzing collaborative work. Group flow was chosen to guide this study for the following three reasons. First, group flow is a state that many musicians aspire to attain, and can stand as a benchmark for optimal collaboration. Second, group flow theory is the only one amongst those compared that situates itself in a creative context. As a result, the strengths of activity theory and distributed cognition in describing collaborative activity and naming its components are trumped, as group flow gives examples of optimal collaboration practices for musicians. However, it provides more abstract concepts that apply to any collaborative activity (e.g. pre-existing structures, extrinsic goals, and actors with requisite skills). Finally, group flow theory makes suggestions from creative practitioners about what conditions are required for the sharing, exchange, and incorporation of ideas in an improvised collaborative task, while activity theory, distributed cognition and situated action do not.

Group Flow Description

Sawyer's concept of group flow is related to the concept of flow articulated by Mihaly Csikszentmihalyi (1990; 1996) to describe an optimal experience when an individual is at his/her creative "peak." Many interviewees in his study commonly used the characteristics described in Figure 3 to describe the feeling of being in a state of flow (Csikszentmihalyi, 1996, p. 111).

Table 3: Flow Characteristics

	There are clear goals every step of the way, so the actor always knows what needs to be done next and when in flow.
	There is immediate feedback.
	There is a balance between challenges and skills, making the task neither too frustrating or too boring.
	Action and awareness are merged: The actor can attend to others while effortlessly engaging in his/her task.
	Distractions are blocked out: Actors are only aware of what is relevant at the moment.
	There is no worry of failure.
	The actor engages in the task because he/she enjoys it (its intrinsically motivating).
	Sense of time becomes distorted.

This concept is related to Csikszentmihalyi's definition of flow (1990). However, Sawyer states that flow was meant to "to represent a state of consciousness within the individual performer, whereas group flow is a property of the entire group as a collective unit." In order to measure group flow, Sawyer argues that researchers cannot solely use surveys or other cognitive psychological tools that ask individuals if they've experienced the characteristics of flow

mentioned above. Instead, they must look at the interaction between individuals in the group (Sawyer, 2003, Kindle Locations 1116-1117).

One of the chief distinctions between Csikszentmihalyi's concept of flow and Sawyer's concept of group flow is that a group cannot reach a flow state without effective goals, communication, and interaction. Csikszentmihalyi's concept of flow focuses on the euphoric feeling that comes as a result of an individual's actions. However, group flow comes from the actions, quality of interaction, and connectedness with other group members. The central use of group flow theory is its ability to analyze a group's performance and the rules, norms, and guidelines used to structure interactions that put groups in a position to perform at their peak.

The Group Flow Experience

People experiencing group flow report feelings of joy, warmth, connectedness with each other, and an effortless connection with their instrument that allows them to play things they hadn't previously thought of. When musicians experience group flow, some say that they are so connected to their group members that they can anticipate their future contributions, and cannot make a contribution to the group effort that is inappropriate or out of place. Musicians experiencing flow also liken their playing together to a good conversation, where partners don't just talk to one another, but also listen and offer contributions to the conversations that account for and add to things that their partners previously said. The following quotes are descriptions of the feeling and effect of group flow from accomplished jazz musicians:

“...I wouldn't give up anything for some of the experiences I have had playing this music. There's a feeling that you just can't buy... It's a beautiful, floating feeling

that is hard to describe in words. It's a wonderful feeling, almost like getting out of your body. I never know when it's going to happen, but when everybody is there and it happens, it really happens. ... It's almost like there's a oneness. You and your instrument are one, there's no separation. And it's like a oneness with the music. It's like you're in tune with the universe" (Berliner, 1994, Kindle Locations 9167-9172).

"Every jazz musician wants to be locked in that groove where you can't escape the tempo," ... You're locked in so comfortably that there's no way you can break outside of it, and everyone's locked in there together" (Berliner, 1994, Kindle Locations 9055-9057).

"He can interpret things I play in the hippest way, hearing things in what I did that I never even thought of... I'll hear myself do something because of what he played and say, 'How did I ever think of that?' I just played the way I play, and he played his thing against it, and we came up with a new thing together" (Berliner, 1994, Kindle Locations 9109-9112).

Table 4: Group Flow Concepts and Examples

Antecedents	Definition	Example
Extrinsic Goal	Task that needs to be completed by the group.	Having a good sounding blues jam based on the song (standard) "Killing Floor."
Pre-existing Structures	Elements within a specific domain that can be used to organize and pre-determine parts of a performance or group effort.	See behavioral norms, communicative structures, musical structures below.
Social Practices		
Behavioral Norms	"Shared expectations of appropriate behavior" (Mitchell,1978) that facilitate interaction between musicians.	For jazz musicians – Soloing only for the length of the song's chorus. Each musician will have a chance to solo.
Communicative codes	Words, phrases, or nonverbal signals with a tradition in the profession that musicians will use to communicate with other group members.	Twirling or dropping hand to give an

		<p>indication to start playing.</p> <p>The band (or recording) stops playing or reduces the volume to indicate that one should solo.</p>
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Extrinsic Collective Goal

Sawyer states that group flow is more likely to occur when the group has some sort of extrinsic (explicit) goal balanced by structure. This goal, which must be shared by the group, is linked to the task that the group wants to accomplish with the song. This could be a group of musicians recording a free jazz performance or writing a classical composition to be played by a string quartet, or a group of computer programmers building an application that finds the nearest ATM .

In order for group flow to occur, creative activities (known as problem-finding activities) with unspecific or loose goals that are very improvisational in nature must be balanced with few shared structures that predetermine or coordinate the efforts of those creative activities.

Activities with very clear goals and objectives must be balanced comparatively speaking with many more structures, to predetermine and arrange the creative contributions of the people.

As the figure indicates below, if there are too many shared structures for the given specificity of a goal, everyone's creative output will be too predictable and will not support group flow. If there are too few shared structures for a given goal, the creative contributions will not be

harmonious enough for the group to achieve flow. While there is a relationship between group flow, shared structure, and goals, Sawyer (2003, 2007) does not specify the weight or importance of each type of structure, or mention that the relationship between these entities is linear (as evidenced by the breadth of the arrow). Some examples of these shared structures in music and other contexts are discussed below.

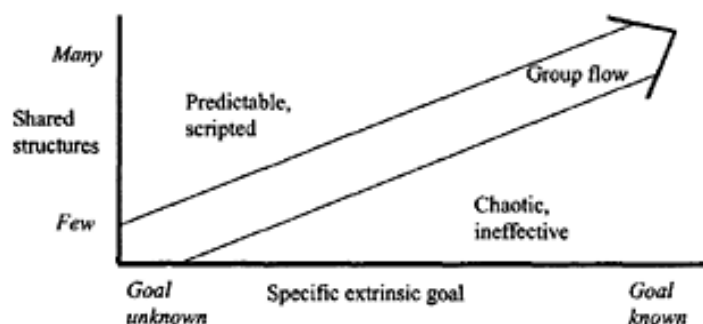


Figure 3. Shared structures versus specificity of project goals.

Pre-Existing Structures

Pre-existing structures are defined by Sawyer as elements within a specific domain that can be used to organize and pre-determine parts of a performance or group effort. These structures are explicit and implicit social arrangements and practices used to coordinate creative people, so they can work together effectively toward achieving some end. To make an analogy to a group meeting, these structures may specify that one understands commonly-used phrases and how to combine these phrases to make a logical sentence, have a meeting agenda (brief or detailed), understand when to contribute and for how long (so as to offer others the opportunity to speak), and only contribute information that falls within a job description.

At least four of the following types of structures must be in place for musicians to promote

group flow:

1. Agenda- An overall flow or outline of the performance that all participants know in advance. The exact length of each segment and timing of transitions must still be improvised.

2. Shared repertory of ready-mades- Pre-formed/fabricated patterns of notes. This includes knowledge of how they typically sequence in order. Jazz musicians are expected to have the skill and training to know a set of commonly-played songs called jazz standards, and have a working knowledge of jazz music theory. Bastien and Hostager (1988) define music theory as standards for selecting, and building upon new musical ideas, including rules for proper chords, chordal relationships, and chord progressions. When a particular song is called, the musicians get immediate information concerning these and other musical patterns. This information reduces uncertainty about the musical task and inventive variations on the musical themes contained in the song. (1988, p. 587).

Having an understanding of music theory, being familiar with bandmates, and knowing the songs allows a musician to understand (or narrow down) what to expect bandmates to play in the future. These understandings make it easier to decide how to play in a way that will be coherent and constructive with the contributions of group members.

3. Job/Group Function- Clearly-defined roles for each of the performers. Some styles of music will suggest that the rhythm section (pianist, bass player, drummer) are only there to fill the role of supporting the musicians who have solos in the song, while other styles of music may suggest that the rhythm section has more latitude to be creative with their contributions to the

performance. For example, many records or performances do not feature solos from the person playing the bass guitar, mainly because their job is to maintain time (or the rhythmic pulse of the song). If the bassist does get to solo, he/she will be accompanied by a drummer to maintain the rhythm and pace. Drummers also maintain the role of keeping time and, at times, can be discouraged from having a long solo, for fear that a tune will lose its groove.

These roles can be different for performers who must collaboratively create and manipulate a recording of the music. Some additional roles that are filled for computer-mediated music composition are listed below:

Arrangers can be responsible for moving the building blocks of the song around in an order that's the most pleasing to the group. Producers /Engineers may take on recording, editing, mixing, or processing sound to turn the song into a cohesive finished product.

Songwriters/Composers typically make decisions on melody, harmony, rhythm, and tone of the musical piece. At times, the role of songwriter can be separated from the role of performers/instrumentalists, who play their interpretation of the music written by the songwriters/composers (Tobias, 2012).

These roles can bleed into each other, with people in collaborative songwriting projects tending to take on more than one of the roles listed above (Tobias, 2012). For example, there are many singers/songwriters that write and perform their own songs. While they perform, they may improvise variations of the melody, harmony, and rhythm that transform it into a totally new song.

4. Common agreement on the conventions- The set of tacit practices governing interaction in the group. This includes understanding when to speak, for how long, and the manner in which to speak respectfully of other members in which to enter. In improvisational jazz performances, there is an unwritten code amongst performers to organize the performance and ensure that everyone has a chance to play. Some of these common conventions listed below are an example of structure one might find governing a jam session amongst jazz musicians.

Table 5: Social Practices Governing Musical Interactions

Sample Practices Governing Jazz Improvisation	
	The leader decides the song and the key of the song.
	The soloist at any given time determines the style for the group.
	The 32-bar chorus is the basic unit of a solo (each solo should be the same length).
	Nonverbal communication cues, such as eye contact at key moments, that indicate important pending events.
	No musician should play in such a way that shows up other musicians involved.

Note: From (Sawyer, 2003, Kindle Locations 1278 -1285).

Distributed Task, Time, and Place

One of the weaknesses of group flow is that its rooting in creative group improvisational performances means that all contributions, evaluations, and refinements of creative ideas must happen immediately, at the spur of the moment. As such, there isn't much discussion about the impact of capturing the contributions of that performance in a form where distant and future collaborators may add to it. All the groups studied to formulate group flow theory practiced and performed face-to-face at the same time and place.

Groove as a Proxy for Group Flow

Distributed music collaboration that uses asynchronous technology is quite a different work arrangement than face-to-face music collaboration, which causes musicians to experience things like group flow and groove differently. Zbikowski (2004, p. 275) defines groove as multilayered, rhythmic, melodic, or harmonic patterns “whose repetitions form the basis for either a portion or all of a particular tune” that make the listener feel compelled to move or feel good. Berliner (1994) states in his study of groups of jazz musicians that striking a groove amongst or “negotiating a shared sense of the beat” provides the basis for a performance to come together. He goes on to state that the groove depends heavily on the synchronization of the bass player and the drummer. Charlie Persip, a musician in Berliner’s study, describes the role of the bass player and drummer creating groove by saying:

“For things to happen beautifully in the ensemble...the drummer and the bass player must be married. When I listen to the drummer and the bass player together, I like to hear wedding bells”(Kindle Locations 8145-8146).

Musicians must interact and collaborate together to compose compatible musical contributions in order to create this feel. While musicians do not report the spiritual out-of-body experiences that jazz musicians report during jam sessions, they do repeatedly experience the creation of groove and use the extrinsic goals and pre-existing structures required for group flow to occur to create optimal creative collaborations that are possible for asynchronous communication technologies.

Groove urges listeners to move along with the strong rhythms created by the rhythm section

and complemented by the rest of the band. On some occasions, after a groove has been created, members of the band “lock into” one another and feel like they’re at one with the music being created by the unit.

Group flow provides a conceptual and analytic basis to account for when groups of people work in a shared state of enjoyable collaboration. For this research, group flow is used to conceptualize and study jazz musicians collectively performing. In doing so, it serves as the conceptual language to describe the roles, goals, skills, and norms of behavior it took for those groups to reach their peak. Musicians experiencing group flow report feeling like they’re floating, smiling at each other, and having an almost spiritual experience playing with each other (Sawyer, 2009).

Observing these elements of group flow can be quite difficult in an online environment. While group flow captures the practices of jazz musicians in an optimal collaborative process, it does not discuss the attributes of a good musical collaborative product (recording). One output of collaborations in Kompoz is a recording that can be examined for evidence of the collaboration. To assess group flow, we use a proxy measure from the recording, based on the simple premise that, if the recording grooves, or make its listeners want to move, it can be considered to be a successful collaboration. This measure of a positive collaboration can then serve to triangulate against the assessment of musicians who managed or participated in that collaboration.

In Keil’s (1966) analysis of jazz music, he discusses the importance of establishing a consistent, regular rhythmic pulse to creating a groove, and the different ways a rhythm section can play together to achieve that pulse. He describes the value of that constant rhythmic pulse to the

groove and its listeners in the following:

“To the extent that you feel like tapping your foot, snapping your fingers, or dancing, gratification is also constant, and when a jazz fan does not feel like doing this, he begins to question the merits of the group that provides the stimulus.” (Keil, 1966, p. 347)

Zbikowski states that when a groove occurs in soul, blues, or jazz is that people often “...stop whatever they are doing and begin to pay attention to the music; they either put their bodies in motion or adapt ongoing motion to follow the pull of the groove.” He goes on to say that “real or imagined body motion is how most listeners respond to a groove...and it is a prerequisite for the musicians producing the groove.” He closes his analysis of groove in part by saying that James Brown’s “doing it to death” was a good groove, because it provided many targets for bodily motion [or dancing].

In other words, observing the presence and frequency of a listener’s bodily motion yields a proxy through which to measure the success of a musical collaboration, by examining its recording. Group flow and groove are not the same phenomenon, but provide complementary tools to analyze online music collaboration. Group flow is process-focused, while groove is product-focused. Group flow theory outlines skills, social practices, and structures that are present in the process of optimal music-based collaboration. The observable effects of groove (i.e. the urge to move) when listeners hear a recording furnishes the tools to judge the success of a collaboration from its end product, which group flow does not provide.

Sawyer (2003, Kindle Locations 1152-1153) says of group flow "...[it] can inspire musicians to play things that they would not have been able to play alone, or that they would not have thought of without the inspiration of the group; "the highest points of improvisation occur when group members strike a groove together, defining and maintaining a solid rhythmic ground for their musical explorations." While the presence of groove doesn't necessarily indicate the occurrence of group flow, it is a part of an optimal collaborative experience for musicians.

Advantages of using Group Flow and Groove over Other Approaches

The strength of group flow is that it takes the core of activity theory, its modeling of collaborative activity as constituted by people, tools, roles, norms, and goals, and requires group participants to be mutually engaged, at a minimum, for it to occur. The theory goes one step further to situate these theories in creativity, and state the conditions that must be present amongst creative groups in order for group flow to occur. In other words, while activity theory does a great job of stating what a collaborative activity looks like, group flow suggests what specific norms, skills, and roles a group of musicians must have to reach its peak.

Activity theory (AT) supporters will also find that group theory wholeheartedly embraces social psychology, and sees group creativity as an activity mediated by tools (e.g. instruments, language, and signs). As such, it leverages the naming power of AT by using roles, goals, and norms (rules in AT) as compatible and recognizable theoretical concepts. Additionally, mutual engagement requires participants to listen to contributions from others in the group and respond appropriately. However, group flow further defines what an appropriate response is

within a musical context. Participants contributing to a group flow state cannot take previously played ideas and just reiterate them repeatedly. Group members must provide their own interpretation in order for flow to occur or continue once it has been achieved.

Finally, while mutual engagement and communication amongst group members are required for group flow to occur, the correct chemistry, skills, norms, and personalities must also be in place for a group to perform at their creative peak. While collaborating, being mutually engaged and constructively communicating with band members are each important components. However, they are not the end or the goal of many musicians. Still, all musicians want to experience the sublime feeling of being “in the groove” with their fellow bandmates and achieve group flow.

Chapter 3: Research Design/Methodology

This section discusses the case study research method and how it is appropriate for examining groove in online music collaboration, when measured against experiments, surveys, and the ethnographic method. It also provides information about the research site, criteria for selecting candidate cases for the study, and how group flow can be used to structure and analyze content and data from collaborative songwriting projects and study participants.

Criteria for Choosing a Research Method

At this point, the academic literature has not covered the process of distributed music composition in great detail, and more descriptive work must be done to capture how these groups communicate and collaborate. In such a situation, McGrath (1979) argues that quantitative research methods, such as laboratory experiments, simulations, and Likert-based surveys do not work well with research problems that have not been well-covered in literature. Quantitative research methods tend to overlook important features of the situation being modeled...by holding these variables to a single constant value" (McGrath, 1979).

A research method provides investigators a systematic, structured way of collecting and analyzing data to answer a research question or test a hypothesis. Given that, the strengths and weaknesses of a research method must fit the research question, the nature of the phenomenon of study, research site, and expected contributions, and must be feasible given the resources and access available to the researcher.

The case study method was chosen because online music composition is at a stage in the research that could still benefit from studies aiming to describe and explore. As such, there are not any tested and verified measures that could be used to determine how people have achieved group flow or optimal interaction in music collaborations. Sawyer also indicates that group flow is a phenomenon based on social interaction that cannot and should not be measured with a survey item or psychological construct. Experiments also prove not to be an advantageous research method, as their strength lies in controlling all factors in a phenomenon, so that measurable changes can only be attributed to the independent variable.

Online music composition occurs in the field. As such, it would be very difficult to control every aspect of a project other than the variables that the research intended to measure. This concern aside, much like other social phenomena, there are literally hundreds of variables to consider when studying online music composition. Experience with an instrument and recording tools, length of time in the community, personality, length of instrumental training, and past collaboration history with a group are just a small sample of the variables that might be of concern. Online music composition is also an improvisational creative activity that can be unpredictable. As such, the research required a research method that can accommodate discoveries that are unaccounted for by the theory or reviewed literature. Group flow theory is a great fit for this phenomenon. However, it is based on face-to-face musical collaboration. There will be some unanticipated observations and adjustments that must be made for the theory's propositions to hold true amongst online groups.

Experiments and the survey method don't have the flexibility to incorporate these

unanticipated developments, as case studies and ethnographies do. Ethnographies also have the data collection tools (e.g. document/content analysis, interviewing, content analysis, and field note-taking) to draw insights from the rich and varied sources of data (e.g. music recording, text discussions, and project metadata) available in online music collaborations. However, ethnographies are best suited for the study of how small groups of people live life and participate in and become a part of an online or physical community. Two issues arise with using this type of method for the proposed research question. First, questions that are an ideal fit for the ethnography that focus on participation in and life as a part of an online music community have been partly answered by other researchers (Lysloff, 2003; Harvey, 2010). Second, the research question also uses theory as more than a lens, but also a guide to data collection and analysis, to question whether musicians are experiencing groove. In many cases, ethnographies are not shaped as heavily by theory at the outset, outside of those that leverage advocacy/participatory and critical approaches of the study.

Case Study

What is a Case Study?

A case study is a qualitative research method that “investigates a contemporary phenomenon in depth and within its real-life context when the boundaries between context and phenomenon are not clearly evident” (Yin, 2004, p. 18). The strength of this method is its flexibility in allowing investigators to use theory while employing multiple data collection strategies.

Investigators employing the case study method have the choice of using interviews, physical

artifacts (e. g. tools and works of art), documents, archival records, and direct and participant observation as sources of evidence for the case report. Having the choice of this many data collection methods allows investigators of distributed music collaboration to analyze sheet music (documents), video/audio recordings of practices (direct observation), computer software/hardware (physical artifacts), and chat logs of team members communicating about a song.

Yin (2009) emphasizes that one of the strengths of the case study method is the ability to use the aforementioned data collection methods to collect all the relevant data available and triangulate these observations to make a well-supported argument. Ethnographers are also encouraged to bolster conclusions by using data from a variety of sources. However, they may be discouraged from allowing theory to guide data collection efforts.

Case study investigators are encouraged to create propositions that state what they may expect to see in observations, based on relevant literature and theories. The investigator will use theory along with their own experiences as tools to judge what events and pieces of evidence are relevant to the goals of the study (Yin, 2004).

Limitations of the Case Study Approach

Case studies often examine phenomena that take place in small groups of people, and employ data collection methods (e.g. interviews and direct and participant observations) where the researcher is the instrument collecting the data. Since the investigator is the data collection instrument, it becomes difficult for future readers to retrace the steps of the author for the

purpose of replicating the study, or seeing the evidence supporting or contradicting the author's claim. Yin (2009) suggests that investigators should create a database of all data, observations, and documents for this purpose. He adds that researchers should investigate rival or contradictory explanations to research questions, to address claims of bias and bolster the authenticity of the analysis. Critics of case studies also contend that it is difficult to obtain results that apply to people other than participants in the research study. This critique often appears because case studies do not select (or sample) participants for their studies, based on how well they will represent a population of people who may engage in the task or process being studied.

Multiple Case Research Design

One common method for counterbalancing the aforementioned critique is to conduct research examining multiple cases, to determine whether similarities and differences amongst the events occur due to a theory, or despite the prescriptions of an established theory (Merriam, 2009; Stake, 2005). For this study, a comparative case study research design was used, to compare and contrast the skill and social practices, and use of tools amongst two projects that achieved significantly different levels of groove. A survey was distributed to members of the Kompoz.com online collaborative music composition community, to identify potential projects for the study. Judges listened to recordings from these projects and noted the times at which the songs made them move and the percentage of groove as the percentage of the song where they felt the urge to move. The two cases that show the greatest difference in groove were chosen for the study, to determine the differences and commonalities between the team's use

of tools and the social practices suggested by group flow for creative collaboration.

Site and Participant Description

Kompoz.com is one of the most popular online music collaboration communities on the Internet, with a total of over 20,000 users and more than 200,000 pieces of audio material. This site allows people of all ages and skill levels (novices to established professionals) from around the world to reinterpret old songs or write completely original pieces of music.

Musicians can choose to participate in composition projects called sessions that are open or closed to public participation. Closed sessions require aspiring participants to audition by submitting a sample of music to the session leader. Conversations amongst group members in both open and closed sessions are available to the public (people who are not members of the session or the site). When a musician has been accepted to the session, he/she will upload a contribution to the project by recording it to an audio file and uploading it to the project on Kompoz.com. Once members have satisfactorily shared ideas and negotiated what the group's song should sound like, a "mix" is created. A mix is a file that literally combines all of the ideas uploaded by group members into one finished song file.

Contributing to a Kompoz Project

One of the first steps to complete in order to join a project is to create a profile. The profile will have a picture, a list of the talents to provide to a project on Kompoz, and the genres of music one is comfortable with. The talents and genres are important because, Kompoz will

automatically send e-mail messages listing projects that match the genre and have a need for the talents listed in the profile. Members running collaborative composition projects on Kompoz can click on a profile to listen to work on past collaborations. The profile also allows members to post links to Facebook, YouTube, and SoundCloud accounts, so that project leaders can see other examples of work.

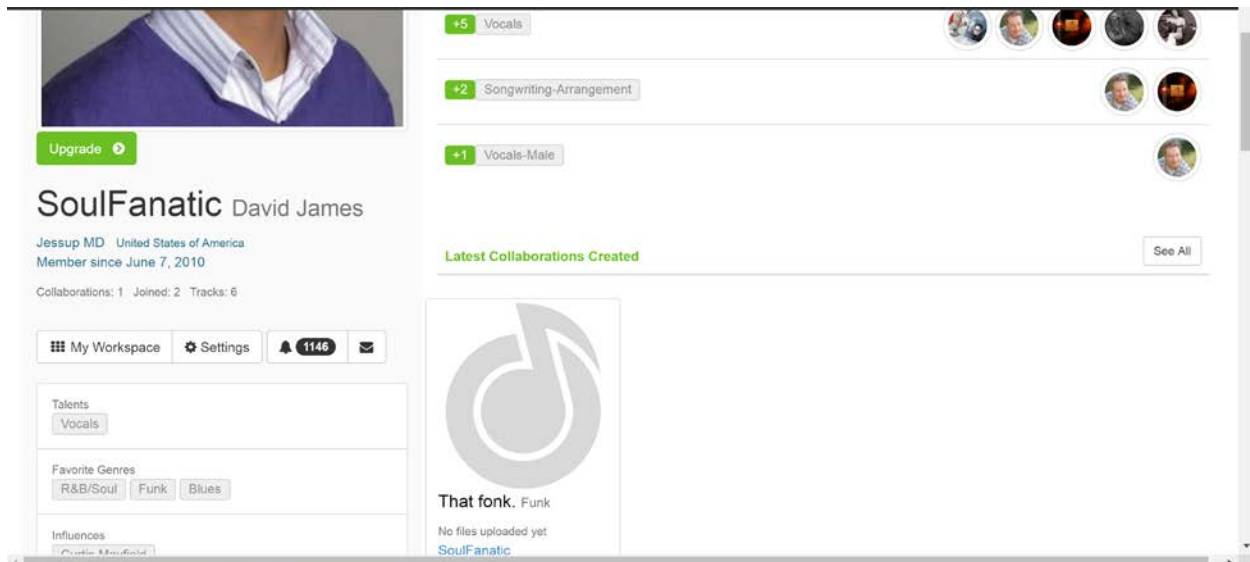


Figure 4. Artist Profile in Kompoz

After creating a profile, one must find a project he/she would like to contribute to by clicking on an emailed project matched to talents, using the search function, or browsing projects (called collaborations on Kompoz) using the collaboration link at the top of the screen. From the collaborations link, one can filter the projects by the talents that are needed to finish the collaboration. The recommended collaborations that match the talents listed on one's profile will be listed by default. One can click on each of the pictures above the collaboration to hear the most current version of the song.

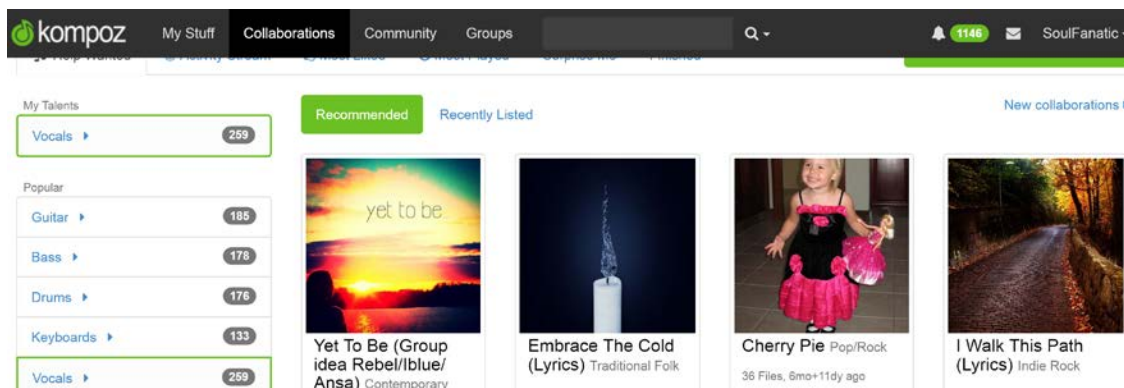


Figure 5. Projects needing Vocal Talent

Once a collaboration is of interest, a person must audition to contribute talents to a project, by recording and uploading an idea for review by the project owner. To record an audition with the ideas to add to the song, one must download the most current (and appropriate) mix of the song. For example, if you are a bass player (or vocalist), you would download a mix of the song that does not have any bass playing (or vocals) on it (if available), so as not to get in the way of your ideas. To download a mix, click on a project, then click on the files tab, select a mix, and select the “Download” button.

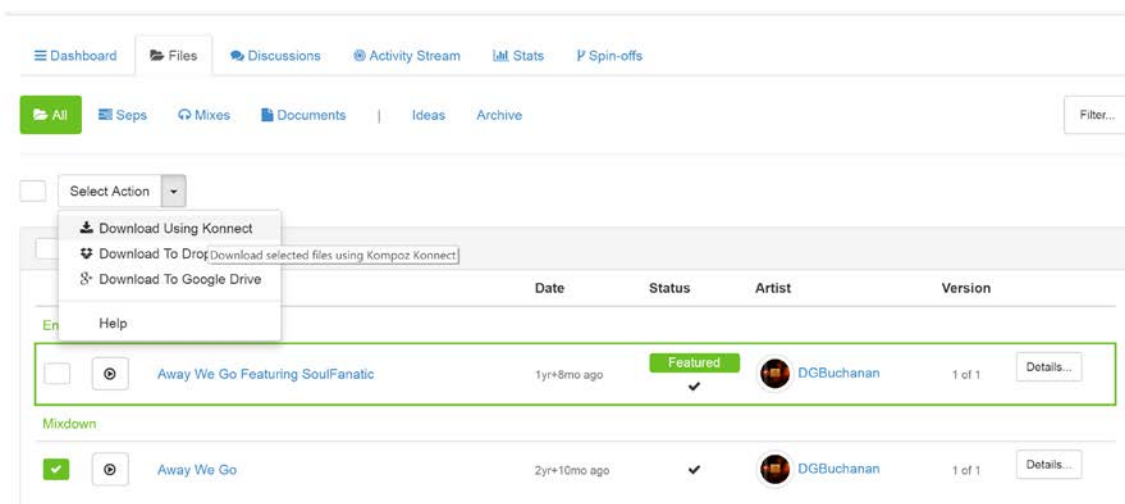


Figure 6. Downloading a mix to Record your idea

Once a mix is downloaded, it can be opened in a music-recording program or digital audio workstation of choice, so as to hear the song while recording the audition.

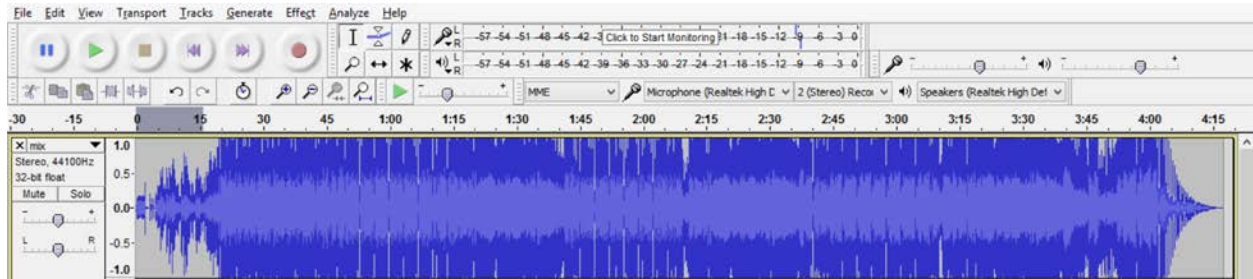


Figure 7. Opening a mix in a DAW

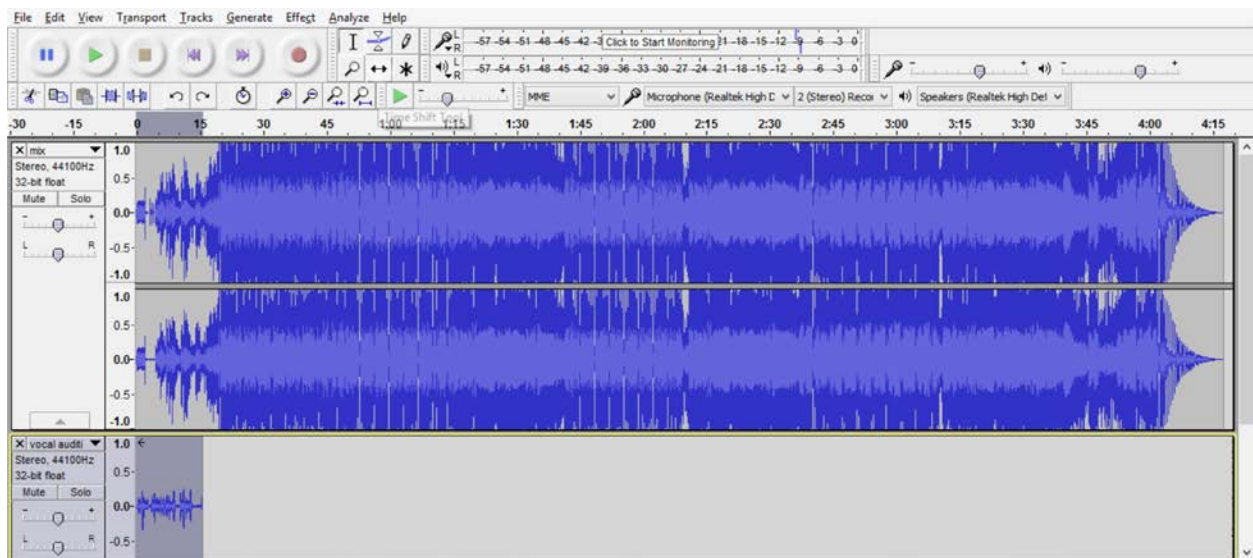


Figure 8. Recording your contribution

After recording the idea, one must save the file in a digital format supported by Kompoz (e.g. MP3 for free accounts and lossless/uncompressed audio formats for paid users), and click the upload button for the audition to be sent to the project owner.

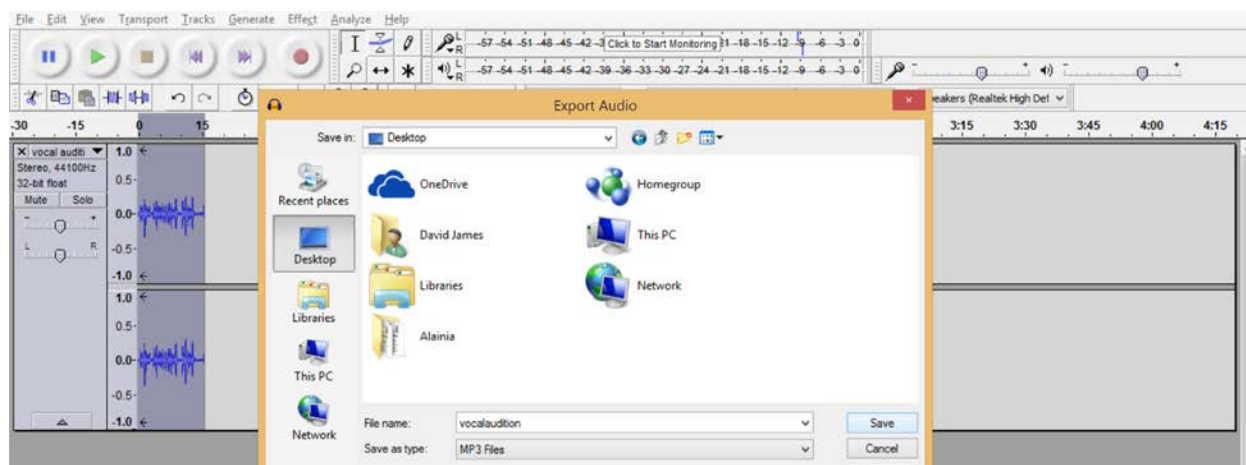


Figure 9. Saving your contribution to an MP3 file



Figure 10. Uploading your contribution

During the data collection phase of the study, Indaba music and Kompoz were two of the most prominent online communities for collaborative music composition. Indaba was the more prominent community of the two, as it has over 1 million members as of June 2016. Adweek discussed (<http://www.adweek.com/socialtimes/4-reasons-why-Indaba-music-is-dominating-socially-driven-music-collaboration-online/17492>) the major players in the online music collaboration space in 2010, and of the five sites mentioned (Tune Rooms, MixMatchMusic, Kompoz, Virtual Recording Studio, and Indaba Music), only Indaba and Kompoz remain. Messages were sent to executives at Indaba asking for permission to collect data from members and collaborative composition projects, but no response was received. A solicitation was also posted in three different public community discussion boards to recruit members to discuss their collaboration experiences on Indaba, to no response.

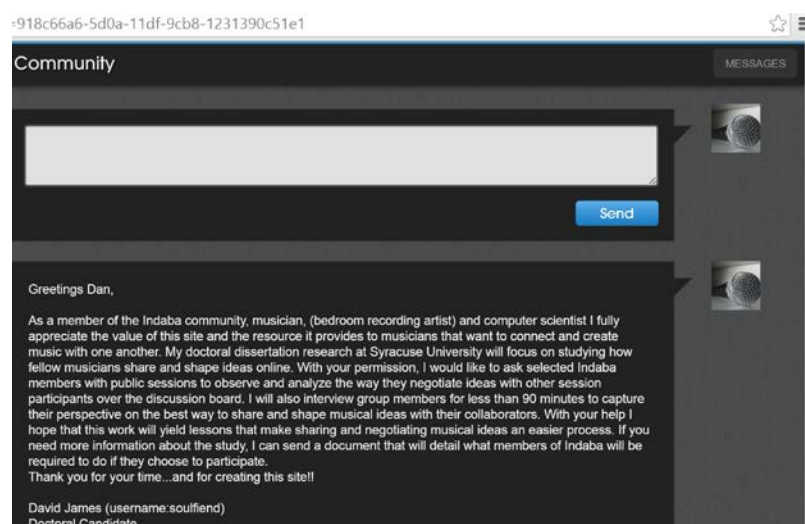


Figure 11. Request to conduct study at Indaba

At the time of data collection, Indaba allowed members to create original songs with a group of other members or participate in a remix competition. Remix competitions are events where famous professional musicians upload the stems, or all of the instrumental parts (e.g. drum, bass, and guitar parts) that comprise their song. Indaba members participating in the contest can then manipulate (e.g. speed up, slow down, shorten, or transform) those stems, and also record original ideas to complement the original or transformed instrumental parts to create a remix. The remix then becomes public on the Indaba site and members vote on the best entry.

Currently, Indaba has removed the the option for musicians to collaborate to write original songs, and exclusively focuses on facilitating remix competitions. Indaba members who created a profile have a sessions button available to start a collaborative composition with other Indaba members, which is no longer visible on the site.

Indaba music does have a few key differences that made it different from Kompoz. Indaba does not require its users to have mixing and recording software, as it has web-based mixing and

recording software called Mantis. Mantis allows any member to record their singing or playing ideas straight to music sessions (housed on the Indaba music servers), making them available to collaborators and the author via any computer with an Internet connection. The tool also made over 10,000 pre-cleared (copyright-free) samples available to members, for use in their own original compositions and remixes. Indaba also had an instant messaging function that showed members when collaborators were online. However the latest version of Indaba has removed that function, yet still allows private messages to be sent to other community members. This is a function that is available in Kompoz. Indaba also allows members to attach feedback to the sound recording, so that the comment becomes visible on the screen when the listener has reached the part of the song that the comment references. Kompoz users do not have the ability to tie comments to the song's waveform.

Kompoz is one of the only major online music communities that has a critical mass of users and the tools available for remote groups of musicians to collaborate on songwriting. February album writing month is a newer tool for collaborative music composition that arose in the writing of this dissertation. FAWM.org has the mission of helping users write "14 songs in the 28 days of February." The site encourages individual users to write songs rather than record demos or finished versions of songs. It is only active during the month of February.

Collaborative songwriting is also encouraged. However, it is not at the center of the community's mission as it is for Kompoz. The platform is free for all users and allows them to retain any intellectual property they post to the song.

Kompoz, on the other hand, encourages members to finish polished versions of songs, and

gives them the ability to license and sell them. Kompoz also allows members to list mixing and mastering as a talent, which lets project owners have members help make their collaboration a finished product. As a result, Kompoz has a store called Soundblend, where community members can sell their songs and receive a percentage of the profit determined by their level of membership. Members with a free membership receive 70% of the proceeds from sales in SoundBlend. Members paying \$5 per month receive 80%, and members paying \$10 or \$20 per month receive 90% of the sales revenue.

Kompoz also features a podcast, user groups, and help wanted section. The Kompoz podcast features collaborations made in the community, and gives musicians the opportunity to discuss and introduce songs. The podcast discusses topics of interest to working and recreational musicians such as copyright, licensing, and online music collaboration. User groups are discussion boards that group users into areas of interest like Guitar Players, Vocalists, Keyboard Players, and Music Video Production, and discuss tricks/tools of the trade, best practices in their respective areas, and resources for learning more about their craft. The help wanted section allows community members to post ongoing collaborations and advertise needs for musicians to fill roles to help finish a song in progress. The community also provides an area called showcase where Kompoz members can share collaborations to elicit feedback from other community members.

Data Collection

A text-based survey was distributed to members of the community to identify projects in which they experienced group flow. The survey provided descriptions of group flow and groove

experiences from jazz musicians (noted below), direct from interview data in Sawyer (2003, 2007) and Berliner (1994).

The survey provided the following description of group flow and asked participants if they had an experience similar to the one described below when creating with other musicians on Kompoz.com. This survey was distributed before changing the study to look for groove.

However the data was still used, because groups must establish a shared sense of the beat or groove, before achieving a group flow experience.

Descriptions of Group Flow in Initial Survey

“Every jazz musician wants to be locked in that groove where you can’t escape the tempo” ...
 “You’re locked in so comfortably that there’s no way you can break outside of it, and everyone’s locked in there together.”

“He can interpret things I play in the hippest way, hearing things in what I did that I never even thought of... I’ll hear myself do something because of what he played and say, ‘How did I ever think of that?’ I just played the way I play, and he played his thing against it, and we came up with a new thing together” (Berliner, 1994, Kindle Locations 9109-9112)

“...I wouldn’t give up anything for some of the experiences I have had playing this music. There’s a feeling that you just can’t buy... It’s a beautiful, floating feeling that is hard to describe in words. It’s a wonderful feeling, almost like getting out of your body. I never know when it’s going to happen, but when everybody is there and it happens, it really happens. ... It’s almost like there’s a oneness. You and your instrument are one, there’s no separation. And it’s like a oneness with the music. It’s like you’re in tune with the universe” (Sawyer, 2003; Berliner, 1994).

Four out of seventeen survey respondents indicated that they had similar experiences with other musicians while creating online collaborative compositions in the Kompoz.com community.

In the following question, survey respondents were asked who experienced group flow to

identify projects where that experience occurred. Of the four members that acknowledged they had group flow experiences, two listed projects that were examples of the phenomenon. One member, Frank, listed three projects. The other member, Paul, listed 14 projects where he recalled experiencing group flow.

Paul's response to the query asking him to identify projects was:

Sentenced2Funk Fat Company Fat Lazy Snail Tony Parker Robins Egg Blue
Incubator a Hip-Hop/Funk collab Sheeps Of Fear Project Funky Party Jam Mr. Z
Instrumental Disco Funk Jam VooDooUThinkUR U Don't Care Bout Me Incident at
Wacka Chicka Audio Hallucinations Do It

Of the available cases to study, Paul's cases were chosen because of past experiences working with him on projects in the community. The researcher is familiar with funk music, which is the large share of music that he likes to create. Paul listed 14 projects in his survey response data, and served as a project manager/owner of seven of these projects. Of the seven projects that Paul owned, five were selected for the judges to listen to. Three of these songs would be likely candidates to exemplify a groove experience, while two were selected as potential examples where the song contained less groove or no groove at all.

Songs one, two, and three made me move the most, while songs four and five made me move the least.

Song 1: <http://www.Kompoz.com/music/player/85689?isPopup=true>

Song 2: <http://www.Kompoz.com/music/player/446375/530527/1?isPopup=true>

Song 3: <http://www.Kompoz.com/music/player/408800/410989/1?isPopup=true>

Song 4: <http://www.Kompoz.com/music/player/460498/465209/5?isPopup=true>

Song 5: <http://www.Kompoz.com/music/player/416397/589005/2?isPopup=true>

Judges listened to these songs and indicated the moments that made them want to move and the times at which the song didn't inspire them to move, or stopped their movement. The songs where both judges reasonably agree on the percentage of time each song made them move, the sections that caused groove or took away from it, and the reasons for a change in the groove level in a song, became the two cases to examine for the study.

Data Collection Details and Sources

Data from the two cases came from artifacts present in the dashboards for these projects in Kompoz.com. Each project has a dashboard that lists information about the project, such as the creative brief that lists the direction of the project in text, and some of the facets useful for structuring the project such as the key, tempo, genre, and the talents needed to complete the composition. The dashboard also has a file repository for musicians to upload the ideas they want to contribute to their composition, captured in the form of a digital audio file. Each uploaded audio file accepted by a project manager has an attached discussion board that allows the project manager and other team members to provide feedback on an uploaded musical idea. Every conversation excerpt in this study comes from a discussion board attached to an uploaded music idea. In total, the two cases had 112 uploaded sound files with 323 total comments on uploaded music ideas. Across the two cases there were 19 total collaborators (12 in case 1 and 7 in case 2). The first case studied took place from December 2012 to September 2014. Case 2 began in March 2014, releasing a finished recording in August 2015.

Positionality

I chose this topic because I became familiar with the challenges of virtual teams, by completing data analysis tasks and writing literature reviews. When selecting a dissertation research topic, a colleague challenged me to study a topic and phenomenon that I'm personally connected to. I have been a singer for the past fifteen years and have written songs for ten years. I have a very deep love for music, and as such, wanted to find a way to stay connected with friends of mine who are music lovers and musicians, despite living in different places. While working on a song with a friend who plays the guitar, I called him on the phone, so that he could hear the ideas that I played. As I collaborated with him and other friends I wondered why this had to be so difficult. Though some of these collaborations didn't leverage digital technology, it served to validate the feeling that music collaboration in virtual groups was a topic worth study for my dissertation. Since those collaborations, I have contributed lead and background vocals to three collaborative songwriting projects in the Kompoz.com online music community. Prior participation in singing groups, and digital songwriting collaborations for years does give me some insight on what the online collaboration process looks like. However, this experience may cause me to exclude or gloss over issues that seem routine to the task, that may be of interest to those who haven't engaged in distributed music collaboration.

Why Funk?

I chose to study funk songs for this project, because it, along with other forms of Black American music, is the type that I am most familiar with. My stepfather was a DJ in the seventies, and many of my days were spent listening as he played soul records from the

Spinners and The Isley brothers, or funk records from James Brown and George Clinton. Funk, along with other forms of Black American music fit this study, because funk groups play by feel, listening to each other to ensure that they are playing together, and inspiring listeners to move. What is absolutely critical to a successful funk song is the band coming together to play a rhythm that is infectious and undeniable. When speaking about describing his sound, James Brown was quoted as saying that [“his] strength was not in the horns but in the rhythm...[he] was hearing everything, even the guitar like they were drums....Later on they said it was the beginning of funk...”. (Maultsby, 2006, p. 297) The rhythm is the engine of a funk song, and if doesn’t make its author(s) feel something or its listeners want to move, then it doesn’t have a purpose.

The first time I remembered wanting to sing was visiting a talent show at Bishop Loughlin High School in Brooklyn, NY. The only song I remember that night as a nine or ten-year old, was a performance of Boyz II Men’s “End of the Road.” Though Boyz II Men had four great individual singers, what they were best known for was their ability to harmonize as a unit. “End of the Road,” much like some of their most popular tunes, had an acapella portion that closed out the song, with nothing but hand claps and their voices. For the next few days, all I would do was sing the melody of that portion of the song, thinking it was the coolest things I’d ever heard. When I entered high school and was given a choice to join the chorus or take wood shop, that talent show made the decision easy. Singing in three choirs during high school developed my deep love of harmony, appreciation for music, and the coordination it takes to perform well as a unit. These years also served as the start of my music education, where I learned about song structure, basic music theory, and vocal performance. After graduating and leaving chamber

and gospel groups in high school, I continued to sing in a collegiate chorus and gospel choir. After leaving college, I had a strong desire to continue singing, but didn't have a group to practice and perform with. I began using the Fruity Loops DAW to create my own music, and began to play guitar a few years after, to become a better songwriter and musician. I've continued to play for the past four years.

When it comes to the collaborations that I have contributed to on Kompoz, and the experiences I've had with choir groups, my ear immediately looks for the pocket or the groove. If I'm trying to sing a background or lead vocal, I think about how my contribution meshes with harmony melody and rhythm that the group is already playing. If a drummer is playing something that sounds good, I will do my best to sing something that will complement his/her playing. While I may often fail to meet that standard, I always feel that the sound of the unit is more important than my contribution as a singer. With that I will always be biased toward songs where the drums, bass, guitar, and piano fit together like jigsaw puzzle pieces, where each musician is playing brilliantly while giving space for each other to shine together.

Role of the Researcher and Impact on Projects

I have participated in three collaborations on Kompoz.com, where I contributed lead and background vocals for funk and R&B projects. I chose to work on these, as they were the genres I felt the most familiar with. Paul led one of the collaborations I participated in and provided most of the projects that were submitted as potential examples of groove. Paul provided these projects after I participated in a project that he managed. Both of the projects used as cases for this dissertation ended before I began data collection. I did not serve as a participant in either

of the cases studied in the dissertation.

Recruitment of Judges

Judges were solicited for the study by posting the call below on Facebook for musicians and funk enthusiasts to listen to music for the study. The judges would listen to the songs and note the times at which the song made them move, and also note the time that the song made them stop moving, while explaining the musical features that caused their change in movement.

Three musicians responded to the call, and two judged songs for the study.

“Calling musicians and funk enthusiasts! I'm conducting research on funk bands for my dissertation and need your listening expertise! It will require you listening to two or three songs for no longer than 15 minutes. Please let me know if you might be interested.”

The first musician, Phil, who served as a judge for this project is a guitarist and drummer based in Pittsburgh, Pa, who has been playing for the past 18 years. Parker, the second judge, is a saxophonist based in Howard County, Maryland, who has toured for 16 years with the Jazz Ambassadors (the US Army Jazz Band), performing in 100 – 160 shows a year. Both judges were given gift cards to Amazon to for their time and expertise.

Judges listened to recordings to determine whether they urged them to move at any point, to determine whether the tracks successfully created groove. If both tracks generated groove, I tried to determine which track was more successful at sustaining groove and how the group used tools and social practices in a way that caused different levels of groove.

After two projects that produced differing levels of groove projects were identified, I performed

content analysis on their discussion on the project bulletin board surrounding musical ideas for the project and recordings, by downloading audio snippets from that project.

Description of Analysis

The Application of Groove and Group Flow to Collaborative Music Composition

Collaborative (Asynchronous) Music Composition vs. Live Improvisational Performance

There is a continuum between live improvised performances and recordings of scripted pieces of music. All of these media are capable of producing a groove that makes the listener feel good, due to its musical elements and the coordination of the musicians involved.

The following lists the continuum of improvisation (in descending order) modified from Sawyer (2003):

- Live Improvisational Performance (face-to-face)-process is the product, autotelic, and unpredictable)
- Online Synchronous Collaboration (face-to-face)-bandwidth limits speed of communication, and process is still the product.
- Online Asynchronous Collaboration-though a product is the result, the performance still has an indexical nature like live performance, in that past performances and contributions provide constraints for newer contributions.
- Scored Conducted Ensembles-many shared, pre-existing structures, clear goal, predictable, and ritualized.

The instant speed of musical communication and action required amongst improvisational musicians partially determines how quickly and deeply groove can develop amongst musicians – assuming the same level of proficiency to respond instantly to musical contributions with appropriate contributions of their own. There is no deeper, spiritual experience in music than witnessing or performing with a group of proficient musicians engaging in a live performance. The ability to feel (and respond to) the energy of the crowd, adjust, or completely change your performance from one second to another based upon what you're hearing from fellow musicians cannot be surpassed in a face to face environment.

Sawyer compares improvisational jazz performances in a face-to-face medium with performances of classical European music that are often structured and scripted with sheet music, arguing that these performances can also elicit group flow. Though we cannot measure whether group flow occurs in an asynchronous music composition, we can measure whether the band created a groove that compelled a listener to move. Players must coordinate with one another, so that the rhythm of the tune is made clear to the listener and easy to move to.

Groove can be accomplished without reaching group flow. However, neither can be accomplished without having skills, social practices, and tools (e.g. chord progression, genre, common vocabulary, and vision for the song) to coordinate the efforts of the musicians and execute.

Distributed music making is more improvisational than scripted performances, because each player can completely improvise contributions to the song. However, it offers fewer opportunities to change playing based upon the playing of collaborators. Each performer can

make a take as short or long as they like (one verse or the entire song). However, the cumulative way in which the contributions build to make the song significantly constrains future performers with each round of submissions, much moreso than live performance. Each round of submission requires a performer to record and save their idea, so there is no way for other performers to instantly hear that idea while it's playing and change their own play instantly in response. In this medium, the entire idea (regardless of its length) must be captured and sent. Prior contributions must be deleted, re-recorded, and resubmitted to adjust to new musical contributions. In live face-to-face musical performance, these decisions to incorporate musical ideas happen instantly from moment to moment, and there is no chance to revise what has happened in the past. Live performers can only choose the degree to which they will acknowledge and build upon a contribution. The table below compares the two processes.

Face-to-face Improvisational Performance (Sawyer,2003, Kindle Locations 1955-1957)	Asynchronous Musical Collaborations
<p>The emergent - the sound of the (improvisational) performance at the current time.</p> <p>Vectors of indexical presupposition – performer’s contribution at that moment has to be compatible with the sound of the performance at that moment.</p> <p>Indexical entailment - what the performer plays at that moment alters the current sound of the performance and future performers must contribute something compatible with this new sound.</p>	<p>Performer two is able to hear and react to everything performer one has recorded. However, performer one cannot adjust her/his playing to performer two, but can revise and re-upload the contribution once performer two is finished. “Infinite” time to create, evaluate and revise ideas.</p>

<p>Performers must evaluate ideas in an instant and choose the degree to which their playing will build upon those ideas. These players cannot go back and time and change ideas that they've played. Ideas do not have to be recorded and are heard by all group members instantly.</p>	<p>Musicians must wait until their colleagues record and upload ideas in order to react to them. Each performer also improvises musical contributions to the song.</p>
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Figure 12. Face-to-face performance vs. asynchronous musical collaboration.

One difference is that a performer has a chance to revise or resubmit contributions to a project, and that there are products/artifacts and shareable representations of ideas that are made as a result that can be analyzed along with the process that created them. Live performance only offers the opportunity to analyze the process, as the process is the product, unless a transcript or a recording is produced and analyzed. At the post-production stage of the music collaboration process, adjustments can be made to the arrangement, rhythm of musical contributions, dynamics, and tone to better fit the vision of the project and create a deeper groove. This mode of collaboration also allows the group or the person leading the group effort to reject contributions that do not fit the vision of the project, before they are blended with the current version of the song.

Each performer can make a take as short or long as he/she likes (one verse or the entire song). However the cumulative way in which the contributions build to make the song significantly constrains future performers with each round of submissions, much than live performance. Each round of submission requires a performer to record and save their idea, so there is no way for other performers to instantly hear that idea while its playing and change their own play instantly in response. In this medium, the entire idea (regardless of its length) must be captured and sent, and prior contributions must be deleted, re-recorded and re-submitted to adjust to

new musical contributions. In live face-to-face musical performance, these decisions to incorporate musical ideas happen instantly from moment to moment, with no chance to revise what has happened in the past. Live performers can only choose the degree to which they will acknowledge and build upon a contribution.

Groove is an experience that requires players to listen to one another so that they can play together, with respect to rhythm, melody, harmony, and dynamics. The concepts that group flow provides in extrinsic goals and pre-existing structures furnish the best theoretical tool to examine how musicians establish social practices to play together to achieve groove.

Since collaborative music composition creates a product in the form of a recording and captures the process of creation in the conversations and records kept in project discussion boards, the analysis of these cases must account for both the product and process. Product-based analysis will check whether the tracks have the potential to groove. I did this by asking judges who are intimately familiar with the genre of music whether the recording compelled them to move or dance any point during the recording. If so, the song was considered to have created a groove. The judges were also asked to note the times at which the music compelled them to move, and the portions of the recording that did not. If one song grooved and the other didn't, the study examined how the use of social practices and digital tools contributed to the groove in one track, but did not generate groove in the other. If both tracks generated groove, I determined which track had a diminished level of groove in comparison to the other, by reviewing how frequently the song made the judges move, and examining the judges commentary about the song. To analyze the collaborative composition process, I described how groups used extrinsic goals and

pre-existing structures from group flow theory to help create a groove. Alternatively, I captured how certain uses of technology and interactions that violated group flow theory took away from the song judged to have diminished groove. A comparative analysis determined the similarities and differences between the use of extrinsic goals and pre-existing structures in both projects. The process analysis listed the order of the versions of the song, providing an aural history of how the song evolved into the finished product.

Coding of Data in Songwriting Projects

Data in the songwriting projects were coded and categorized according to the theoretical concepts of group flow (extrinsic goals and pre-existing structure) which are explained in the table and description below.

Table 6: Group Theory Concept Chart

Antecedents	Definition	Example
Extrinsic Goal	Task that must be completed by the group.	Having a good sounding blues jam based on the song (standard) "Killing Floor."
Pre-existing Structures	Elements within a specific domain that can be used to organize and pre-determine parts of a performance or group effort.	See Behavioral Norms, Communicative Structures, and Musical Structures below.
Behavioral Norms	Behavioral Norms are "shared expectations of appropriate behavior" (Mitchell, 1978) that facilitate interaction between musicians.	For jazz musicians, soloing only for the length of the song's chorus. Each musician will have a chance to solo

Communicative Codes	Communicative codes are words phrases or nonverbal signals with a tradition in the profession that musicians will use to communicate with other group members	Twirling or dropping your hand to give an indication to start playing The band (or recording) stops playing or reduces the volume to indicate that you should solo
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Extrinsic Goal

The extrinsic goal for a project is a vision or direction that the leader of the project has in mind for the song, that must be shared with his/her collaborators, to get a result that is pleasing to him/her. Example of a very specific extrinsic goal: I want a sleepy jazz composition that sounds like it came from Miles Davis' early sixties recordings.

Example of an extrinsic goal that is not very specific: Free for all! Have at it!

Pre-Existing Structures

Pre-existing structures are social arrangements and practices that help to organize and pre-determine parts of a musical performance, so that practitioners know how to contribute to the song in a way that's effective for the group's goal, and is in step with the contributions of other group members.

Example(s): Do not play faster or slower than the prescribed tempo of the record. Include name of the instrument that you play in the file name of your musical contribution.

More specific goals that are well defined will be matched with more pre-existing structures to ensure that group members achieve that goal, as per the prescriptions of group flow theory. Less specific visions will have less pre-existing structures and will leave more artistic choices to be determined by the taste of contributing musicians.

In online music collaborations, it's less important to state what song will be performed, and more critical that contributing musicians are provided an idea or a vision of how the song should sound. Covers or reinterpretations of songs are limited to private projects on Kompoz.com. The leader's vision can be achieved by stating a mood or genre he/she may desire that the tune end up in, or by identifying the style or sound of a specific recording to emulate.

In face-to-face improvisational jazz groups that are experiencing groove, the leader of the group must establish pre-existing structures so that group members can work together smoothly. The leader may mention the key that the group will perform in, which lays out (to a degree) what notes musicians must play in order to make harmonious contributions to the performance. The leader also must establish the tempo of the song, and set expectations for the roles and responsibilities of each player, clearly communicating where and how each player should contribute. The leader also has the responsibility of getting a group of musicians together that are most likely to create the groove that he/she wants.

Groove Judging Procedure

Links for Songs 1 through 5 were presented to the judges through an online instant messaging platform. Both judges were asked to indicate whether there were periods in the recording that

made them want to move, or didn't make them want to move at all.

Song 1: <http://www.Kompoz.com/music/player/85689?isPopup=true>

Song 2: <http://www.Kompoz.com/music/player/446375/530527/1?isPopup=true>

Song 3: <http://www.Kompoz.com/music/player/408800/410989/1?isPopup=true>

Song 4: <http://www.Kompoz.com/music/player/460498/465209/5?isPopup=true>

Song 5: <http://www.Kompoz.com/music/player/416397/589005/2?isPopup=true>

After asking the judges to complete their task, it was clear that groove is not a binary construct. Instead, it is best described as a continuum of values, where groove can be more or less intense or not present at all. Both judges noted periods by marking the minute and second of the recordings where they felt more or less compelled to move. The judges also stated what features of the music made them more or less inclined to move, and why those features caused them to lose or gain the urge to move.

Groove Analysis

Groove is defined as a multilayered piece of music that gives listeners the urge to move.

(Zbikowski, 2004, p. 275) If a judge indicated that a song wanted to make him/her want to move at any point while listening, the song was said to be successful at creating a groove. Although the first judge took detailed time data about where groove was lost and gained, his notes on the track solidified which track (track 5) should be chosen as the exemplar of diminished groove.

Prompt for Judge 1 (Phil)

You just have to listen to a few songs and note down the times at which the song made you want to move, and the times that the song may not have made you want to move.

Phil: "Definitely didn't feel either of these songs (4 and 5) as much as the last few (songs 1-3). Particularly on song 5, it was like a full sound assault coming at you the entire time...very few changes in volume, tempo, or other factors that would allow you to build up with the music. Not sure if that helps, but I figured I would vent because that crap kills me when I hear people play. "

Judge 1 (Phil) selected songs 1 through 3 as the songs that he "felt" the most. However, of the five tracks given to the judges, only songs 1 and 5 had the same two Kompoz members taking on leadership roles for the project. Paul was a project creator and rhythm guitarist for both songs, while Jim took on the role of manager bassist mixer and arranger. Project creators and managers in Kompoz tend to bear the responsibility of establishing norms and standards for communication and behavior, which can be critical to facilitating an environment that produces groove. Selecting two projects with the same creative management and leadership shows they have the skill needed to create a groove. It also sets the stage to examine what was done differently between these projects that diminished the groove, other than being completely different groups of people.

Both judges listened to songs 1 through 5 and were told to note the times where the music made them want to dance. At the end of the first set of data, I noticed that the judge also provided times where the compulsion to move became more or less intense. At that point, groove became less binary to more of a spectrum with a variety of values. When the second judge was asked for data, it included moments where he felt more or less intensely compelled to move while he heard the songs.

Prompt Text for Judge 2 (Parker)

Note down when the song makes you want to move, and note the times that also don't make you want to move, and why. If those feelings increase or decrease in intensity for you let me know

The second judge also provided data that did not fit a binary conception of groove. Both judges were also asked to note the features in the music that compelled them to dance, or lessened that feeling. While the judges provided times down to the minute and second, I took care to note of instances where the judges mentioned times that were different, but were referring to the same sections of the song (or musical content with the same purpose).

Parker: Groove died at 2:28 with lame guitar solo, and even worse at 3:20 when guitar destroyed the entire track. Just being honest here. Hope this helps. Now I need to listen to some PFunk to clear my head.

Phil indicated that this was the track that made him move for the shortest duration of time amongst the songs that he received, and most clearly disturbed his feeling of groove. Our other judge Parker indicated that the groove died for almost half the duration of the song, while Phil indicated that the groove died from 2:15 to 4:20, which is also almost exactly half the song. Music is a subjective experience, where differences in experiences and taste can count for a great deal of variability in judgement. To handle this characteristic of the data, I focused on the sections of the song where the judges agreed on the presence or absence of groove, and what caused the change in the song.

Visualizing the Groove Data

When judges noted that there was a section of music that urged them to move, that time

period was marked with an orange color. If they noted that the urge to move became more intense, it was illustrated with a darker orange bar. Sections of music where judges indicated that there were consecutive decreases in the intensity of groove were denoted by shades of orange that became lighter. In this case, the last decrease in intensity is marked by a blue, which signifies that there is no groove. As an author, the concept that there could be negative groove conceptually didn't make sense, but could be explored in the future.

Use of Groove Visuals and Measurement

It is critical to note that the groove data captured from the judges should not be reduced in such a way that there is a groove scale or formula. Though something may be labeled more or less intense groove, I'm not attempting to associate those categories with a numerical value that is consistent across songs. It's merely to note the presence/absence of groove, and use the colors to note that there is a change in intensity. This visualization is a rough tool, along with the use of the judges' comments, to see if there are songs where they agreed on sections of music that did or did not achieve groove. While there may be some way of measuring biometric data to determine whether a value can be attached to the feeling of a groove, that inquiry is out of the scope for this study.

Groove Data Visualization

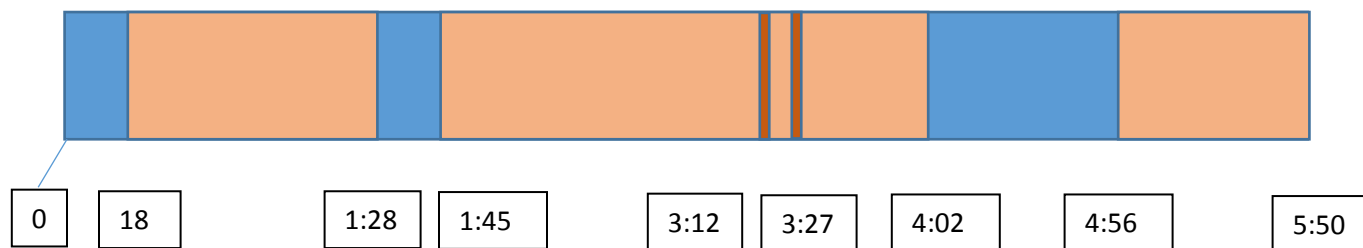


Figure 13. Phil's groove data on "Sentenced 2 Funk" (song 1, case 1).

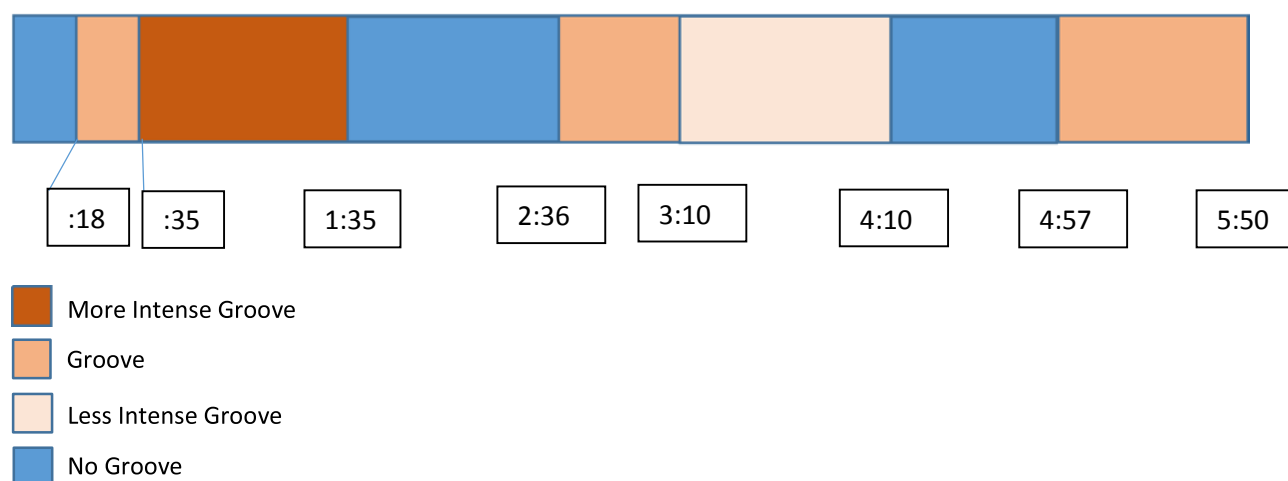


Figure 14. Parker's groove data on "Sentenced 2 Funk."

Song 1 ("Sentenced 2 Funk") was the only song of the five sent to the judges where both judges indicated that the musicians achieved groove and were able to intensify the feeling of groove for a significant period of time. Both judges also had some agreement about periods in the song that urged them to move.

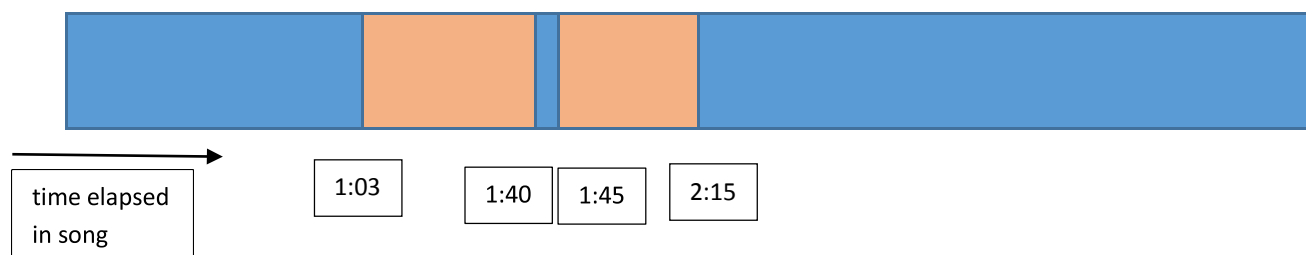


Figure 15. Phil's groove data on "U Don't Care About Me" (song 5, case 2).

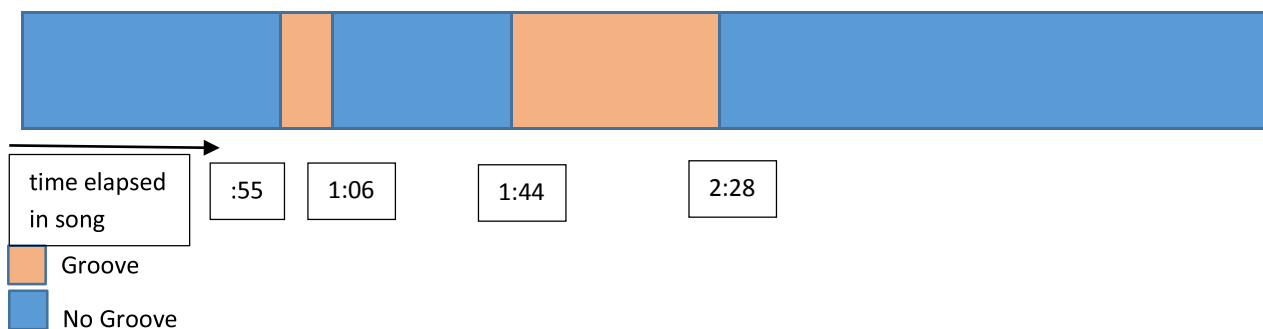


Figure 16. Parker's groove data on "[U Don't Care About Me.](#)"

When looking at the graphed groove data, it becomes clear that song 5 ("U Don't Care About Me") was not able to create groove as frequently as song 1 ("Sentenced 2 Funk") in the view of the judges. The judges also did not feel any positive changes in the intensity of the groove for song 5.

The groove visualizations for the remaining songs show that judges couldn't come to agreement on periods during the track that caused the presence or absence of groove.



Figure 17. [Song 2](#): Parker groove data.

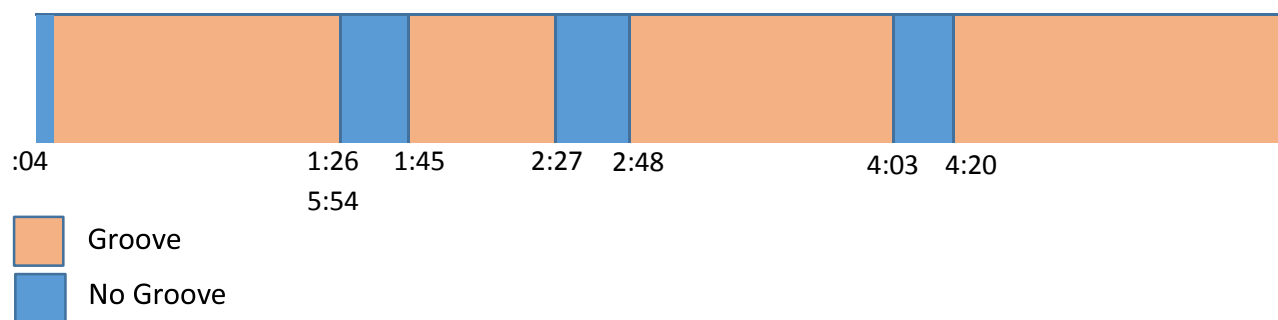


Figure 18. [Song 2](#): Phil groove data.

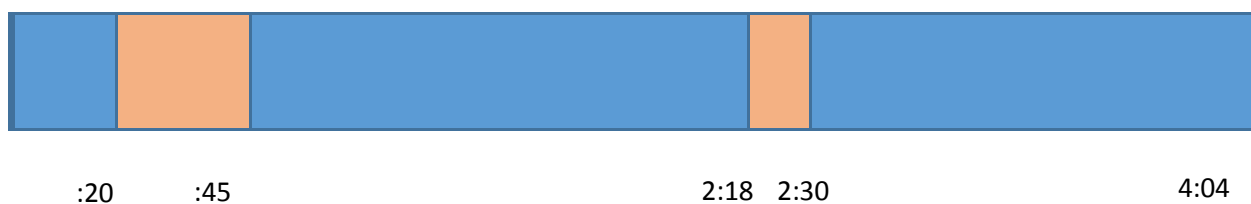


Figure 19. Song 3: Parker groove data.

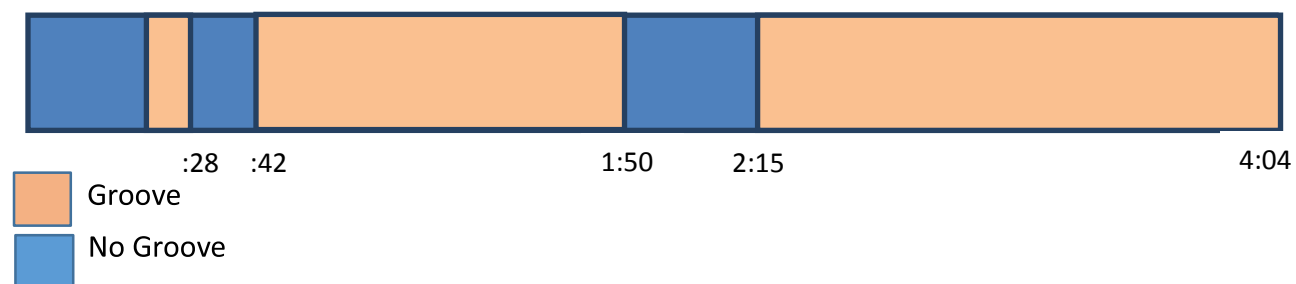


Figure 20. Song 3: Phil groove data.



Figure 21. Song 4: Parker groove data.

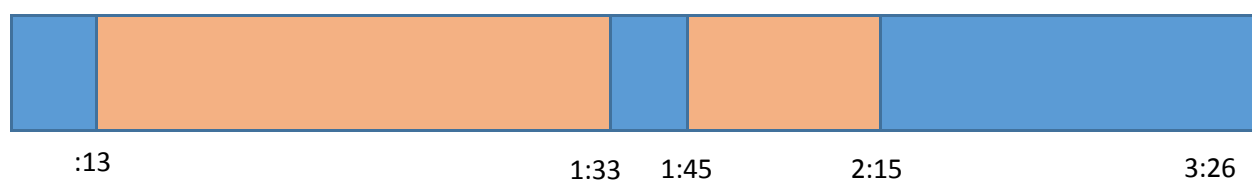


Figure 22. Song 4: Phil groove data.

Case Selection

After analyzing these songs, it became evident that the judges agreed on the sections of the music that either caused the songs to gain or lose groove in songs 1 and 5. In songs 2, 3, and 4, the judges had drastically different opinions about the sections of music that did or did not

achieve groove. Song 1 is a strong candidate to serve as the exemplar, as it's the only song of where the judges agreed that the musicians were able to generate a groove and intensify it. The judges were not asked to discuss their choices with one another in the hopes of them increasing their agreement, because it was assumed that the judges' opinions were fully formed and shaped by their wealth of experiences. The variability of their judgement was addressed by analyzing the songs they did agree on with respect to the level of groove and the cause of its positive and negative changes.

Song 5 is well-suited for comparison as the case with diminished groove, as it did not generate groove for nearly as long. The judges also agreed on the sections of music where groove was lost, and the driving factors behind the groove being lost. In the following table, commentary on songs 1 and 5 highlight where the judges agreed on groove. Comments in the notes section only appear when the judges pointed to the same section of the song.

Table 7: Alignment of Groove Judgements (Song 1)

Song 1 Phil	Song 1 Parker	My Notes
0:18 – Start moving and more intently listening.	:18 Start moving– intensifies at :35 with bass line.	Before :18 it's just keyboard and handclaps, and at 18 seconds, the drums cue everyone to join in.
1:28 – Stop moving.	1:35 – Groove decreases.	Both are after chorus which is what Kompoz group calls “the C part with the zombie dance.”
1:45 – Start moving.	2:36 – Groove increases.	
3:12 – Groove increases.	3:10 - Groove decreases with sax solo.	

3:27 – Groove increases.

4:02 – Stop moving.	4:10 – More significant decrease in groove where vocals drop out.	4:02 starts the C section of the song again where both agreed previously that the groove decreased or went away.
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Song 1 Phil

Song 1 Parker

My Notes

4:56 – Start moving.	4:57 – Groove increases until the end.	Picks back up when the drums come back and the song leads back into the A section (after 18 seconds).
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5:42 – Stop moving.	5:42 – Song end.	Both agree that the groove lasts until the song ends, thus agreeing that the A section grooves.
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Other notable times where I was moving more emphatically: 3:12 - drums, hi-hat 3:27 - drums, toms	I want to move at :18 when the groove settles. Picks up around :35 with the bass line added. Groove goes down around 1:35 when bass takes over melody. Back up at 2:36 with original groove restated. Back down at 3:10 with weak sax solo, down even more at 4:10 when drums drop out. Back up at 4:57 to end
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Table 8: Alignment of Groove Judgements (Song 5)

Song 5 Phil	Song 5 Parker	My Notes
1:03 – Start moving. (Same section but doesn't agree with Parker until the drums come in).	:55 - Start moving.	:55 offers the most space when the least # of instruments are playing, and the guitar is reinforcing the rhythm. At 1:03 the drummer plays a steady pulse that complements the rhythm.
1:40– Stop moving (drums totally drop out).	Vocals (1:06-1:10) – Stop moving.	
1:45 – Start moving	1:44 - Start moving (better with the bassline).	Bassist is playing the same pattern as the high hat on the drum. Bass drum is accenting the bass guitarist. Lead guitar is leaving space and only playing on the end of count three and the end of count 4.
2:15 – Stop moving.	2:28 - Stop moving.	2:15 is the end of the last section – and is the start of the same section that Parker is referring to. 2:28 - (start of guitar taking the lead. Leaving no space and not really playing along with the rest of the band).

Phil's Notes	Parker's Notes
<p>Definitely didn't feel either of these songs as much as the last few. Particularly on song 5, it was like a full sound assault coming at you the entire time...very few changes in volume, tempo, or other factors that would allow you to build up with the music. Not sure if that helps, but I figured I would vent because that crap kills me when I hear people play.</p>	<p>Groove died at 2:28 with lame guitar solo, and even worse at 3:20 when guitar destroyed the entire track. Just being honest here. Hope this helps. Now I need to listen to some PFunk to clear my head!</p>

Summary of Research Design, Data Collection and Analysis

This study employed a multiple case study method to examine the role of digital tools and social practices in achieving groove. Members of the Kompoz.com music community were surveyed, to identify projects where they have experienced flow, knowing that musicians can experience groove as part of the group flow state. Judges listened to each song and noted the times at which the song urged them to move, corresponding to times when the musicians created a groove. After the groove analysis, songs 1 and 5 were identified as projects where judges agreed as to the cause and timing of changes to the level of groove. The analysis in chapters 4, 5 and 6 showed how the musicians used group flow concepts (extrinsic goals and pre-existing structures) to coordinate their efforts and generate a groove in song 1. The analysis also

reviewed song 5, which was not as successful at creating a groove, to determine how the use of tools and social practices contributed to its diminished level of groove.

Chapter 4: Analysis of “Sentenced to Funk” (Case 1)

The following chapter provides background information for the case, and a raw narrative for a chronological account of the events that occurred during the case. After the time ordered sequence of events, how the group used discussion of the extrinsic goals and pre-existing structures to aid their collaboration is presented.

Background of Case (“Sentenced to Funk”)

“Sentenced 2 Funk” is an online collaborative composition started December 5, 2012 and completed with its final version being uploaded in March, 2013. The composition elicits the contribution of musicians from Geneva, the Netherlands, New York City, Jacksonville, North Carolina and Miami, FL, who contributed drums, bass and rhythm guitar, saxophone, and electric piano. The project took place on Kompoz.com, an online platform for collaborative music composition, that allows any instrumentalist or musician with Internet access and the hardware to record their instrument, to sign up for a limited free membership or premium paid membership.

Chronological Narrative

On December 5th, Paul posted an incomplete idea for a funk song called “Sentenced to Funk.” One of the first auditions to join the project came from Jim, who recorded himself playing bass guitar along with the most recent version of the project. Paul, the author of the collaboration, already included rhythm guitar, synth, and percussion in the track Jim mixed with his bass

audition.

Bass Audition

After uploading his audition, Jim tells Paul in the discussion board that he “couldn't make up [his] mind what bass idea to put up as audition...so here's 3.” Paul gives Jim praise for his idea and accepts it, telling him the things he would tweak to better serve the project.

Paul says “...so funky beyond my imagination man...no words for that...if we want 'to fine tune.' I would say: on the A-part, try to come with something smoother, maybe more simple? On the B part (strings break), leave it that way :pfff amazing..... on the C part, try to experiment: I love the mix of slap and speed walking bass u did can u try a more primus weird style??”

One onlooker community member, who will soon join the project, also submits a comment praising Jim's bass audition. FREDERICK says “[DAMN]! Nice work.” Paul replies, by thanking him and saying that he can't wait for him to join the project. Paul then gives Jim a bit more detail about his feedback, by more clearly labeling the parts of the piece targeted in his previous comments. Paul says “Jim, to give u a clue on the B part, I called the Zombie Dance.....(not the Michael's one[reference to thriller?] the Ugly one).” After Paul provides feedback, another onlooker community member logs in to pat Jim on the back for his bass audition.

Horns

The next instrument(s) that would be added to the song were the horns, and FREDERICK would

upload his sax ideas to audition for the project. Paul likes the contribution but has some feedback for FREDERICK that would make the contribution better suit his vision. However Paul is not a native English speaker, and he has to grapple with getting his vision across to FREDERICK in a text medium. Paul says “No problem, i was just asking if u could try the same line u came up , just waiting a time or two between the phrase , u see what i mean?kinda more percussive? Sorry i'm not english fluent and first time i'm collaborating on Kompoz”

FREDERICK tries to interpret what Paul means and replies “Something like 2 bars on and 2 bars off?” Paul indicates that FREDERICK’s interpretation was correct, and Jim chimes in to let FREDERICK know he did a good job with his audition, joking that he thought it impressive that FREDERICK understood Paul’s feedback. Paul laughed, and agreed that the sax playing was good.

Horns Part Two

FREDERICK re-recorded his horns and uploaded the new file to the Kompoz project. After submitting the idea, an onlooker community member immediately praised him for the idea saying “Sweet.” Jim also chimed in, saying “dope [FREDERICK]...☺.” Paul also chimed in, saying that he loved the modification to the horns as “incredible!!! The break is so sweeeeet....that’s in the box!!!! Sep plz!!!!!!”

After the horns were submitted to the project, the drummer recorded and uploaded his ideas, after receiving an invitation to collaborate. Paul responded to the submission by saying “Hi JOHNgreat drums thank you so much!!!!!! ”

Using the horns and bass in addition to the idea Paul submitted to start the collaboration, Jim creates another mix. Jim comments, explaining that he's changed the order (arrangement) of the ideas to get a "better build-up/introduction of instruments," but expressed that he wasn't quite sure of what to do with the part of the song with the string section.

Paul comments that he likes the bass, but the song still needs some keyboards. He says "the build-up intro would sound perfect if there were some keyboard fills instead of the current one I think.... still struggling to find some funky keyboards..." FREDERICK suggests a keyboardist to Paul in the Kompoz community that would fit his funk vision.

After receiving comments on this mix, Jim creates a mix incorporating the acoustic drums from JOHN. After hearing the mix, JOHN compliments Jim for the job he's done by saying "Wow , Fantastic Mix ! Thanks for tightening up my track!!! Groovin Track ..Man Awesome Bass !!"

Jim makes a version where the composition is lengthened, changing the arrangement and adding a clap/chant track to claps only from Jim. He sends invites to others to record clapping to make it sound like a crowd. Jim also takes the time to lay out the arrangement with a comment directly underneath the mix. He says, "I stretched out the arrangement to almost 5:00 min now...better I think for this kind of funky groove. Sequence is now: Intro 8x Verse 1 instrumental 8x funky slap 8x verse 2 chant& sax 20x orchestral break 8x funky slap 8x verse 3 chant& sax 16x funky slap 16x sax solo 8x verse 4 chant& sax 8x orchestral break 4x funky fingers 16x end/fade."

This extended mix was met widely with praise from Paul, FREDERICK and kompoz members

who aren't involved with the project. FREDERICK said, "Ausgezeichnet... er... fan-funking-tastic!!!" An onlooker said, "Really slick Jim. Great lines man!!! What a great groove...love the solo work too!"

During the next version of the mix, Jim adds the claps and chants that he's received from people, after inviting their contribution. Those contributing claps and chants praised Jim on the sound of the mix, and the contributions within it.

During mix version version 1.6, Jim turns down the clap/chant section, edits the drums and bass, and creates a guitar-less mix of the song. Using the guitar-less mix Paul re-records the rhythm guitar for the song and uploads it to Kompoz.

After the first attempt at recording the rhythm guitar into a file, Paul comments how he had issues keeping pace with the tempo during the first part of song. Paul says of his performance "Hmmm, hope u can come with something for my the messy start on the first 2 a part.... as I'm struggling with the tempo all along the track I definitely can't play the last b part more than 2 bars straight." He invites Jim to do what he deems necessary in editing to make the rhythm guitar sound good. Paul then asks about Jim's opinion on the second part of the song (b part). Jim responds, indicating that the guitars are okay, but the song needs content and the arrangement/placement of the ideas need to change. Jim says of the arrangement and recordings "Chants&claps are nice, but no more than filler (although Biff did his best to lively up things :))...the orchestral break seems misplaced to me at this point. The repeated horns theme and sax solo is the only thing really happening...not enough. I'm not sure where to go from here but it should go somewhere....lead vocal is the most obvious way (rap?) but a multi-

instrumental passing solos around kinda thing could also be. dunno..."

Paul told Jim that he could get a mic to add more voices and make it sound more like a crowd.

Paul also suggested adding a weird voice during the b part, like "part like the worms of Ohio brother or the horrible voice on Dr. Funkeinstein" or "passing solos on the a part with the crowd chanting?" Jim agrees with the weird voice idea, but says that he realizes he needs to record an actual crowd for the recording to sound like a live crowd.

FREDERICK chimes in and lets the group know that the chants could sound more like a crowd "by placing them in a wide stereo spread... pan one 50% left, another 50% right, one 60% left, one 60% right, etc." He adds that the use of reverb can also make it seem like each of the recordings are coming from a different place in the room. Reverb or echo makes an instrument sound like its further away, while less reverb makes it seem closer. Jim responds that adding a sense of space doesn't fix that the chants are not energetic, and do not create a "party mood." However, he agrees to try the technique.

Keyless Mix

Jim creates a mix without piano so that a member of Kompoz could fill their need for a pianist on the song. After receiving an invitation, Buck recorded his ideas on an electric Rhodes keyboard and submitted them to the project. After uploading the file, Buck says "here you go Jim - played all the way thru so you could pick what you'd like. Got a solo in there as well. Let me know if this works for you. GREAT tune!" Jim thanks Buck for the quick response and compliments the quality of the recording. Soon after, an onlooker community member praises

Buck's keyboard work (and the song), saying "oh my goodness! Buck has the funk too! Good job fellas."

Mix version 1.9

Soon after receiving Buck's keyboard recording, Jim worked the idea into a new mix with Paul's updated rhythm guitar part, claps and chants edited with FREDERICK's technique to sound like a crowd, and a stretched out sax solo. Jim also added a bass solo to the mix that he called the "classical bit." The musicians participating in the project commented that they loved the latest version of the mix, and Paul praised Buck's playing, saying "real cool Rhodes Buck btw!" Paul also praised the sound of the crowd by saying "Great mix Frederick trick working!".

Mix version 2.0

After updating the sound of the crowd in the mix, Jim creates and uploads another mix, with rhythm guitar that Paul re-recorded and feels is tighter. Jim also added body to the snare drums, and took away some reverb to bring the drums closer to the listener. Jim expresses that he's not happy with the bass solo and the chants in this version of the mix.

After listening to the mix, Paul says that he loves the mix, and that Jim should get rid of the chants if they're not working and keep the claps. Paul also asks where the bass solo is and what a group member is chanting a after saying "sentenced to funk." Jim responds, "1- the classical bit 2- sentenced to funk-no parol-I said goodbye," and Paul laughs. Buck listens to the mix and gives Jim praise for the latest version of the song saying "DANG Jim! Great job you guys!" An onlooker community member not participating in the project also listens to the mix and chimes

in, saying "Feeling the funk:) Great work..nice and tight!"

Following Paul's feedback on the location of the bass solo, Jim records another bass solo and plays with its placement, with an updated version of the mix. He follows his upload of the mix with this comment: "looking for an angle to insert a bass solo....might be over the top." Paul listens to the mix and gives Jim some feedback on the placement of the bass solo, saying "Crazy love it! I think it's just coming too quick into the song would be a perfect intermediate moment maybe just before the end part or after the sax solo..... so cool!!"

Jim agreed to try the feedback, and FREDERICK chimed in saying that he liked the solo and "felt a Zappa moment," comparing the solo to work by famous musician Frank Zappa.

Acting again on Paul's feedback regarding the bass solo, Jim changes its location to the end of the song (4:09), with the next version of the mix he uploads to Kompoz. He also turns down the guitar, and changes the panning (location from left to right in stereo) of the horns. Members of the group laud Jim's mix, saying "This kicks ass.... the sax solo comes in perfectly. Great elements throughout. The bass/crowd break is a cool interlude" and "great punchy mix! love the clear sound besides all these instruments! and this FZish moment is really refreshing!! like a walk near a purple lagoon....." referring to a song by Frank Zappa. A few community members also logged into the discussion board to offer praise, saying "Brilliant!!! My feet... moving... want more!!!" and "Freakin' awesome! There's a lot going on here and it's all wide open and clear."

For the final mix of the song, Jim adds some mastering, turning down the volume of the 5k

frequencies in the song by 2dB. He also cuts away some low frequencies from the bass and kick drum, and high frequencies from horns to further clarify the mix. Jim also adds a chorus to the song, and the mix is met again with resounding praise from his team members and other members of the Kompoz community.

Analysis of Extrinsic Goals and Pre-Existing Structures

The extrinsic or collective goal for these online collaborative composition projects is generally to make a good song that fits the vision of the project creator. A description of that vision can be listed under the creative brief section of the project. Paul lists his as a “a schizophrenic Funk 1 shafty EW&F style with a more Praxis\RHCP styles.” Those familiar with the bands Earth, Wind, and Fire (EW&F), Praxis, and Red Hot Chili Peppers can get a picture of some of the sounds the project creator would like to hear in this song.

The screenshot shows the Kompoz website interface. At the top, there is a navigation bar with the Kompoz logo, 'Collaborations', 'Community', and a search bar. Below this is a project header for 'Sentenced2Funk Funk', featuring a colorful, abstract illustration. The header includes the text 'Started by DocDaFunk, licensed as Creative Commons Attribution-Noncommercial' and buttons for 'Like', 'Follow', and a flag icon. A secondary navigation bar contains links for 'Dashboard', 'Files', 'Discussions', 'Activity Stream', 'Stats', and 'Spin-offs'. A red rectangular box highlights a section titled 'Creative Brief' with the text: 'A schizophrenic Funk 1 shafty EW&F style with a more Praxis\RHCP styles'.

Figure 23. Kompoz collaborative project dashboard.

Pre-Existing Structures

Pre-existing structures are elements within a specific domain that can be used to organize, coordinate, and pre-determine parts of a performance or group effort. The following three types of pre-existing structures are required to produce group flow, and were present in projects that produced a groove:

- Clear roles for the performers in the participating in the project.
- A set of tacit social practices governing interactions between group members
- An outline of what's to come in the performancer

The following sections will walk through each of these types (roles, social practices, outlines of what to expect in the song) of pre-existing structures and show how they were leveraged to produce groove in "Sentenced to Funk."

Clear Roles and Responsibilities

Table 9: Roles in this Case

Member	Role(s)
Paul	<i>Project creator, guitar, synthesizer (violin, keyboard), vocals, percussion</i>
Jim	<i>Bass, arrangement, mixing</i>
FREDERICK	<i>Saxophones (instrumentalist)</i>
JOHN	<i>Drums (instrumentalist)</i>
Buck	<i>Electric piano (instrumentalist)</i>

Roles within collaborative music composition projects are often quite fluid, and are filled as a need emerges, given a specific vision for a song. The project leader/creator sets this vision for a song with a description of what he/she would like the final product to resemble, and will upload an unfinished idea as a starting point for the song. Musicians or instrumentalists are invited to collaborate or audition to join the project, by submitting their own contribution after hearing the unfinished idea. If the idea is one that doesn't meet the specification of the project owner, the auditioned idea is rejected. If it fits, it will be accepted and revised to best complement the song as it sounds

Jim: Couldn't make up my mind what bass idea to put up as audition...so here's
3.

Paul: Hmm... As a newcomer i think i haven't managed well my project....sorry but let's say the Dutchman killed the competition..... Jim first let's say i almost cryed when i heard this....So funky beyond my imagination man... no words for that i prefer ...the last 3-part changes we could stay with it.”

The mixer will take these ideas and merge them together in a way that fits the song. The mixer uses dynamics to make sounds louder or softer compared to each other. Panning pushes the sound closer to one ear or the other, while reverb makes a recording sound like it took place in

a room larger or smaller than the one it's recorded in. Reverb is also used to control the perceived proximity of the sound to the listener. The mixer will also use equalization, which amplifies or attenuates the boomy low bass frequencies, midrange (or mid) frequencies (where the majority of the spoken and human voice resides), and the high/treble frequencies that all sounds have. The arranger takes sounds contributed by the musicians and puts them in the order that best fits the vision of the song and the groove that they are trying to produce. In the first text segment below Jim, the mixer and arranger for the project, describes what he has done (panning, reverb and dynamics and equalization) to the constituent sounds in a mix to make them sound cleaner and more cohesive when mixed or played together. In the second segment, Jim arranges the contributions in a way that slowly introduces and layers the keyboards first and the drums second, before the rest of the instruments build tension and establish the groove. As we can tell by the segment below, the ownership of a role or a set of responsibilities is highly fluid, based on the talents of the contributors, and is not mutually exclusive with other roles. Jim took on the role of being the mixer/arranger because he had more experience than Paul in managing the project, mixing and arranging the musical contributions.

Jim : "... panned triangle left for a better balance with guitar :) again a different intro. less harsh mid-higs in bass plucking sound. more body in the snare allover less lowmid reverb/ dryer sound. "

Jim: "playing around with the arrangement. was shooting for better buildup/introduction of instruments. still not quite sure what to do with the E-/D part..(the orchestral break)."

Social Practices Governing Interactions between Group Members

Bastien and Hostager (1988) state that social practices for a group of improvisational performers include a set of behavioral norms and communicative codes. Behavioral norms are defined as “shared expectations of appropriate behavior and facilitate the integration of musicians” (p. 587), and their contributions to a composition within the context of collaborative songwriting.

Communicative codes are defined as communicative behaviors, words, or actions with an assignment of a meaning to that behavior. Communicative codes are used in improvisational performances to communicate with fellow band members while they are playing their instruments. However, in online collaborative music composition, it can be useful to communicate a desired sound or style.

First, how communicative codes are used in this project to communicate a style of play that meshes with the project creator’s vision are presented. Next, three behavioral norms are discussed that musicians in “Sentenced 2 Funk” used to sync tones and seps to establish temporal integrity, assigning one person the role of mixing, editing, and arranging contributions in a way that best suited the desired groove.

Communicative Codes

One musical structure used in face-to-face improvisational performance to promote group flow are communicative codes (Bastien & Hostager, 1988). Communicative codes are very short, easily understood phrases or gestures used to send performance-related messages to the group. For example, chorus directors frequently pat the top of their head to tell the group to

come back to the beginning of the song. In this project, members would use communicative codes in the form of references to specific artists or songs, to quickly describe a desired song. Below, Paul the project leader tells his bassist Jim that he likes the performance overall, but would like the last part of his contribution to be weirder, and in the style of a band called Primus.

Paul – “Jim ... if we want "to fine tune" I would say: on the A- part try to come with something smoother, maybe more simple? On the B part (strings break) leave it that way :pfff amazing..... on the C part try to experiment: I love the mix of slap and speed walking bass u did can u try a more primus weird style??"

Listen to the first 40 seconds of link below to hear the bass contribution that Paul commented on:

<http://www.Kompoz.com/music/collaboration/85689/file/331417>

Below is a song from Primus that showcases their style:

<https://screen.yahoo.com/primus-170014833.html>

Listen to the bass solo (starting around 4:11 mark) where Jim incorporates Paul’s feedback about playing in the style of Primus:

<http://www.Kompoz.com/music/collaboration/85689/file/359554>

Behavioral Norms

Seps and sync tones are sociotechnical tools that are used to ensure that all contributors’ musical ideas are inserted in the right place in the final song, while allowing the group’s

arranger/mixer to move and edit these ideas in a way that best fits the vision of the song. This type of “temporal integrity” is quite important, as the human ear can detect a delay as small as 20 milliseconds, and can affect the groove in a song (Jordà, 2002).

Seps (short for separates) are musical ideas that have been separated from the rest of the music they will be mixed with in a collaborative song. Many times, musicians will hear a song as it stands, and will send an audition of the musical idea they hope will be added to the collaboration. This idea is mixed in with the current version of the song, to give the project creator an idea of how the finished project would sound with his/her contribution. If the idea fits with the project creator’s vision of the song, he/she will ask for a sep. Project creators do this because it is difficult to separate two audio sources from one another once they have been bounced, or rendered.

[Sax ideas 2](#) uploaded by FREDERICK

Paul : incredible!!! tthe break is so sweeeeet!

Paul : that's in the box!!!!!!! Sep plz!!!!!!!

Bobby:.i will load a sep wave for the mixer dudes over, in any case rock on with your bad self my brothers in funk!

Once a sep is created and the musician’s idea parts with its context, it becomes difficult to tell where the audio should fit within the finished song. Sync tones are a short piece of audio at the beginning of any musical content uploaded to Kompoz. While all of the surrounding audio is excluded from the musical idea, the sync tone from the song stays to provide an indicator of where the finished song starts. The tone also serves as a visual marker, allowing the

mixer/arranger to synchronize the ideas by other musicians with the current version of the song, by lining up their sync tones. Sync tones are most often not aurally pleasing, because their purpose is to be visually distinctive from any other piece of audio in the project. Many times these tones are synthesized click tracks that sound four or more times to the tempo of the song.

“Sentenced to Funk” extended mix version 1.2

Jim: added handclaps and vocal/chant idea track. and a new sync tone arrangement and finding the right contributors/contribution for a deeper groove (Jim/inviting Buck/ReggieB/Bobby b).

In collaborative music composition, the group of musicians contributing to the song is in flux, and will often change along the way to incorporate the musicians that are most likely to be able to execute the project leader’s vision at the moment. In the extract below Paul, the project leader, listened to the current version of the song and realized that the project would be better if he could get a pianoplayer that could play funkier than he could.

Paul - *the build up intro would sound perfect if there were some keyboard fills instead of the current one i think.... still struggling to find some funky keyboards...*
FREDERICK- Really nice arrangement. See if Reggie might be funky enough for you on keyboards.

Jim, the mixer, invites Buck, a keyboard player, in the extract below, because he believes that his audition will fit better than the original keyboards for Paul’s funky vision.

Buck (keyboard player) - *“...here you go Jim - played all the thru so you could pick what you'd like . Got a solo in there as well. Let me know if this works for you. GREAT tune!”*
Jim - *“Great Buck! and thanks for the quick response [to the invitation to contribute]. I'll work it in with parts of original. Cool solo!”*

Mixers and arrangers will also keep the contributions that are most likely to groove and fit with the vision of the project, and reject the other ideas or portions thereof that do not fit with the vision. Whole ideas that do not fit the vision are often rejected and the musician is notified via private message. Musicians also only have one chance to audition for a project, and will put multiple ideas in one recording, to obtain better odds of an idea being accepted for the song.

Bobby (guitarrist) “...i kicked out some stuff, maybe you can use it, just cut what you like and paste ” (no public response – not incorporated into the final version of the mix)

Jim(bassist/mixer/arranger) - *Couldn't make up my mind what bass idea to put up as audition...so here's 3*

An Outline of What's to Come in the Performance

In live improvisational jazz performances, everything happens off the cuff, and there is no chance to revise a contribution or refer to some written document as a guide of what's to come. An outline of what's to come can be critical. In the case of online music collaboration, musicians have an opportunity to hear the current version of a song to understand how they can and should contribute. In this case, the arranger Jim took on two critical responsibilities: handling the versioning in the project, to ensure that musicians had access to the most current version of the song, and explaining where a musician's contribution fit into the finished product, by explaining the arrangement.

Outline for the Project

In the text extract below, Jim explains that he has lengthened the song to 5 minutes and gives

an outline to explain his new arrangement for the tune. He names each section by its sound (e.g. funky slap), and how many counts of four (8x means 8 counts of four) the section lasts in the song.

Jim: I stretched out the arrangement to almost 5:00 min now...better I think for this kind of funky groove. Sequence is now: intro 8x Verse 1 instrumental 8x funky slap 8x verse 2 chant& sax 20x orchestral break 8x funky slap 8x verse 3 chant& sax 16x funky slap 16x sax solo 8x verse 4 chant& sax 8x orchestral break 4x funky fingers 16x end/fade.

Versioning Practices

One important part of collaborative music composition is ensuring that contributing musicians have access to the most current, most appropriate version of the composition. This process, called versioning, is cited as the most challenging part of collaborative writing (Noel & Robert, 2004), and is still quite challenging for musicians collaborating in online communities like Kompoz.

Jim, the project's bassist, mixer, and arranger tackles this problem by manually adding a version number and description of the how the version uploaded is different from current versions.

Title: "Sentenced to Funk" extended Mix 1.2

Jim - added handclaps and vocal/chant idea track. and a new sync tone...since I stretched out the arrangement to almost 5:00 min now...better I think for this kind of funky groove.

When a contributing musician is brought in to replace an existing part or instrument in the song, Jim would mute that instrument in the original song and send that version to the musician. When the musician records their own idea, they won't have to compete with or get

thrown off by the previous idea. In the extract below, Jim creates a mix of the current version of the song, with Paul's original keyboard performance muted, so that Buck's performance on the keys will not have to be constrained by the original keyboard ideas.

*Title: Sentenced to Funk mix 1.8 keyless Title: Sentenced to Funk Rhodes Sep
Buck(keyboard player) - here you go Jim - played all the thru so you could pick
what you'd like. Got a solo in there as well. Let me know if this works for you.
GREATtune!*

Versioning practices are somewhat supported in Kompoz and other tools made for music collaboration. Gobbler (<http://www.gobbler.com>), a cloud-based music collaboration service made for sharing projects from Digital Audio Workstations and Indaba (<http://www.Indabamusic.com>), another online music collaboration community offer versioning support for music compositions.

Noel and Robert (2004) conducted a web survey with 41 respondents to capture their writing processes, difficulties and benefits of it, and the tools used to accomplish collaborative writings tasks. Writers in the study expressed that version control, reconciling different writing styles, and gaining synchronous access to documents were the most difficult tasks. The majority of the study participants expressed that collaborative writing was worth it, because they believed that it resulted in a better product than a work with just a single author.

While an asynchronous collaboration technology solves the issue of providing synchronous access to the most current version of the collaborative song, groups still struggle with version control and integrating a variety of playing styles and contributions while creating a cohesive piece of art.

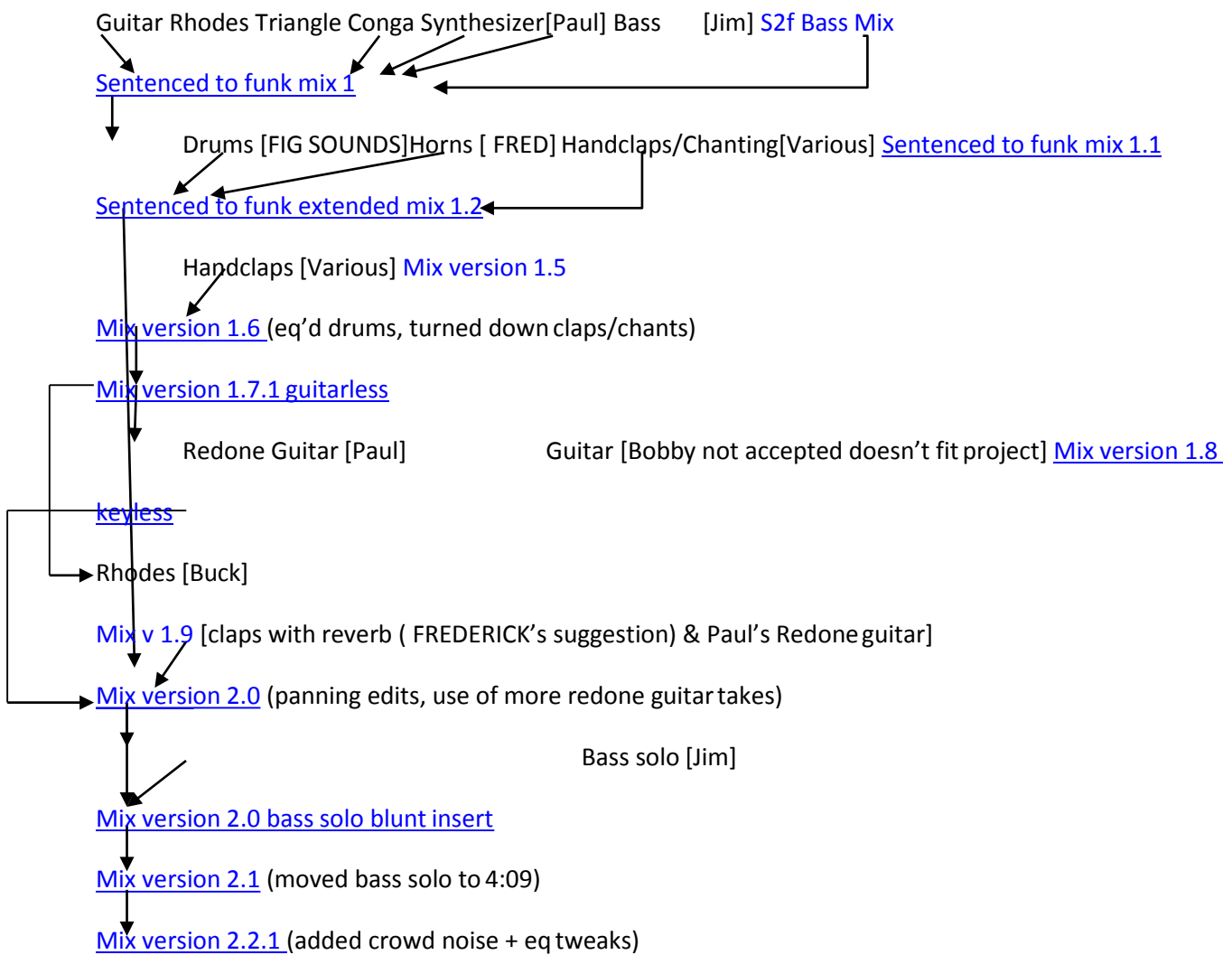


Figure 24. Chronology of mixes to show the evolution of the song.

Chapter 5 – Analysis of U Don't Care about Me (Case 2)

Background of the Case ("U Don't Care about Me")

"U Don't Care about Me" is a project in the funk/hardcore funk genre, that began on March 7, 2014, ending August 2015 on Kompoz.com. Seven musicians collaborated to make the song hailing from, Switzerland, Australia, Netherlands, Spain, and Greece, contributing bass, lead and rhythm guitars, Hammond Organ, electric drums, and synthesizer sounds. The case includes an account of the events in a raw chronological narrative, and proceeds with an analysis of how team members used extrinsic goals and pre-existing structures to facilitate the creation of the group's music composition.

Chronological Narrative

Jim posts a mix of the group's efforts so far, minus the drums and with an updated rhythmic guitar track from Paul, with the hope of trying to get a drummer to record some ideas for this song. Metro hears the track at its current state and is so excited by it that he says "I want to make the drums track...please, please!! Or I cry and stamp one's feet." He uploads his take on drums that he records on his electronic drum set. Jim tells Metro that, while he appreciates the idea (especially the pattern he plays on the bass drum), that he would like to have some acoustic drums on the record. Metro lets Jim know that his acoustic drums are in storage and it would be quite difficult to get them out and record something for the project. Hearing this, Jim tells Metro that he would like to hear what he comes up with in the future while he looks for

some acoustic drums to fill out the song.

Following this advice, Metro uploads another recording with his electric drums backing the song, and Jim states that he thinks the drums sound really cool. Metro says that he really loves the song and asks him if he's thought about making an R&B version of it. Jim gives it some thought and shares with Metro that he's been thinking about taking the song in the direction of something in the metal genre. Metro remarks that his newest contribution really helps to take the song in that direction, and he receives praise from Paul saying that the track is great work. After hearing Jim's comment that he would like to go in the direction of a metal song, Metro uploads another drum recording with that style in mind (mixed with the song at its current state). Metro's drum idea is met with a warm reception from people, including Jim, Paul, and musicians in the Kompoz community who aren't a part of the project. DawnP, an onlooker musician said "Damn!! Hotter then hot!! You gentlemen are on fire!! Love this" when she heard the drum idea that Metro submitted when mixed with the contribution of the other band members.

Metro then uploads a MIDI file of the ideas that he's uploaded to give Jim and others the flexibility to change the drum sounds to something that's more his taste, and to change the rhythm of the drums if he needs to. Around the time that Jim is working with Metro to solidify the drums for the song, Victor hears a mix of the song without lead guitar and states that he hears a melody and solo that he would like to add to the song.

Adding Lead Guitar

Victor uploads his initial lead guitar ideas for the song combined with the current mix. After Paul listens to the idea, he tells Victor that he likes the idea, but Victor is playing in a way that covers up the vocals that are present in the current version of the song. Jim also listens to the contribution and adds that he agrees with Paul's assessment of the track, suggesting that he should take a solo from 2:19 – 2:40 and 3:14 until the end to leave enough space for the other instruments on the track to be heard. Victor agrees and says "It was as if we are playing in live," which is interpreted to mean that you can't play over the contributions of other musicians (or step on each other's toes) in this online collaboration medium, much like a musician wouldn't do if he/she were playing or singing on a stage.

Victor goes on to record another idea for the lead guitar on "U Don't Care about Me," however after Jim listens to it, he realizes that Victor records his solo outside of the bounds that he suggested in the previous upload. Jim reiterates that he would like Victor to play from 2:19 to 2:40 and 3:14 until the end, so he can have some space to add a part where he is playing his bass, making it seem like they are dueling. Victor agrees and says he will upload the two parts tomorrow. Jim repeats the regions where he would like Victor to play, just to be sure that he understands, and tells him to make sure that he leaves "a gap or a long note here and there," so that there is room to provide a response with his bass playing. After re-recording and uploading his solos, Jim and Paul show approval of the contributions, yet give no feedback on the discussion posts stating that he should change them.

Adding Synth and Organ

At this time Greg also uploads his contributions to the song which were recorded parts from the

Hammond organ, a synth background for the middle of the song/outro, and some synth stabs (quick, short notes such as horns on the intro of Al Green's "Tired of Being Alone") for the verses of the song and the end of choruses. Jim and Paul thank him for his contributions, and let him know that he will work the synth stabs into the next version of the mix, without indicating that he needs to make any revisions before doing so.

The next version of the mix that includes evidence of Greg's contributions (synth and organ) is the archived version of mix version 5.7. However, one available mix, which was also archived version 5.6 of "U Don't Care about Me," precedes that version of the song.

Balancing the Contributions in the Song

In this version of the song, Jim states that he has an issue with his programmed drums feeling mechanical, and tries to remedy that by adding variation to the part he has recorded. Jim reaches out to his group to judge whether there are any other places in the recording that feel mechanical. Paul says that he's thinks the drums sound cool, but says they'll be tough to double with the triangle (possibly a comment about the busy nature of the drums). Jim responds that "the drums could do with a little triangle ☺" (an inside joke amongst the members in the project).

After uploading version 5.6, Jim takes some time and uploads another mixed version of the song (version 5.7). Jim asks for the group's thoughts on the job he's done mixing the most current version of the song. Paul comments that "the main riff [Paul's rhythm guitar] sound better and Freddie [lead vocalist] is more in front [easily heard]," and that the mix is almost

done! Jim comments that he's made "lots of little tweaks, but could use a set of fresh ears." Jim says this probably means that he has heard the song quite a bit, and can use some perspective from someone who hasn't been as close to this mixed version of the song. Paul agrees that a fresh set of ears can be useful to evaluate the mix, and says "let's wait for Capt and Co," the rest of the group to comment on the mix. Greg checks in to give his opinion on the mic, and states that the lead guitar should fade out to give room for the vocals during the first vocal line, the background vocals on some phrases are gone, and the lead guitar is too loud from 2:14 to 2:42. Jim says in response to Greg's feedback that "the lead guitar at the intro didn't end its phrase...that's why I faded it into the vocal," and that he would increase the volume on the background vocal. Jim's response indicates that the last version of the lead guitar he received before making this mix still stepped on the toes of the lead vocalist at the intro, by playing over. Jim also went on to disagree with Greg's feedback that the lead guitarist's volume is too loud during the solo by saying "I think that lead [guitar] needs to be that loud.... Thanks for listening and commenting...although I might not agree on all comments I really appreciate the feedback." One onlooker community member states that the mix is good work, and the lead vocalist states "sounds awesome to me guys. I love what you did with the vocals too."

Still Searching for Acoustic Drums

At this point in the song (October 2014), Jim is still searching for acoustic drummers to record a part for the song rather than relying on the computer programmed drum part that is backing the song. Bob, another drummer in the community, knowing that the song needed drums, uploaded his drum ideas for Jim's review. Bob is worried about the fact that the drums are too

rocky for Jim's taste and the direction of the song. Bob also tells Jim that he had a few issues with timing while he recorded his drums for the song, stating that the recording was sent "warts and all" without editing.

To work out some of his timing issues, Bob asks Jim whether the tempo of the track was 120 or 119 beats per minute, and says that he didn't record with a metronome (allows the musician to keep track of the tempo, and make sure that it stays consistent). Jim tells Bob that the song was recorded at 120bpm and asks if he had any problems with synchronizing his contribution to the current mix of the song. Bob states that he set his recording software (Cubase, as he is using electronic drums), to a tempo of 120 bpm, and the recording was still going out of sync after 20 seconds. Bob suggested that maybe the drumless mix of the song was in a format that may affect the synchronization (MP3 rather than WAV). Jim and Paul tell Bob that the drumless mix is already in WAV format (which wouldn't affect the timing of the recording), and Jim expresses to Bob that he would prefer to have acoustic drums on the song. Bob tells Jim that he doesn't have a recording setup for his acoustic drums, as it costs over 2500 GBP to get his new drum set. He goes on to state that it would cost another 800 pounds to get the microphones and recorder he needs to record his acoustic drums. Though Bob can't take on acoustic drum duties for this song, he tells Jim that Mark, is a great drummer in the community that does have a good recording setup for his acoustic drums.

Though Jim hasn't found acoustic drums for the song he feels that it could use a piano solo and uploads an idea that he's recorded to fill that role. After Jim posts the solo, he asks the other members in the group what he should do with the idea. Jim says "multiple choice: a- bad idea,

dump it. b- good idea, bad performance, invite keyboard player for redo. c- perfect! put it in the mix and be done with it. d- leave me alone.”

The members of the group overwhelmingly voted to keep the idea, with Paul saying “Bwahahahah!! C all the way!!” and Freddie, the lead vocalist, saying “C Baby...have we sold this and made a million bucks yet?” Paul responds by saying “Shhh!!!! Jim believe we still haven’t finished yet!” Jim laughs and says that the track is almost done, and Freddie responds that he can’t wait to show off the track on Facebook.

The conversation regarding the following mixes that incorporated Jim’s ideas on keyboard illustrate why he wasn’t ready to mark the track as finished.

Jim posts version 5.8 of the mix, where he brings back the backing vocals on the chorus, following Greg’s suggestion on the last mix, and made the organ and synth stabs 1dB louder. After seeing the post, Paul comments that Jim “got the keys right” and that he loves the mix. Greg adds that the track is “falling into place”, and that Jim has done a great job with the mix. However, Greg still feels like the lead guitar “is 1 or maybe two 2dB too loud...sit[ing] on top of the mix [meaning that it’s heard over the other instruments], stronger than the vocals”. He goes on to say, after bringing the loudness of the guitar down, the mix will then be finished.

Jim responds by saying the lead guitar needs to be as loud as it is, and that the background vocals with the harmonies are covering up the lead vocals. Despite Greg’s critiques, an onlooker community member took the time to listen to the mix, and comments that the song is a “great tune [that is]...very well put together.”

In the following version of the mix (version 6), Jim simplifies the rhythm of the drums and makes them more prominent by shortening the reverb effect applied to them. Jim also edited the rhythm pattern of the hi-hat cymbals and made them louder, added his bass solo to the mix, and decreased the overall loudness of the track by turning down master compression. Paul comments that the track sounds awesome “but it lacks a little ‘in your face’ sound.” Jim asks Paul if he feels that the previous mix sounds better, and states it’s probably due to the master compression. It can be fixed by having the track mastered. Paul responds that the previous mix was more powerful than the current version of the track. However, Jim responds that the bass, guitar, and drums get lost in the mix when the overall song is pushed to be louder. The solution is likely not making the song louder. He goes on to say “excellent mastering would be nice at this point...” however the group doesn’t have someone participating in the project that is proficient at that task.

Jim tries his hand at improving the mix, by lowering the background vocals to bring out the lead vocals, and also master the track. Greg also uploads his attempt at mastering to the project, but it wasn’t accepted as the final version of the song.

After Jim and Greg uploaded their mixes, Frank was invited to master the recording. Frank is an experienced community member who is often asked to mix and master collaborations on Kompoz. Frank accepted the invitation and applied his mastering tools to Jim’s most recent mix.

After hearing Frank’s mastered version of the song, Jim said “this must be the one...unless Mark decides to redo the drums,” and asked Paul if he felt the same way. Paul agreed, stating

Frank did a “SUPERB JOB,” and remarked that this version was so good that he must have listened to it about 20 times. He also stated that he missed having Corey’s acoustic drumming on the project, after listening to the mastered project. The lead vocalist also lauded the sound of the track along with an onlooker community member. Bob also tells the group that the song sounds great, and that he has a recording setup for his acoustic drums. Bob says that he can’t promise the quality of what he will play, but he will give it a shot. Paul responds excitedly, “Hey Bob!! There's already a drumless for this version!” and tells him to have fun. The final version of the song and the file repository don’t offer evidence of Bob’s acoustic drum recordings making it into the song. Frank’s mastered version of the song was marked as the final version for the project.

Extrinsic Goals

A creative brief provides direction and inspiration, and defines your goals and objectives. The

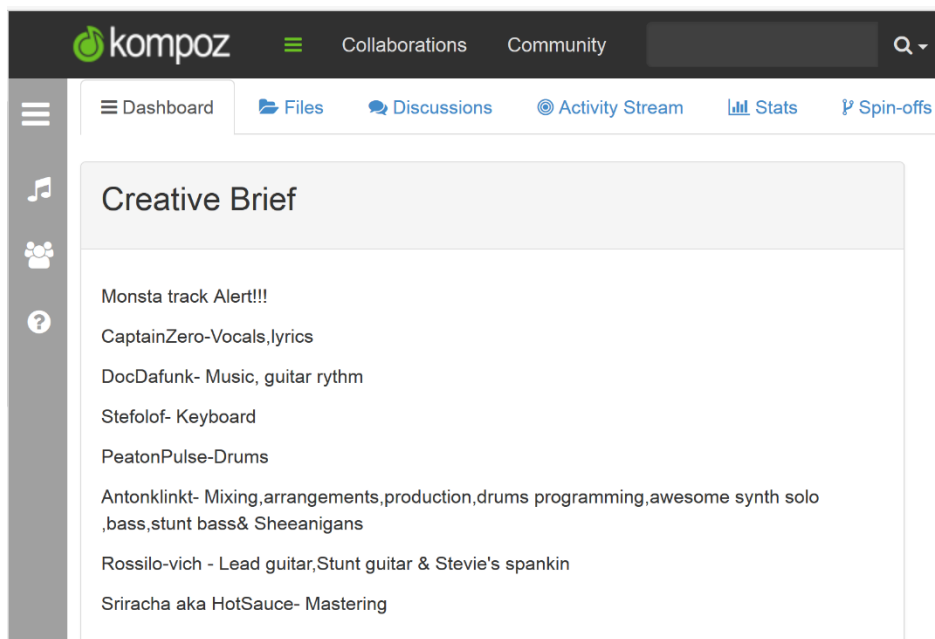


Figure 25. Creative brief for “U Dont Care About Me.”

creative brief can be used to share the mood to capture, musical influences, or lyrical ideas.

From <http://www.Kompoz.com/music/helpcenter/tutorial/57>. Unlike the first case in the study, at the time of data collection, the project did not list a creative brief that could be used for guidance, but instead listed the roles of the contributing collaborators and an appraisal of the completed song.

Musicians typically rely on some guidance from a composer or session leader to get a mood, feeling, or theme that can be used to guide stylistic choices that they will make in their contribution to a song. Collocated groups of musicians who are rehearsing can have a conversation before hand about the direction of a song they're creating, or stop and have a conversation to iron out any misperceptions about the direction of a song. However, if the direction of a song is not clearly communicated upfront, the project manager or creator must talk with every contributing musician about their vision for the track and whether the contribution fits, or reject the contribution outright. Other band members must read the comments section/feedback of every uploaded contribution to be made aware of changes in that vision, and make future contributions that align with that vision. For example, during this track, Jim shifted the sound of "U Don't Care about Me" to shift from R&B and funk to incorporate some sounds from the metal genre. Jim's desire to incorporate metal in the song was expressed, in the comments section of a drum idea that was contributed to the project.

[u don t care Drums](#)

1yr+5mo
ago

Comments:

Jim commented 1yr+5mo ago

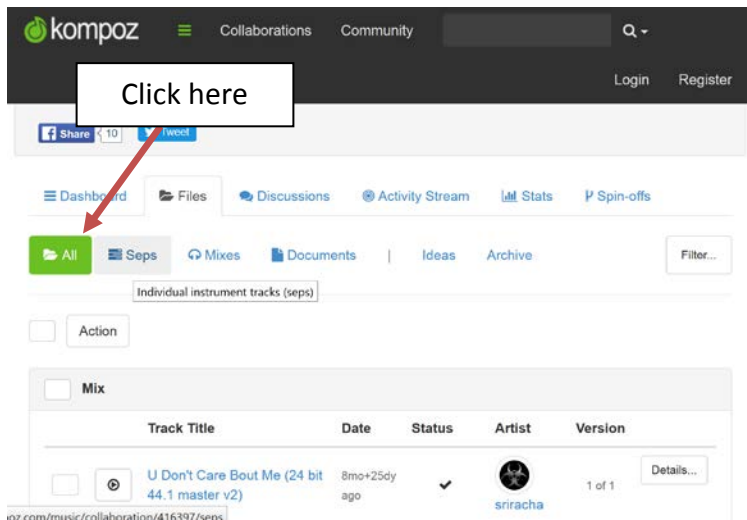
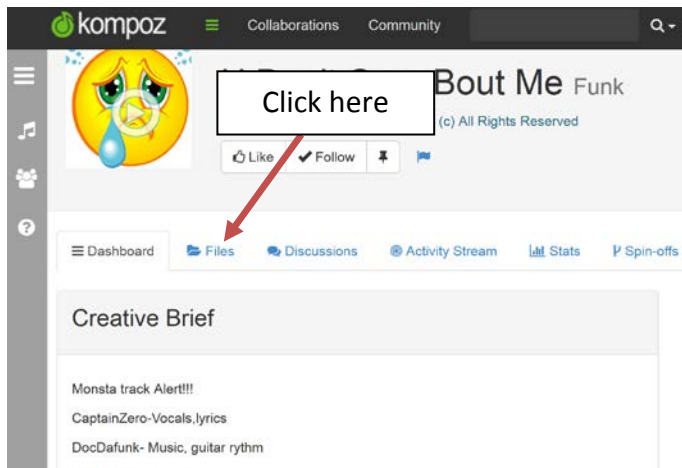
This is kinda cool! it has got a marching feel I didn't expect.

Metro commented 1yr+5mo ago
Thanks Jim, I love this song. Have you think on a R&B versión?

Jim commented 1yr+5mo ago
I was more thinking towards metal... \m/

Metro commented 1yr+5mo ago
Now is metal...no?

From the dashboard (or project homepage), a project collaborator would have to go through the following screens in order to see that comment from the project manager indicating his change in vision.



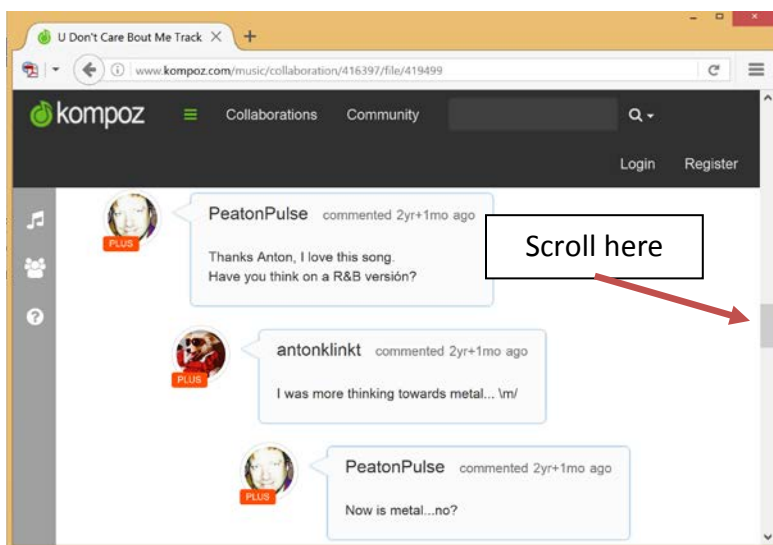
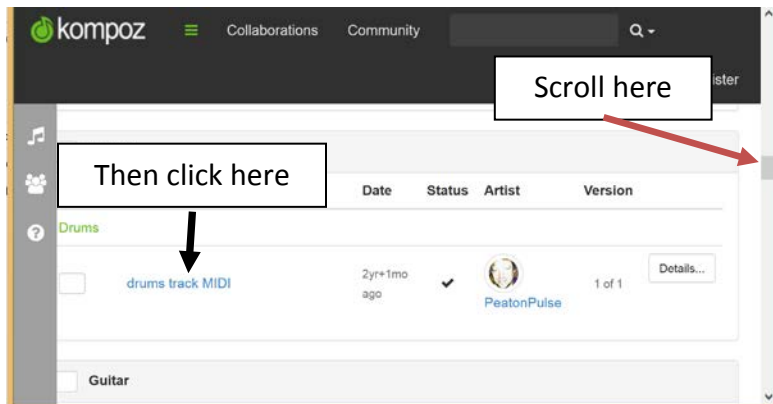


Figure 26. Screen sequence of feedback on a musical idea.

Alternatively, someone participating or interested in the project could receive an e-mail alert every time a file is uploaded or a comment is submitted to that project, to see the conversation between the project manager and drummer. In face-to-face settings, a bandleader would just stop a rehearsal and have a short conversation that is heard by all members to talk about pursuing another direction for a song.

Pre-Existing Structures

Pre-existing structures are the bits of information provided to collaborating or contributing musicians that serve to structure and pre-determine their output. These guidelines are in place to give guidance, so that musicians can play well together, without clashing with respect to timing, note choice, or style of play. The three pre-existing structures mentioned on the projects were genre, key, and tempo. However, they also include social practices for interaction between members, clear roles for each musician, and an outline of how the song will proceed (arrangement).

Table 10: Pre-Existing Structures for “U Don’t Care About Me”

Type	Values
Genre(s)	Funk, Hardcore Funk
Key	D Minor
Tempo	120 BPM

A genre can give a musician a very broad idea of what stylistic choices may be appropriate for a song, and a broad picture of a targeted sound. Musicians also indicate genres that they are comfortable playing when they complete their user profiles. Kompoz.com will automatically send an e-mail to musicians when a project has been created in their preferred genre that has indicated that it needs musicians with talents listed in the profile. The genre for this project was hardcore funk and funk at the time that the data was collected for the study.

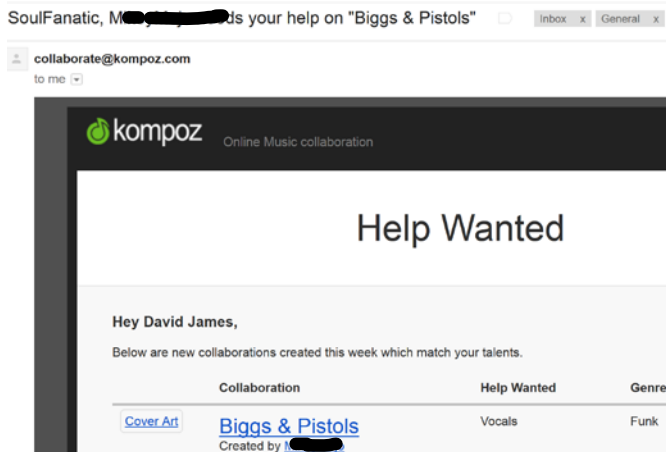


Figure 27. Email from Kompoz matching projects with musicians.

The key will specify the eight notes that a musician can play during the course of the song that will be harmonious with his/her collaborator’s ideas. The tempo (counted in beats per minute) will set the pace of the song and serve as a tool to synchronize the playing of the musicians in the project. However, a tempo mismatch on one musician’s digital audio workstation caused a synchronization issue that may have kept him from participating.

Table 11: Roles of the Participating Musicians

Musician	Role
Jim	Mixer, arranger, bassist drum programmer, synth player
Paul	Project Creator, Rhythm Guitarist
Greg	Organ (instrumentalist)
Victor	Lead Guitar (instrumentalist)
Frank	Mastering (instrumentalist)
Metro	Drums (instrumentalist)

In this case, the responsibility of managing the track and arranging the ideas fell upon the project creators Paul and Jim, with Jim doing most of the heavy lifting (arranging, mixing and choosing which ideas to accept). This distribution of the responsibility of leading the project is the same as the previous case, as Paul doesn’t trust his ears (over Jim’s) to mix the musical

contributions for the project or arrange the ideas.

Jim commented 14 days ago

Paul, you think the prev mix sounded better? Probably the master compression. After a while, I found that tiring on the ears...easily fixable with some mastering. Or is there something in to the mix not right for you?

Paul commented 14 days ago The previous mix is more powerful , yes

Paul commented 12 days ago

Honestly i shouldn't be allowed to give my opinion sound-wise , i'm now livin' in the swiss mountain and my ears are stuffed 365days a year ... so u decide what suits better!

The only new role that appeared in this case was the task of mastering the final version of the recording. Mastering is the process of preparing a track for mass duplication, which includes using equalization compression and other editing tools to make the final product as clear and noise free as possible. Mastering tools do not work with the individual instrument tracks, but works with a final mixed copy of the song. This process is much like adding the icing or the glaze on a cake. While the ingredients aren't changed after the cake is baked, there are a few things to do to make the taste and appearance of the cake better. Jim remarks above that he is bothered by the overall loudness of the song, which can be addressed by mastering tools. However, this is not his area of expertise and he invites another member of the Kompoz community into the project to complete the task of mastering.

Social Practices Governing Interactions between Group Members

Sync tones and Seps

Seps and sync tones were used in both cases as a tool to ensure that all ideas could start at the exact place in the song that the musician dictates. The sync tone consisted of four clicks (counting the beats in each measure) that proceeded at the tempo of the song (120 bpm). Once Jim, the project manager, imports all of the tracks with a sync tone, he has to make sure the tones visually line up to ensure all of the contributions from the musicians in the project are synchronized. Below is an example of Jim asking the lead guitarist Victor to send a sep (or recording of his playing separated from the other instruments) of his lead guitar idea.

Victor- commented 1yr+5mo ago

the guitar solo begins with a hammer for playing together with Jim. it is not very complicated. After that I am going crazy, It amazing. I can't tying myself. Please, if you consider I could record again not too "on live"

Paul commented 1yr+5mo ago

i like it!!! Now it's more Jim's feedback who's important, let's see what he thinks!
But anyway u're killin'

Jim commented 1yr+5mo ago very cool. Sep 'm up please

Communicative Codes

Using Artists or Recordings to Provide the Description of a Targeted Sound or Style

In live face-to-face performances, musicians must play their instruments and simultaneously communicate with their band members to coordinate the performance. Hand gestures, signals, and words are used to make this communication happen during shows. In both this case and the previously studied project, we see that references to musicians and recordings have been a successful communication device, to give others a description of a sound that the band has

achieved or would like to target. In this project, one of the auditioning drummers makes a reference to a David Lee Roth recording called “Showtime” (TheManFromCabo,2014) , to ask whether they would like to continue in that style for the drums at the beginning and end of the song. After this quote, Paul the project creator, uses a reference to Steve Vai (written as Stevie in the quote, a famous rock guitarist) to show his appraisal of the contributions his lead guitarist submits, in the project’s creative brief.

Bob commented 10mo+19dy ago

Oh my word! So what bits on your current drum track do you guys like / dislike? Are you locked in to the David Lee Roth Showtime shuffle intro / outro? It's a great track to rock out to (I did last night for an hour) - just wondering what - if anything - I would do to improve on it?

[Paul:]

Victor - Lead guitar, Stunt guitar & Stevie's spankin

An Outline of the Expected Performance

One important organizing discussion that must occur lays out the arrangement of the tune. The project leader or team member assigned the responsibility of arranging must let players know in which parts of the song their ideas will be placed. Alternatively, the part of this job that is arguably more important is making contributing musicians aware of the portions of the song where they shouldn’t play.

One difference that occurs between this track and the previous case that has more groove is that the guitarist is playing in sections of the tune where the leader of the session doesn’t want much lead guitar.

Here Jim asks Victor, the lead guitarist, to re-record, because he needed to leave space for the bass guitar to echo and respond to the guitar solo, by saying “please leave me a spot.” He soon reiterates the point below to let the lead guitar player know how important it is to have that space, so that it can sound like the bass and lead are dueling. The bass playing is already pretty dense (but very good), and Victor’s playing is also quite dense as well. If Victor does not follow Jim’s guidance, it will be difficult for the bass to be heard. In the final version of the mix, the guitar still occupies most of the aural space in the song.

Paul and Jim both liked the solo’s the lead guitarist plays over most of the song with the exception of one portion of the recording. Paul gives feedback that the guitarist must leave space for the lead vocalist by not playing while he sings, but generally likes his playing style. Paul even goes on to encourage him to play more free, and crazy.

Victor- commented 1yr+5mo ago

Hi, It is a idea. I would like to try some guitar solos for the main solo. There is a part where I didn't play nothing, but if you like the second guitar sounding, I could play on that part (from 1:38) also.

Paul

i like what you're doing but u can't play at the same time as the voice! But yes that's the spirit!! some fills could be cool on the slow part(01.38 to 02.10) but u need to let the voice sounds.... i love the craziness on the solo!!! Muy rico!

Jim commented 1yr+5mo ago

I agree with Paul. maybe do some small riffs where the vocal leaves gaps, first solo 2:19~2:40 , grand finale solo 3:14~end... (better skip the bass solo there) I like the vibe/tone and the weird guitar left at 2:10

Here Jim, the project manager, provides Victor a second reminder to leave space for the other

players. Both judges indicate that the groove on this track died once the song hits the guitar solo sections that Jim is referring to in his discussion post (2:19 -2:40 and 3:14 until the end).

Jim commented 1yr+5mo ago

sounds great but can you try what we talked about earlier: first solo 2:19~2:40 , grand finale solo 3:14~end (I've just put up a version without the bass solo) <http://www.Kompoz.com/music/collaboration/416397/file/416568> I'll add some bass solo parts in the second solo later as a sort of guitar/bass duel ...(so...please leave me a spot and be gentle :)

Victor commented 1yr+5mo ago

Not problem. Then, I will record a new solo again. I will upload tomorrow.

Jim commented 1yr+5mo ago

Cool. Just to be sure ; it's 2 solo's; -1 from 2:19 till 2:40 ...I can use the one U just uploaded but I think you rather redo it than have me cut it...(it's a bit too long) -2 from 3:14 till the end...and keep in mind we're going for a little duel...so leave a gap or a long note here and there... get it? ;)

While the guitarist is at fault for playing out of place in the arrangement that the project manager is establishing, the technology could do better to provide a visual representation of the arrangement rather than simply text in a discussion board, so that musicians don't forget where they should contribute. Soundcloud.com is a site that will host music files that people upload for the purpose of sharing with other online users. When users comment on tracks in Soundcloud, they are automatically inserted into the waveform so that the comment is lined up with the point at which the song was playing when the comment was made. Similar functionality can be used to denote what the arrangement of the song is directly on the songs waveform/timeline, and visually show the sections where an instrumentalist should play.

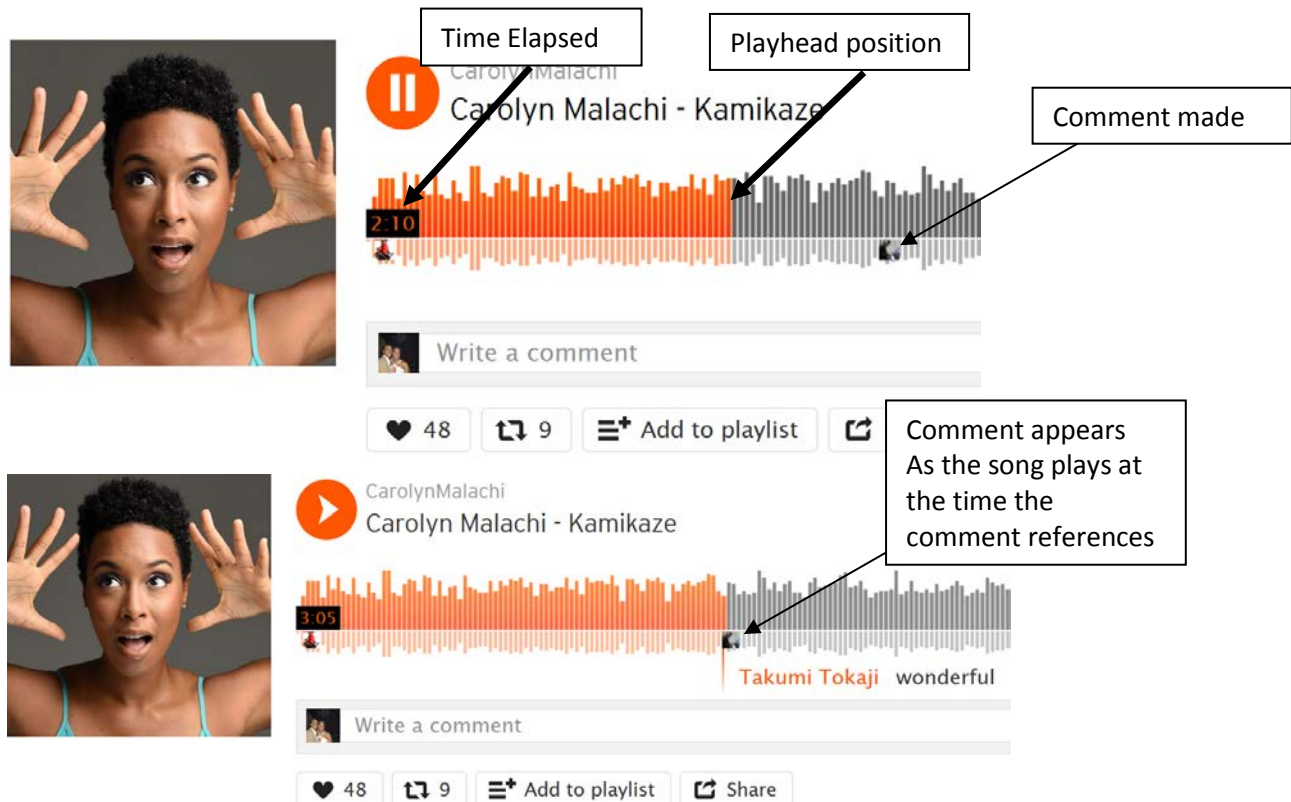


Figure 28. Example of comments attached to a song timeline

Summary

This team of musicians used extrinsic goals and pre-existing structures such as seps and sync tones to synchronize contributions, communicating the roadmap of the song or the arrangement to the contributing musicians. They also created versioning schemes to help create groove. On the other hand, the extrinsic goal or vision changed in the middle of the project, and that shift may not have been communicated in a place that was clear to the group and newly-joining contributors. The lead guitar player didn't mesh as well with rest of the band, and didn't provide much space to hear their contributions. The judges identified that contribution as the reason for decreased groove. However, the lack of available drummers and the cost of hardware to record drums also contributed to the diminished groove.

Chapter 6: Post Hoc Analysis

What Tools and Strategies are Used to Increase Groove in Digital Collaborative Recordings

Although group flow is an appropriate theoretical lens to understand the musical interactions and social practices that take place to build a groove, the theory was built on analyzing the real-time interactions of performing jazz groups that met face-to-face. In collaborative music compositions, musicians must first create a shareable representation of their work in the form of a digital file that can be sent to colleagues and integrated with the accepted musical ideas of the group. This step is not required in order to improvise and write music in groups that collaborate face-to-face. A number of factors were observed concerning the digital tools used to create these representations that could impact the groove in a project.

Table 12: Use of Tools that Help/Hinder the Project

Tool	Purpose
Compression, EQ, Panning, Volume Automation	Creating space or separation between the instruments so that all performances can be heard. Also used to control how prominently each instrument is heard throughout the song.
Seps and Sync tones	Ensures that all musical ideas are synchronized.
Audio Compression	Negatively affects groove by adding silence to the beginning and or ending of the track. This added silence can potentially throw off the synchronization of the ideas in the song.
Drum Programming/Metronomes	Could negatively impact the groove by creating a rhythm that is too uniform, and feels artificial. Programmed drums often have to be humanized by getting rid of "perfection." Humans do not hit the drum

	with the exact same force every time, or play a rhythm idea the same way every time. At times music that doesn't have these variations, don't motivate us to dance.
Arrangement	The human ear likes variety. Ordering musical ideas in a way that causes the overall volume, energy, and harmonic content to climax and fall throughout the song, generates interest.
Versioning	Collaborators need to add their contributions to the version of the song that is the most current and appropriate.

Sound can occupy three different dimensions: volume, frequency, and horizontal space (or panning). Two sounds that have the same frequency or pitch can be heard at the same time if they take up a different location in horizontal space (% of sound in the left and right ears).

Below are strategies that can be used to ensure musicians who are playing at the same time are all heard as clearly as possible, also called achieving instrument separation. This is important in creating groove.

1. Musicians limit the frequencies played by their instruments that overlap with the fundamental frequencies of other instruments.
2. For example, most lead and rhythm guitar players avoid using the two lowest-pitched (or bass) strings on their guitar when playing, because they would compete with the notes and frequencies that a bass player would play. Similarly, piano players may avoid playing below a certain note on their instruments, to stay clear of the low-pitched instruments (e.g. cello, double bass, bass guitar)
3. Musicians can provide more space for their colleagues to be heard by just playing less often

during the song.

4. For example, rather than playing a whole note each measure that would take up all the allotted time in a song, they could play an eighth note (taking up 12.5% of the time), leaving 7/8ths of the measure (87.5% of the time) empty to be filled with the ideas of other colleagues.
5. All of these principles can be done with varying effects after the song has been recorded with mixing and editing tools (i.e. EQ, compression, and volume automation). However, it is significantly easier to fix these issues with the play of the musicians, rather than fixing them after the sounds have been recorded. Fixing issues in the mix is much like taking a picture that doesn't have enough light, and using the brightness and contrast tools in Photoshop or Microsoft Paint. The photographer can also appropriately turn on a light and position before the picture is taken.
6. Make sure all of the instruments take up a different area of horizontal space at the mix stage with panning tools. An instrument panned 100% left would be approximating the sound of being at the left edge of a stage. An instrument panned 100% right would approximate being on the right edge of the stage, by only playing in the right ear. A sound panned 50% left, 50% right would play evenly in both ears, and would represent someone playing in the absolute middle of the stage.

As with all subjective phenomena, rules and guidelines are meant to be broken. Phil Spector, a producer and engineer for the Beatles, was known for his technique called the Wall of Sound, which placed all of the instruments in the same physical space.

Two sounds with the same frequency content in the same physical space will have their amplitudes add together to make a louder sound. There is a physical limit to the loudness of any sound (at 0dbfs), where the audio will become harshly distorted, if it gets any louder. This upper limit of sound intensity keeps from having too many sounds with the same frequency playing at the same time. Much like walking into a classroom where everyone is talking at the same time, the only way to be heard is to talk louder than others. The volume of a recorded track over time can be controlled by two techniques: compression and volume automation.

The purpose of a compressor is to even out the intensity (volume) of a sound over time. This is done because one can't simply turn up the overall volume level of a song to make the quieter sounds louder, since the louder sounds will also increase in volume and eventually distort once they reach 0dbfs (Apple Inc, 2010).

Compressors are controlled by setting a volume level called a threshold, above which the audio is attenuated by a value called the ratio. As the compression ratio increases, the compressor more intensely limits the volume once it crosses the threshold.

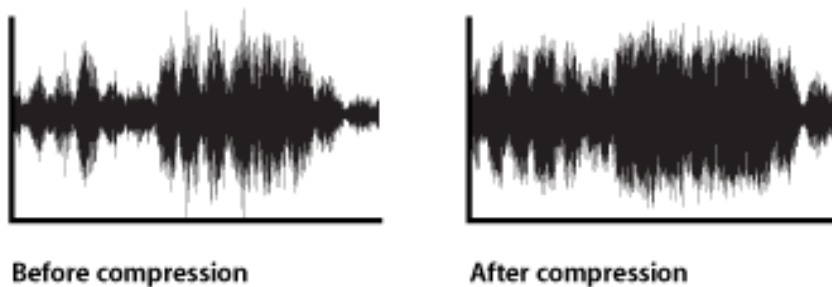


Figure 29. Illustration of how compression works. From (Apple, 2010).

Volume automation lets audio engineers draw a curve where the volume level is on the Y-axis and time is on the X-axis. After the curve is drawn, the digital audio workstation uses the Y

values to set the volume for that track over time. As an instrument gets louder compared to others in the recording, it becomes more prominently heard. However, if it is too loud for too long, it can cause fatigue for the listener. Instrument tracks with a lower volume level will sound less prominently heard, compared to the other instruments in the mix, as if played in the background. Volume automation is a good way to control how prominently an instrument is heard over time, and can also be used as a tool to edit out part of a performance without permanently deleting it, by setting the volume to zero.



Figure 30. *Illustration of volume automation. From (Bennett, 2005).*

The following sections show how digital tools augmented or took away from the groove in this project.

Tempo and Its Effect on Groove

Metro, a drummer for the project, provided a MIDI file of his rhythms on the electric drums and invited the rest of group to use it as they saw fit. Jim used that file as a base and took away kick drums to simplify the rhythm. The tempo (120 beats per minute) ended up being quite critical, as another drummer (Bob) ended up trying to record another version of drums over the track. After listening to the percussion idea he recorded for the project, Bob realized he had trouble

getting synchronized with the rest of the musicians. This can quickly become bothersome, as the human ear can detect delays in timing that are as small as 25 milliseconds (Jorda,2002).

Cubase, much like other DAW's, allows tempo to be entered for drums or any other instruments programmed to play. However, if the tempo is not set to the same value as the tempo in the collaborative song, the synchronization the two pieces of music will begin to drift apart.

Hence why Bob says about 20 seconds into the music that the click started to "push," or play out of sync.

Bob commented 10mo+4dy ago

Q> What temp is this recorded at it's not 120 or 119 - it's in a spooky hinterland somewhere between the 2.... I've recorded this without a click but it would be good to have it for the next take :)

Jim commented 10mo+4dy ago

120..quite sure...you had sync problems?

Bob commented 10mo+4dy ago

yeah even lining the 4 click intro up, as best I could, about 20 seconds in the click was pushing... I assumed it was slightly less than 120.... Pfffff..... Cubase (rolls eyes)

Jim wanted to obtain good drums for this track. However, Bob's inability to get match the tempo with those of others in the project, among other things, kept his drum ideas from being accepted.

Bob commented 10mo+4dy ago

Maybe a Wav version of the drumless rather than MP3?

Jim commented 10mo+3dy ago

the drumless is wav.

Audio File Compression

Some MP3 file encoders such as LAME, a free MP3 file encoder, will compress audio to a smaller file size. However, it may “add padding to the beginning and end of each song” as a side effect (Taylor, 2000). The use of a sync tone escapes this problem, because the sync tone will happen before the start of the musical idea for the track, and provides an exact time between the actual start of the track and the musical idea to be added. The project manager can simply delete any added space in front of the sync tone, as it is a visual marker for the beginning of the recording. If a sync tone is used, the added silence at the beginning and end of the song will throw the idea off by the amount of time that the padded silence occupies in the compressed MP3 file. Another way to get around this technical issue is sharing a music file in a format like .WAV that does not compress the audio, as the project manager has done above.

Recording Equipment Expenses

Strong drum parts that create their own groove are critical to the feel of a funk song. Without a strong, convincing performance on the drums, it is difficult to make a good funk recording. Though Jim did his best to create a convincing drum part by programming his digital audio workstation, he realized that the track needed a recording of real drums to create the groove he sought. Jim tried for almost a year to get a drummer with the skills (Mark) to execute his vision, but was unsuccessful. This is a contrast to the first case, where Paul and Jim got the drummer of

their choice (John) to contribute to “Sentenced 2 Funk.” There was no conversation or negotiation about the drum performance, and they immediately accepted his contribution.

Jim :To be honest, I'd prefer real (acoustic) drums here. Bob commented
9mo+27dy ago

Jim, I was thinking about this last night - if you want real drums that are mic'd up, you should hit up Mark. He's always got a great sound with his kit (Gretsch Catalina I think?) and has all the great to record it. Great drummer too?? Just a thought?

Jim commented 9 days ago:

this must be the one...unless Mark decides to redo the drums ;) Sounds great Bill, thanks a bunch! -Paul? ...up to you.

Paul commented 9 days ago

WHAT??? Bill u sly dog :)!That mastering is perfect! SUPERB JOB HotSauce!
There's so much stuffz who came back to the surface! Oh Boy i must have listened 20 times to this! Missin Corey so much.....

One of the issues that kept the project from getting acoustic drums for the project is that it is an expensive proposition to buy a setup to record. Bob, one of the drummers who submitted electronic drums for the process, discussed how costly it was for drummers to purchase a high-quality setup to record drums for online collaboration. In the text below, Bob states that his drum kit cost about \$3860. However, he does not have the \$1667 it costs for the recording equipment he needs. This limits the number of available drummers on Kompoz and those who do have the skills and good recording setup in higher demand.

Jim commented 9mo+28dy ago

Lol. You planning on a recording setup for it?

Bob commented 9mo+28dy ago

Yeah just not yet.... I was saying to Paul (on FB) that the new kit, hardware , cases and cymbals have already cost over £2500, and i want to record using good mics (audix or similar) - they cost around £800... And then I'd want to record to something like a zoom r16 that I can take to rehearsal rooms rather than a laptop etc, so there's another £280..... It's a lot to pay out in one go!

The Use of Electronic Drums and Manipulating Velocity Data

The drums heard in this project were programmed in MIDI using Jims DAW rather in lieu of acoustic drums. Changing the volume and timing of each drum strike is important to the feel of a track, as humans do not strike an instrument the exact same way every time. There are slight variations in tempo, loudness, and, sometimes, pitch. Some believe that using a metronome, which clicks at regular intervals to produce a tempo that does not vary, results in performances that are stiff, making it difficult to create a groove. Producers spend significant amounts of time varying the rhythm of their drum part and the loudness of each drum hit to make it sound as if it was played on a real drum set. Jim's comments below echo that experience.

Jim commented 1yr+4mo ago,

I was trying to get a believable drum part (reduced the double kicks/more variation in dynamics) The last part (3:14) still feels mechanical..other than that,.any parts that stick out to you? [listen to http://www.Kompoz.com/music/collaboration/416397/file/426961_at 3:14] [months pass]

Bob commented 10mo+4dy ago

Hmmm going to work on that double pedal intro thing... But... I have to say, the drums you have are pretty damn cool - Are they programmed or what?

Jim commented 10mo+4dy ago

yep, many hours programming.

Creating representations of rhythm and feel (time) also posed problems for producers in Duignan, Noble, and Biddle's (2010) study. Producers mentioned that creating a representation of rhythm in the digital audio workstation that matched their idea of a satisfactory rhythm or groove was quite difficult. One of the producers in the study summed up the difficulty of this task with the following quote:

Interviewer: Do you find yourself fine-tuning timings?

Participant: It is important for creating a groove, and the way that certain beats fall on the bar. The grid is exactly divided, but to get a good groove you often need to move certain elements of the track slightly ahead or behind of the beat. That is a huge part of music production. It is probably the most time-consuming part of music production, and it is not necessarily a good thing. (Duignan, Noble & Biddle, 2010, p27)

Using Mixing Tools in the DAW to Create Groove

Jim used the editing capabilities in his DAW to simplify the drums and add variation, to give the track a better overall feel. He also decreased the reverb on the vocals and drums, which would make them more prominently heard in the song. The track, at its current stage, covered the rhythm guitar and the drums, which were at the core of funk and establishing a solid groove. The transients (a drumstick hitting a drum, finger hitting a guitar, or bass string) give the ear a place to land if in order to move to a piece of music. While they were going in the direction of metal, it seemed like the density and volume of the lead guitar covered up some of those elements.

Jim commented 14 days ago

changes: intro :Freddie and hihat drum edits, deleted lots of triple and quadruple bassdrums and more variation in the shuffle hihat at the end theme. Highlighted the hammond riffs and lots of other little fader automation. allover shorter verbs(vocals,drums) added synth solo slap-bass -2dB hihat -3 dB easier on the master compression...actually there's almost no mastering tools used here...honest mix.

Paul commented 14 days ago

Love the arrangements!! Sounds awesome but dunno it lacks a little "in your face" sound 2me (i don't know how to put it mixing-wise)

Greg commented 14 days ago

Sounds great overall! Great synth solo!!

One of the tools Jim used to make the mix and song sound better was compression, discussed in the text excerpt below. Compression minimizes the variations in volume in a song over a time period, allowing for an increase in the loudness of the song. His argument was that, although all instruments were not heard as they should, making the song louder would not fix the problem, and may further bury the rhythm guitar and drums. Jim also commented that the constant level of loudness was tiring on his ears.

Jim commented 14 days ago

Paul, you think the prev mix sounded better? Probably the master compression. After a while, I found that tiring on the ears...easily fixable with some mastering. Or is there something in the mix not right for you?

Jim commented 12 days ago

I'm ambivalent about the loudness.. . I know the prev version sounds louder and (maybe) more powerfull at first glance. On the other hand... The transients, tiny peaks in the attack of some sounds like the robot guitar,slap bass, and drums get lost in the mix when pushed too hard with loud mastering. There's some rhythmic tight things going on here that I miss when transients are lost. There's a solution out there, but it's not putting the maximizer 3 dB louder. Excellent

mastering would be nice at this point....

In this project, Paul has the role of playing the rhythm guitar for the track, which along with the bass guitar and drums, has the responsibility of creating a strong rhythmic pulse for the song. After hearing the mix, Jim comments that the bass drum isn't being heard. Paul responds by saying that he is "still not hearing his marvelous fills." Fills are improvised sections, also called licks or riffs, which are used to create interest and fill the space between chords played by the guitarist.

Funk compositions should leave space for the pulse and licks of the rhythm guitarist to be heard, and make its listeners move. The link below provides an example of the role a rhythm guitarist and the rhythm section (i.e. drums, rhythm guitar, bass) should play in a funk composition, and the part they play in creating the groove in a song.

James Brown – Get Up Get Into it, Get Involved @ 3:03–(Ike Dyson SOULTUBE,2013)

Use of Versioning to Track the Latest Project Mixes

Much like the "Sentenced 2 Funk" case, Jim uses version numbers with descriptive names to mark how recent a mix is, and which should be used by a collaborator, based on their instrument. For instance, he created drumless mixes for people who wanted to contribute drums for the project, so that they could record completely fresh ideas that didn't have to follow or be compatible with the existing drums.

[5.9 drumless](#)

[Jim](#)

[U don t care bout me 5 8](#)

[Jim](#)

Comments

Jim commented 1yr+4mo ago

with the backing vocal on chorus..(got lost in prev. version together with Freddie talking track...oops)..thanks Greg! +1 dB on the hammond and stabs re-arranged some of the 'Freddie talking' track

Jim would also make one of the first comments on the mix, a detailed description of the changes made, that distinguish it from the last available mix. In the comments that Jim makes below, he explained that this mix is the same as the previous versions, except he's included background vocals, increased the volume on the organ (Hammond) by 1 dB, and reordered some of the speaking parts on the song.

Summary

To create a track with groove, one must have musicians who know their roles and have the technical ability to fulfill those roles. One must also have someone with the skills to mix those contributions together, and edit and process the digital recording in a way that produces the greatest groove. Face-to-face collaborating performers don't have this concern, because there is no intermediary or representation of their ideas that must be made in order for others to hear them.

Chapter 7: Cross-Case Analysis

The following cross case analysis first examined the differences between the two cases. It then studied the similar ways in which both cases used social practices and digital tools to make songs. Links were created between similarities in the social practices and digital tool use, to work processes and practices in collaborative animations, paintings, and creative stories. The chapter ends with a discussion comparing and contrasting collaborative music composition to open-source software development.

Differences between the First Two Cases

Three factors were the most significant in causing the differences between the levels of groove in the two cases. First, the dominance of one musician's contribution in case 2. Second, the downside of virtual music collaboration. Finally, a vision for the track that may not have been clearly communicated to all collaborators.

The rhythm section (e.g. piano, drums, rhythm guitar, and bass) is the engine that creates groove in Black music. When the rhythm section is tight, and band members are listening to and playing with each other in a way that makes it easy for people to dance, a groove can build and last. However, it's very difficult to create a groove when one person's performance doesn't mesh with the rhythm section. Leaving space with regard to volume, rhythm, and the duration of playing allows listeners to hear and feel the rhythm section along with the solo performance and dance.

Much like any other creative effort, ensuring that all parties in the group are heard is paramount to the creativity of the end product (Ocker,2005;Sawyer,2008). Both judges indicated that the contribution of the lead guitar, without variation in dynamics (stayed very loud) or the provision of much space (or silence), negatively affected the groove in the second case.

Setting and Establishing an Extrinsic Goal

While changing the vision throughout the development of a collaborative music composition project often happens, project managers have to ensure that all members of the group are made aware of that change. In Kompoz.com, project managers can change the genre, creative brief, and keywords describing the track to communicate that change in a central location visible by all musicians. However, at the time of data collection, the creative brief and genre in “U Dont Care about Me” (Case 2) were not changed to reflect the song’s shift towards metal. In addition, the genre is used to send recruitment notifications via email to invite musicians comfortable in that style to contribute to the project. The extrinsic goals of “Sentenced 2 Funk” remained unchanged throughout the development of the projects, and found musicians suitable for executing the vision. One of the disadvantages of asynchronous collaboration is that it eliminates the instant communication of talking with band members in the same space. To compensate for the lack of shared space, communicating important guidance for musicians in a central place, while supplemented with private messages, can help establish vision.

Downsides of Virtual Music Collaboration

The Temporality of the Workforce

Some of the disadvantages of virtual work arrangements also contributed to the lack of groove in the second case. One of the things that makes a work arrangement virtual is the fact that the team, group, or workforce is temporary in nature. In the first case, Jim and Paul were able to get the exact drummer they wanted to execute their vision for the first project. The drummer was invited to the session, contributed, and knocked out the drums for the project in one take. However, the second case showed that the cost of getting a good drum set and access to hardware (e.g. microphones, mixer, and good pre-amps) can prohibit some drummers. These factors, among others, limit the number of drummers that can participate in Kompoz projects, making them highly sought after. Also, many Kompoz contributors also have regular jobs during the day and fit collaborations into their downtime. Although one may have secured a drummer for one project, if he/she is swamped with invites to other projects, he/she may not be available.

Synchronization is Critical

Drummers and other musicians must also ensure that contributions are synchronized with the existing contributions of group members in the project. One drummer had a tempo mismatch of less than one beat per minute, which threw off synchronization with other musicians on the project. In face-to-face collaborations, musicians can withstand some variations in tempo, by slowing down or speeding up to synchronize with the musician that is playing faster or slower than they should. However, in asynchronous virtual music collaborations, once the contributions of other groups have been mixed, their performances are frozen and can't change

to meet variations in tempo.

The Effects of (Some) Programmed Drums on Groove

If one can't find a drummer for a Kompoz project (like the musicians in the second case), one can use a drum machine or sequencer to program the playing of recorded drum samples.

Human drummers vary the intensity and rhythm of their drum strikes, however, computers by default make the intensity and rhythmic spacing of drum strikes perfectly even. Producers, must spend large quantities of time adjusting the timing and rhythm of drums to make them sound human. Drums that sound too perfect or "straight" can lead to a feeling that doesn't make people want to dance to some types of music (Bermiss, 2015). It should be noted that seasoned music producers, especially in hip hop, R&B and soul music, have made careers out of understanding how to tweak drum machines and sequencers to make programmed drums groove. One producer, J Dilla, was famous for turning off the quantize function of his drum machine, forcing drum rhythms to align to an evenly-spaced rhythmic grid.

Much like acoustic drummers, Dilla would make his drum rhythms funky by recording himself manually triggering each drum sound, without any rhythmic assistance or alignment from the drum machine (WeAreDeLaSoul, 2014). However, programming using this method is a Herculean task that required Dilla to practice for thousands of hours to keep consistent time and tempo. His work had so much of an impact on Black music, and how other artists approached programming drums, that his MPC drum machine is on display at the Smithsonian National Museum of African-American History and Culture (Paysour, 2014).

Similarities between the Cases

Cases 1 and 2 showed that projects generally followed the principles of group flow to coordinate their playing, in the hope of creating a groove. Both judges agreed that groove was created for a stretch of time in both cases. However, the musicians were able to sustain groove for significantly longer periods of time in the first case. Group flow theory argues players performing together must have a goal guiding their performance that is balanced by a number of pre-existing structures to coordinate and partly pre-determine elements of that performance.

Projects in both cases employed the use of seps and sync tones as pre-existing structures to ensure all accepted contributions were synchronized in the final mix. Submitting contributions without the background mixed in also allowed someone other than the contributing musician to determine how the musical idea should be mixed into the song. This social practice centralizes the task of mixing to the person(s) who understand the project leader's vision for the song, and puts the task in the hands of the group members with the best mixing talent.

Versioning

The project manager in both cases also devised his own way to organize the versions of mixes in the project. This proved to be critical for two reasons in the cases examined for this study.

Many musicians practice and improvise using a jam, or play-along track. The song is a piece of music, with harmony and rhythm typical of the style of music they're practicing, yet is missing their instrument in the recording. For example, a play-along track for a guitarist would not have

any audible guitar parts. This way, the practicing musician can improvise or play without worrying about complementing or conflicting with the guitarist on the recording.

In both cases, the mixer and project manager for both cases create mixes like jam-along tracks without the instrument of the contributing musician. For example, if the original unfinished idea used to start a project on Kompoz had drums on it to give an idea of what the project creator might like, the mixer would create a drumless mix for a drummer to record his or her idea of the drum part.

Mixes also change to incorporate the most current performances from musicians, and the latest decisions about how those sounds would be mixed together to produce the recording. To keep track of the most current mix, the project manager would attach an increasing version number to its title, and a description of the relevant changes since the last mix.

Use of Communicative Codes

Musicians in both cases used references to well-known recordings or sounds to communicate a desired sound, or to quickly refer to a section of their own song that sounded like another artist's style. In global online music groups with members that hail from many different countries, music served to be the universal language that helped to bridge spoken language barriers in the projects.

Roles

Group flow emphasizes the importance of clear roles and responsibilities amongst group

members to lay the foundation for a good performance. Both cases shared similar roles with the exception of the project manager bringing in someone at the end of case two, to master the project in hopes of improving the sound. Both projects employed a project manager who took on the task of organizing the project, arranging the contributions, and mixing them together to make a finished product. The project creator worked with the project manager in both cases to ensure that his vision for the song came to fruition. In both projects, the rest of the group members typically served as instrumentalists who would record their contributions to the song and give feedback to the project manager on improving mixes.

Table 13: Case 1 Roles

Member	Role(s)
Paul	<i>Project creator, guitar, synthesizer (violin, keyboard), vocals, percussion</i>
Jim	<i>Bass, arrangement, mixing</i>
FREDERICK	<i>Saxophones (instrumentalist)</i>
John	<i>Drums (instrumentalist)</i>
Buck	<i>Electric piano (instrumentalist)</i>

Table 14: Case 2 Roles

Musician	Role
Jim	Mixer, arranger, bassist drum programmer, synth player
Paul	Project Creator, Rhythm Guitarist
Greg	Organ (instrumentalist)
Victor	Lead Guitar (instrumentalist)
Frank	Mastering
Metro	Drums (instrumentalist)

Shared Roles in Collaborative Text Writing and Collaborative Music Writing

Collaborative writing is closely related to collaborative music composition with regard to its creative process, roles, responsibilities, and need for pre-existing structures to facilitate an

optimal collaboration experience.

The roles and responsibilities required for a collaborative music composition task aren't different from collaborative (text) writing, as is seen in the table below. Roles in collaborative music composition are also emergent (post hoc), and the responsibilities they take on are critical to the successful completion of the project (Lowry, Curtis, & Lowry, 2004).

These roles in collaborative music composition (Tobias, 2012) can combine, with one person assuming one or more roles. For instance, Jim is both bassist, arranger, and mixer for this project. He took on these responsibilities seemingly, because he had the skills to manage the project, contribute, and mix the contributions.

Table 15: Collaborative Writing Roles vs Collaborative Music Composition Roles

Collaborative Writing Roles from (Lowry et al., 2004,p. 88)	Collaborative Music Composition Roles
Writer - A person who is responsible for writing a portion of the content in a collaborative writing document (Posner & Baecker, 1992).	Instrumentalist/Musician – Responsible for recording and providing musical content for the collaborative composition.
Consultant - A person who is normally external to a project team who provides content and processes related feedback, but has no ownership or responsibility for content production (Posner & Baecker, 1992).	Done by other members of the community who serve as audience members and express their approval of the project.

Reviewer - A person who has responsibility and ownership for the overall content production of the writers, who can make both content and style changes to a shared document (Posner & Baecker, 1992).	Usually internal to the project and done by the project leader or the musicians creating the content.
Team leader - A person who is part of a collaborative writing team, who may fully participate in authorship and reviewing activities, but also leads the team through appropriate processes, planning, rewarding, and motivating.	The mixer and project creator take on this role of structuring the collaboration appropriately and organizing the work.
Editor - A person who has responsibility and ownership for the overall content production of the writers, who can make both content and style changes to a shared document (Posner & Baecker, 1992).	Arranger/Mixer – Responsible for taking the content provided by each musician, and making a cohesive end product that fits the style and vision of the project.

Creative Process of Collaborative Text Writing vs. Music Composition

One of the distinguishing factors of the collaborative music composition process is that musicians spend the majority of their time looping between evaluating ideas and revising them if they do not fit their vision (Coughlan and Johnson, 2006). Wichmann and Rummel (2013) created a model of the creative process for collaborative writing projects that closely resembled the process of collaborative music composition. Their process included stages for planning, drafting, and a final stage where collaborators evaluated and revised the text.

Most of Wichmann and Rummel's study participants reported working in groups of four or less, and employed a parallel collaborative writing process. Parallel partitioning of a document is described as dividing the writing into sections, while individuals or subgroups work on different parts of the document at the same time (p. 65). In these small group collaborative writing

projects, though there may be identifiable roles and responsibilities, Noel and Robert express that these roles are emergent and fluid, changing as the task progresses, rather than being established before the task begins. Most of the participants also expressed that they used Microsoft Word to engage in collaborative writing projects rather than a dedicated tool designed for that task.

Collaborative music projects also employ parallel partitioning of a song. However multiple parts (e.g. intro, verse, bridge, and chorus) of the song are being worked on at once rather than individually. One or more people are tasked with making the parts into a cohesive whole. Collaborators must also provide contributions that are compatible with the current version of the song.

In the context of this case/song (“Sentenced 2 Funk”), Jim is the mixer/arranger with the job of ensuring that contributions are put in an order that best reflects the vision and feel of the song, and each instrument is heard clearly as is appropriate relative to the volume of other contributions.

Table 16: Collaborative writing issues vs Collaborative composition issues

Selected Collaborative Writing Processes	Issues Caused by Strategy	Collaborative Music Composition Solutions to Issues
<p><i>Parallel writing process</i> – When a team divides work into discrete units and team members work on the task simultaneously.</p> <p><i>Parallel horizontal division</i> - Each participant is responsible for a particular section of a document, and the division is not based on core talents.</p>	<p>Writers can be blind to each other’s work, redundant work can be produced if poorly planned, stylistic differences, potential information overload, and does not recognize individual talent differences well.</p>	<p>In collaborative music projects, the division of the work can depend on the talent of the contributor, the project creator’s vision of the project, and the arranger’s ideas about what may be best for the groove of the song. Musicians will record themselves improvising through the whole song, if they are not told to record only during a specific portion of the song. The project creator or mixer can keep only the portions that best fit the vision of the project, or accept the whole recording if it works.</p>
<p><i>Parallel stratified division</i> - Participants play a particular role, such as editor, author, or reviewer, based on their core talents.</p>	<p>Writers can be blind to each other’s work, redundant work can be produced if poorly planned, stylistic differences, and potential information overload.</p>	<p>In these projects, stratified division roles and responsibilities are only filled by individuals who submit acceptable auditions for those roles, or are invited to fill them by people already involved in the project. Roles and responsibilities are assigned to those who have stylistic differences and redundant contributions are handled in editing and mixing by the mixer or arranger, or are rejected by the project creator if they are too different from his/her vision for the son .demonstrated the talent to execute the duties required by that project.</p>

<p><i>Reactive writing</i> - Writers create a document in real time, reacting and “adjusting and improvising” to each other’s changes and additions without significant preplanning and explicit coordination.</p>	<p>Extremely difficult to coordinate and problems with version control. However, this strategy often yields the most creative results.</p>	<p>Musicians use reactive writing to improvise their contributions (though not in real time), in response to (and in concert with) the current iteration of the song. However, the project mixer can manage version control by making the most current mix of the song available to the instrumentalist, so that the contribution accounts for and is complementary to the current vision of the group.</p>
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Note: Adapted from Wichman and Rummel (2013)

Wichmann and Rummel (2013) conducted a study asking 73 students, in groups of three, to complete a collaborative writing assignment using a wiki. . Their conceptualization of collaborative writing activities is based on a model of single-authored writing, and includes three stages: planning, drafting, and revision, which include evaluating and revising text (p. 263).

The investigators provided groups following this conceptualization of the writing process using collaboration scripts that broke the tasks into planning, drafting, and a revision stage (which includes evaluating and revising text). The script given to groups in the study specified “instructions for interaction including task division that divides the task into individual and joint working phases,” a schedule for each deliverable, an optimal sequence for the completion of the tasks, and how many students should be involved in each task. The groups provided scripts had projects judged to be more cohesive and frequently revised than groups that did not use collaboration scripts.

Groups using collaboration scripts also communicated about their writing tasks more frequently

than those who weren't provided scripts. It has been shown that specificity of the task and the number and rigidity of structures have a relationship that isn't necessarily linear.

Lowry, Nunamaker, Curtis, and Lowry (2005) conducted a study with 479 freshmen and sophomore students enrolled in an information systems course, and asked them to complete a six-week long group writing assignment using only asynchronous collaboration technologies. Lowry and his colleagues gave one group a highly explicit script giving structure to the collaborative task, while the other collaborated without guidelines. These scripts contained suggestions as to the steps of the collaborative writing process like "pre-meeting planning, ice-breakers, goal setting, personalization, process checks, and distributed breaks" (p. 346). The group using the pre-existing structures provided by the scripts were judged to have a higher quality product, more communication, and satisfaction with the process than the group that wasn't provided structure. This is quite different than the notion in group flow theory that the specificity of the task should balance the level of structures in place.

Constraints as Pre-Existing Structures that Aid Creativity

Stokes (2001) defines constraints as rules or structures that "preclude some things and promote others." She identifies two types of constraints: variability and task. Variability constraints define "how differently something must be done" (p. 355). Task constraints "define domain, involve materials and conventions concerning their use, and determine how differently something can be done" (p. 356).

Work by Luther et al. (2008) and Kim, Cheng, & Bernstein (2014) provide evidence that leaders

providing task constraints and guidance to organize and structure the creative work done by online teams tend to make projects more successful.

Kim, Cheng and Bernstein (2014) completed a study on groups using a tool called Ensemble to crowdsource the writing of a dramatic story. Two types of structure were employed to guide the process of writing the story. The authors who created Ensemble structured the workflow of the application such that the lead author of the story could solicit writings from the public, and choose a moderator to help merge, edit, order, and/or delete contributions.

The use of a scene to guide the trajectory of the story, was the second type of structure used to help coordinate the creative output of the authors. Lead authors had the ability to describe scenes at different points to guide the storyline, and gave contributing editors an idea of what was an appropriate contribution. Placing these scene descriptions throughout creates an outline for the story that arranges the content to mesh with the creative vision of the author. In musical collaboration, the changes in the musical content certainly added to the groove in the first study. The balance of these structures with the level of creativity is also important amongst groups of storywriters using Ensemble and other collaborative story writing tools.

“Structuring crowd collaboration is challenging. Too little structure leads to unfocused, sprawling narratives, and too much structure stifles creativity...Unstructured attempts at collaborative creative writing such as the experimental wiki novel ‘A Million Penguins,’ resulted in rampant vandalism and uncertainty about the direction the story should pursue. On the other hand, highly structured approaches, such as sentence-level, round-robin writing in “Folding Story,” constrained participant contributions and resulted in patchwork, incoherent stories...” (Kim, Cheng, & Bernstein, 2014, pg. 745).

Similarly Luther et al. (2008) found that pre-existing structures amongst groups of collaborative

flash animation projects helped to make projects successful. They noted that two types of structures were used amongst flash collaborations, to ensure that contributions were compatible enough to be parts of a coherent whole.

First, leaders generated a set of technical specifications, or “specs,” that described how the artists’ submissions should be formatted. Common specs included dimensions, frames per second (fps), background color, duration, and version of Adobe Flash. These ensure that the leader can compile artwork submitted by multiple animators with unique computer setups and working styles without running into compatibility issues (Luther & Bruckman, 2008, p. 346).

Technical specs were also discussed amongst project leaders and managers to ensure the consistency and the quality of the final product in Kompoz collaboration. Collaborators in both cases discussed bit depth, sampling rate, and bitrate (which controls the quality of the music, similar to the frame rate). Collaborators in Kompoz often don’t discuss file format, because many projects agree to share the highest quality MP3 format (usually 320kbps) available. Most digital audio workstations allow users to export files in this format, so musicians don’t need to discuss the software used to record. While users can send other formats on Kompoz, members at the free level of membership can only send MP3’s.

The second structure useful to artists creating flash animation was the use of themes throughout the project. Luther describes themes as “a linear, continuous, or nonlinear arrangement of artists’ contributions in the final animation,” and goes on to recognize that there must be a balance between the number of constraints that an author imposes with the level of creativity desired in the project.

“On the one hand, themes are similar to specs in that they place constraints on animators and limit their creative freedom. On the other hand, these same constraints are held constant across all artworks submitted to the collab; each artist deals with them in a different way.” (Luther&Bruckman, 2008, p. 346).

Malhotra, Majchrzak, Carman, and Lott (2001) noted that the pre-existing structures that established a coordination protocol helped their creative virtual teams, by coming to an agreement on how often the team should communicate, which technologies should be used to share information with other team members, and rules for appropriate engagement and participation (p. 237).

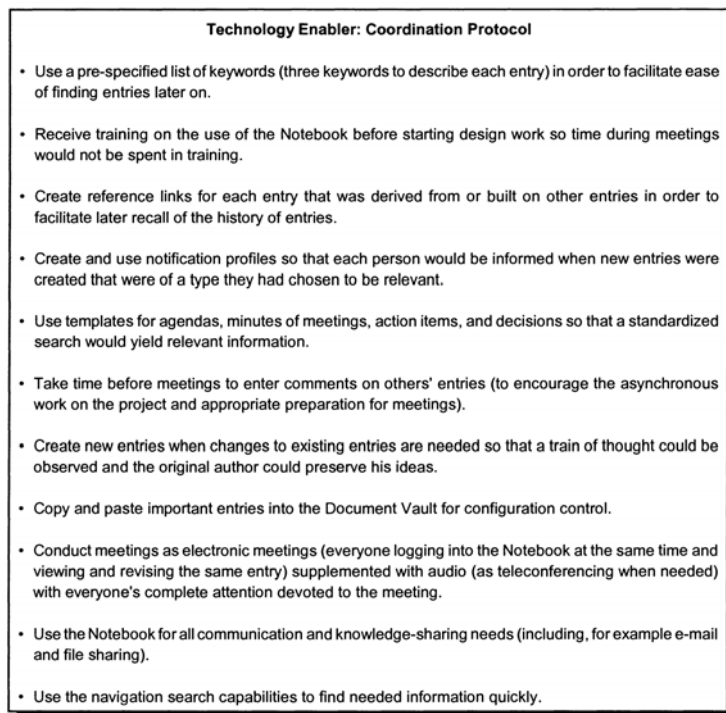


Figure 31 Protocol structuring the use of communication tools

Similarly Rice, Davidson, Dannenhoffer, and Gay (2007) suggested that establishing “formal

procedures and structured processes” enhanced the performance of virtual teams, when tasks were matched with the appropriate tool for communication. The authors suggested that tasks like brainstorming and consensus building were a good fit for asynchronous digital communication tools, while unstructured tasks like evaluating ideas are best for face-to-face communication. This recommendation, however, is not convenient for some global teams of musicians seeking to collaboratively write a song. Musicians in the Kompoz community often evaluate musical ideas, and discuss decisions about arrangements, mixes, and the direction of a project using file repositories and discussion boards.

FLOSS Development vs. Online Music Collaboration

Crowston, Wei, Howison, and Wiggins (2012) stated that the existing body of literature on FLOSS development projects lack a great deal focus on the social processes required by the task, and discussion of how tools are used to help organize and coordinate work in FLOSS development teams. Many studies on virtual teaming focus on the use of tools and the coordination of resources and talent around them (Nemiro, 2000).

Many FLOSS projects have requirements documents that identify what the software should be able to do for its users, while bug-tracking systems keep a list of features in the software that aren't working properly (Crowston, Wei, Howison, & Wiggins, 2012). Developing software is also a task that is more objective than problem-finding tasks, in that code runs or doesn't, and either fulfills a requirement or falls short.

Tasks like creating animations, painting, and composing require participants to continuously

identify new problems, identify possible solutions, and iteratively refine those ideas until they satisfy the author(s). These ill-structured problems (Collins, 2011) where authors don't know what they are to solve beforehand are quite subjective, and have many potential solutions that are subject to the rules and technical standards of the discipline. As Luther states in his work on collaborative flash animations, the requirements document is replaced by the vision of what the leader of the collaborative animation wants. If this vision isn't focused or well communicated to all of the participants of the project, the animation was less likely to be successful.

Collaboration systems made to support these types of creative activities are often cobbled together with technologies familiar from other contexts, like discussion boards, file repositories, and messaging systems. Software development projects have established collaboration processes and tools made especially for these tasks, like versioning software (e.g. CVS, github) bug-tracking systems (e.g. Bugzilla, JIRA). There are also a number of established models for organizing software development (e.g. eXtreme programming, rational unified process, agile development, Scrum), that lay out the planning, analysis, and development process for building software.

Online spaces for collaborative art depend heavily on their leaders to provide this structure. Seasoned collaboration leaders gain the knowledge of how to successfully support these collaborations through their own mistakes, and by learning from other more experienced members, as there isn't a textbook or established process for collaborative music composition. Kompoz.com has a "Collaboration Do's and Don'ts" discussion area, where veteran members share best practices.

Luther and Bruckman (2008) also indicated that collaborative development projects are released quite frequently to the public, as they are typically tools that users wield to execute some goal. As people use the software in unintended (and, at times, unforeseen) ways and under conditions that the designers couldn't anticipate, the software has to be patched and maintained to appropriately respond.

Collaborative art projects produce an artifact to be enjoyed for its aesthetic and aural beauty, and doesn't require maintenance or revisions after released to fix any "errors." The art is typically only released once, and errors become a part of the artwork. The song "Top Billin" from Audio Two, considered to be one of the greatest hip-hop beats of all time, happened by accident. Daddy-O, the song's producer, accidentally hit the wrong button while the drum rhythm played. However, it gave birth to a classic hip-hop song. The song was printed on record just as it sounded after the accident, and was never revised after its release (Ettelson, Drak, & Ahmed, 2015).

Summary

Both cases used the principles of group flow to establish goals and structures such as steps, clear division of labor or roles, sync tones, versioning, and arrangements to coordinate playing to facilitate groove. The roles used to make good collaborative recordings are similar to those used in the collaborative writing process. Structures can also be considered to be task-based constraints, which establish how materials are used to make a creative product. These constraints are not just helpful to collaborative music compositions, but also collaborative novels (Kim et al., 2014), paintings (Stokes, 2001), collaborative animations (Luther et al., 2008),

and cross-functional virtual teams (Malhotra et al., 2001).

Though the use of these structure can be helpful in creating more pleasing pieces of art, collaborators must still make art that allows for contributions from fellow artists. Creating that space served to be the difference between the levels of groove in the studied cases.

Chapter 8: Discussion

This chapter briefly summarizes the lessons learned from the study. It then provides recommendations for musicians and designers of environments for spaces supporting collaborative creativity, and subsequent limitations. Next, it compares and contrasts coping strategies used by musicians in this study to deal with a virtual work arrangement with those found in the literature on virtual teams. The study concludes by identifying questions beyond the scope of the study and directions for future work.

Tools Matter, but People, Skills, and Interactions Matter More

The means to produce a digital recording are relatively accessible today. Most DAW's and multi-track recording applications can export a usable file to start or contribute to a project in the Kompoz community. This feature is also present in free tools like Reaper (<http://www.reaper.fm/about.php>) and Audacity (<http://www.audacityteam.org/about/features/>). An audio interface, the hardware that allows musicians to convert analog sound from their instrument (either through a microphone or electric instrument) into a digital form that can be recorded by a computer, can be purchased for \$100 or more. Recording drums are more expensive, as discussed in Chapters 5 and 6. Mixing and mastering can also require additional expenses for hardware and/or software, to achieve professional results, in addition to the requisite skills to use these tools.

What separated the groove or feeling between the two cases was the melodic and rhythmic interaction between the lead and accompanying musicians on each song. In case 1, the

musicians take turns soloing and are mostly playing within the pocket, or playing to complement the rhythm of the bass guitar and drums. In case 2 the guitar player, while technically skilled in his ability to bend notes and play fast riffs (a group of notes played in quick succession), made the decision in his own words to “go crazy,” and play outside of the rhythm and tempo prescribed by the bass guitar and drums. Different players will have different levels of ability to play just what’s required to build a groove with their bandmates. Gabriel Roth, a producer, bass guitarist, and expert at making heavy funk records explains that skill in his quote from an interview below:

“...Everybody was trying to play, everybody wanted to be a virtuoso all the time, they didn't understand. Even horn players don't quite understand that much any more how to be part of a section. When I listen to all my favourite records, be it James Brown or Cuban orchestras from the '40s or some reggae stuff, whatever it is, one of the things that I really love in musicians is the ability to kind of make one sound and be able to understand that each person playing one note is so significant. It is more important to play one note just right than play a whole bunch of notes. People are using samples because people don't know how to play with the same kind of groove any more. So the biggest resource we have at Daptone is having access to these musicians that are all of the same philosophy. You can't bring ego, you can't be part of a band if you're playing like that. Because of that, we are able to make records that other people are sampling because the musicians on the record are playing with that kind of discipline, that kind of togetherness, that kind of awareness of the whole part of the arrangement...The reason why there is room for someone to play a great bassline is because some guitar player is playing (*sings simple guitar part*). And some other record, the reason why it has a great guitar part is because the bass player was playing (*sings simple bassline*). That is it.”
(RBMA, [2010](#))

Roth highlights that a part of the beauty of Black music doesn’t lie in the proof and demonstration that one is the most technically-proficient musician in the universe, but instead that one has the discipline and skill to play the “simple” effective idea that best meshes with

bandmates, serving to strengthen the groove. The task of producing simple, catchy, emotion-filled music is one of the hardest tasks for a musician to accomplish. Ahmir Questlove Thompson, one of the world's most celebrated drummers who has played with musicians ranging from Sting to Jay-Z and Al Green, cites this as one of the challenges he hasn't conquered as an artist:

One of the hardest things to ever do in music is to effectively write something simple that sticks. I mean, for all the talk of, like, think of the most complex thing. Like, people can talk like Stravinsky's "Rites Of Spring," people can talk about "On The Corner" by Miles Davis, or anything Rahsaan Roland Kirk does, or any of the M-Base jazz movement stuff. People can talk that into the ground. And that's almost easy to achieve. But how many people can effectively write "You Can't Hurry Love"? Like, that, to me, is one of the hardest things to write. Very simple, effective, three-minute pop songs.
(RBMA, 2013)

If skills and interactions (musical or textual) are of critical importance to groove, then from the lens of group theory, those interactions and skills must be supported with appropriate tools, social practices (pre-existing structures), and leadership to select the best team to carry out a musical vision. Below are the recommendations from this study to suggest what those supports should be.

Recommendations

1. Provide a place for musicians to represent the ongoing arrangement and structure of a song, in a form that may not be exclusively textual.
2. Ensure that contributing musicians are clear about where they fit into that arrangement, and whether they are playing too much or little to fit the groove of the recording.
3. Create tools that work for the versioning of musical and other creative materials.

4. Leaders of collaborations must be judicious to only accept contributions in the final mix that fit with their vision of a song, even if that vision is continually evolving.
5. Leaders of collaborations must be vigilant about ensuring that all team members have a clear understanding of their vision of the final project, at every step of the project.
6. Construct a project environment where each band member's accepted contribution can be heard in the final mix.
7. Use references to recordings or well-known musicians to iron out communication difficulties around trying to achieve a specific sound.
8. Always use some method (e.g. sync tones and seps) of ensuring that all contributions are synchronized. However, it's not necessary for every song to be recorded to keep pace with a metronome or click track.

Limitations

This study used a multiple case study methodology, which prohibited making any claims about the social practices and tools used by a general population of people engaging in creative collaborations. In making conclusions for this study, private messages sent between study participants could not be accessed. However, the study did have access to all accepted musical contributions for both cases.

Ties with the Literature

Luther's (2008) findings with respect to the leadership of creative collaboration animation projects is also true for this project. The leader(s) of creative collaborations have a heavy

burden, in that they are responsible for ensuring supportive structures are in place for the project. Without some of these structures that help coordinate the work of the creative collaborations, efforts are more likely to be unsuccessful.

Line and Robey (2009) conducted a literature review of virtual work studies called the paradoxes of virtual work, summarizing the issues faced by people in virtual work arrangements into five paradoxes. Some of the coping strategies the authors listed were echoed in the results of this study, while others could not apply and musicians had to devise other ways to work through the issue. Below is a table of the paradoxes, with the coping strategies from the studies, and a list of the coping strategies the participants employed in this study. This table is followed by examples of best practices in the creative collaboration literature, and instances where groups in the study used these coping strategies.

Table 17: Coping strategies for virtual work challenges used in this study.

Paradox	Description	Coping Strategy	Coping Strategies used in this Study
Virtual teams require physical presence.	Virtual teams are geographically distributed, and members work independent of time and space. However, virtual teams require the physical presence of other members.	Hold a mandatory face-to-face kick-off meeting. Match media with tasks. Keep the rhythm (via webmeetings or face-to-face meetings). Learn to develop relationships through ICTs.	N/A
Paradox	Description	Coping strategy	Coping strategies used in this study
Flexibility of virtual teamwork is aided	Virtual teamwork is flexible. Yet flexibility is	Define clear objectives and prepare detailed plans, but maintain flexibility.	The team that found a drummer who could

by structure.	supported by structural mechanisms that coordinate team efforts.	Best practice provided in (Luther et al. 2012). Select team members carefully.	execute the project vision and musicians who complemented those ideas generated more groove. This also was the group with a clearer stylistic vision.
Interdependent work in virtual teams is accomplished by members' independent Contributions.	Teamwork implies interdependence among members towards common goals. Most work is divided into subtasks that are actually accomplished by individuals.	Hold face-to-face meetings for critical tasks. Use ICT to get all members' inputs. Establish a collaborative culture. Best practice in Ocker (2005).	Project managers used discussion boards to get feedback from group members on musical ideas and mixes.
Task-oriented virtual teamwork succeeds through social interactions	Virtual teams are task-oriented because of their reliance on ICTs. Yet they depend on social interactions to Succeed.	Learn to develop relationships through ICTs. Organize regular face-to-face meetings.	
Mistrust is instrumental to establishing trust among virtual team members	Trust is necessary in virtual teams. Yet mistrust is a condition that leads members to establish trustworthiness.	Build trust based on culture/profession/position/experience. Design team activities. Implement control mechanisms.	Only ideas that are accepted by the project manager are mixed into the final version of the song.

Adapted from (Line & Robey,2009,pg9)

Alignment with Literature

There were many solutions that musicians used that were referenced in the literature on virtual teams, such as selecting team members carefully, using ICT to gain everyone's input, defining clear objectives, roles and plans, and implementing control mechanisms in projects.

Selecting Team Members Carefully, Aided by Structure

Case 2 demonstrated the effect of being unable to find an acoustic drummer and other personnel to maximize the groove for the project. In Case 1, the project manager and owner

sent invitations to the musicians that could achieve their vision for the song, and only accepted musicians and contributions that were compatible with the project. One of the takeaways of this study was that structures (to establish synchronization, agreement on playing styles, and norms around acceptable contribution) are necessary to coordinate and support the efforts of creative practitioners in making a good piece of art. Selecting the right team members was critical to the success of the group studied in Case1. The drummer laid down a strong rhythm with its own groove that all the other musicians organized their ideas around. The musicians made sure that their ideas were complementary to the groove laid down by the drummer. However, the lead guitarist did not lock in with the drummer in case 2, despite the rhythm guitarist and bassist's efforts to do so.

Using ICT to Input/Control Mechanisms

Projects in this study were accepted musicians and contributions only after they were submitted to the project owner and manager as an audition. This mechanism served as a control to ensure that only content that meets the approval of the project leaders became part of the final product. In both cases, the project manager accepted feedback on preliminary mixes and iterations of the songs throughout the process. Teams used the discussion board to effectively evaluate ideas and determine alternative solutions for problems with mixes, arrangements, and instrumentation.

Establishing a Collaborative Culture

The recording with diminished groove in Case 1 had a dominant member who played in a way

that covered vocals and other instruments. The technology used in Kompoz allowed the project manager to capture the ideas of all of the musicians. However, it proved difficult to feature the contributions of the lead guitarist, while hearing the ideas of other musicians on drums, bass, and rhythm guitars.

The group in Case 2 passed around solos in their arrangements, and musicians played in a way that allowed all group members to be heard. The project manager was able to mix together the contributions in a way that allowed all of the instrumental contributions to be heard at the same time, without having to ask other members of the Kompoz community to assist.

Mismatches and Gaps in the Literature

Need for Face-to-Face Meetings

In many virtual team studies, authors cite periodic face-to-face meetings as a way to build relationships (Powell, Piccoli, & Ives, 2004; Maynard et al., 2005) and trust, and ensure that the project moves forward. However, in global asynchronous creative communities like Kompoz, it can be inconvenient for group members to have face-to-face meetings using video-conferencing in tools like Skype and Google Hangouts. Many musicians have day jobs, and will record whenever they have free time. In addition, team members can be geographically located anywhere, making it difficult to find a common meeting time. To overcome this difficulty, members ensure that they communicate their progress (or lack thereof) on the team's discussion board or via private message to the project's manager or creator.

Members also built trust and camaraderie simply by participating in the community and building a resume of projects they contributed to. These projects remain in the community and project owners have the ability to listen to a potential contributor's previous collaborations to determine whether they are a good fit for a project. Since community members are completing a creative activity that is intrinsically rewarding and recreational, planning activities that aren't related to the collaboration aren't necessary.

Gilson, Maynard, Young, Vartiainen, and Hakonen (2015) state in their ten-year review of virtual teams that creativity is a critical part of organizations, and argue that the literature has not adequately investigated effects of virtuality on creativity. Given its importance and the lack of coverage in the literature over the past ten years, they cite it as one of the ten opportunities for future research on virtual teams.

Findings

Annotations and Agendas Aid Creativity

In both cases, the project manager used the discussion board as a tool to coordinate activity amongst the musicians working on their project. When the project manager posted a mix of a musician's contributions, one of the first posts would solicit the feedback of group members. These conversations often resulted in suggestions that helped the quality of the mix, such as FREDERICK suggesting Jim use panning to make the claps sound like they came from a crowd. While idea evaluation can be tough using lean computer-mediated communication tools like a discussion board, as mentioned by Dannenhoffer (2007), using social practices to support the

technology (making the first post describe the ideas in a mix, and the edits made to them) allowed musicians to make the tool work for their purposes.

Project managers also consistently used discussion boards to communicate the arrangement or the agenda of the composition. Musicians from both projects found themselves describing the composition from start to finish, to discuss whether the order of ideas should change, or to tell a musician where their idea fit in the collaboration. When conflicts or misunderstandings arose about where a part should be played, musicians referred to the minute and second in a recording, being clear about where one should play or alter playing. Case 2, where the lead guitarist had a misunderstanding about where to play in the arrangement, resulted in a recording with diminished groove, compared to case 1. Creative groups in Phalip et al. built a feature into their software to map feedback to a minute and second in the musical timeline to facilitate evaluating music in a film score.

Clear Goals and Constraints Matter

The major takeaway from this study is that constraints or structures used to coordinate the efforts of a creative collaboration can improve the end product. Luther et al. (2010) wrote that clearly communicating technical specifications increased the likelihood of success of online flash movie collaborations. The group studied in the first case were able to clearly communicate the direction and style of the project and find personnel that could execute that vision. As such, they were able to produce a track with more groove.

Table 18: Alignment of Findings Best Practices from Creative Collaboration

Study	Best Practices	Strategies Used in the Study
Nemiro (2002)	Idea evaluation is a tough task for electronic media (should leverage face-to-face communication), and must be supported by social practices if it's to be successful.	Teams used the discussion board to effectively evaluate ideas and come up with alternative solutions for problems with mixes, arrangements, and instrumentation.
Ocker (2005)	<p>Dominant team members and imbalances in domain knowledge, and making idea revisions too formalized and structured negatively influences creativity.</p> <p>A Collaborative environment where all group members contribute, having a clear, agreed-upon definition of the problem (or goal of the collaboration) and the approach to solving it increase creativity.</p>	<p>The recording with diminished groove had a dominant member who played in a way that covered vocals and other instruments.</p> <p>The other group passed around solos in their arrangements and musicians played in a way that allowed all group members to be heard.</p>
Bryan-Kinns & Hamilton (2012)	Annotation and authorship tools increase the quality of collaboratively-created work. Allowing all group members to modify ideas doesn't make for better interaction.	Jim used the discussion board to manually note the changes made with each mix, and solicit feedback to evaluate and improve these mixes.
Phalip, Edmonds & Jean, 2009)	Providing technological support for feedback on musical ideas is critical when working with partners who may not be trained in music. The director had a difficult time clearly stating where a musical change should occur in a movie, and describing what (about the music) should be changed.	Musicians identified the areas in a song that were targeted by their feedback, by mentioning the part of the composition (A part, Piano part) or time at which a musical event happens.
(Rice, Davidson, Dannenhoffer & Gay, 2007)	Chat is helpful for allowing the maximum number of ideas to be generated and captured during the idea generation stage of the creative process. A social practice like a voting procedure helps groups take on unstructured tasks like evaluating a creative idea. The authors found that meetings on CMC tools had to be supported with an agenda to be effective.	<p>The project with diminished groove had its lead guitar playing during the wrong part of the composition or arrangement.</p> <p>The project with more groove debated the arrangement (musical agenda) and clearly explained it once it was established. No musicians overplayed during this project</p>
Coughlan and Johnson (2006)	You should allow musicians to capture ideas with as many methods as possible, making sure that the technology makes the barriers to capturing ideas as low as possible.	In the project with diminished groove Jim spent many hours and days using the MIDI tools to

		properly represent his ideas on drums.
Miell and MacDonald (2001)	Compositions where collaborators engage in transactive communication, not just generating ideas, but building upon and revising previously-evaluated ideas yield higher quality pieces of music.	In case 1, musician's contributions built upon the rhythm provided by the drummer, and others in the rhythm sect .
Seddon(2006)	Seddon's (2006) research on students composing a song by trading recordings over email, showed that novices were less critical in their feedback of pieces of music than students with formal training. Groups with students that did not have formal training were not able to critique ideas as effectively as groups with training, because they couldn't give feedback using musical language (or notation) via e-mail.	Despite Paul not having a command of musical language, he used recordings and references to well-known bands to communicate his interpretation and evaluation of ideas. When not referring to recordings, musicians getting feedback for ideas were patient and asked clarifying questions to make sure they understood his direction.
Luther, Caine Ziegler, & Bruckman, (2010)	Groups with more activity and communication around the group task are more likely to be successful . Groups who properly structure and guide their collaborations, with technical and other constraints to coordinate group efforts have more successful projects.	The group with the clearer picture of the guiding vision/goal and style/genre of their project ended up with more groove.

Contributions

Given that this study examines the social practices and digital tools that creative teams use to create groove, measure that incorporates both aesthetic quality and creativity is required. Data from two judges made the case that groove is possible in online asynchronous teams of musicians, which was not thoroughly discussed or operationalized in previous literature. A clarification as a result of this study is that each step of the distributed creative collaboration process (idea generation, idea representation, idea evaluation) impacts the quality and creativity of the creative product. Given the evidence in this study of tools and social practices on the creative process and products of the groups examined, it provided guidelines that could

prove helpful for the construction of future online music collaboration platforms.

Future Directions

Though the study examined how an online team of musicians used tools and social practices to facilitate good creative collaboration, the study could not make an argument as to whether group flow can exist in online settings. There are indicators of group flow in that both cases examined made use of extrinsic goals and pre-existing structures, and others such as projects in new grounds (Luther et al. 2008) and short stories using Ensemble software (Kim et al 2014). However, there were inadequate resources to determine whether group members had a synchronized physiological response to experiencing flow. Once future practitioners can operationalize group flow, researchers will be able to determine factors that make it more or less likely to occur amongst virtual teams.

Researchers in the future can also take strides toward making a theory of creativity that integrates both the creative process and the product. While this study mentioned how the technology musicians used to communicate and create representations of their ideas affected the quality of their songs, enough data could not be collected to construct and test a model. The communication tools in online music communities are also largely the same tools used for communication in business settings. Future research can prototype collaborative music communications tools and determine if they are more effective at communication than discussion boards for a collaborative music composition task.

Appendix A: Theory Choice Description

Theory Choice: Group Flow

The following table provides summary of an analysis judging how these theories addressed different facets of distributed collaborative music composition (collaborative task, distribution of talent amongst time and space, and creative in nature), and will follow with a longer discussion of how each theory addresses those facets.

Table 19: Comparison of Theories used to analyze Collaborative work

Theory	Attention to Collaborating	Attend to Distributed Time/Talent/Place	Tool Mediation	Creative (Requires Users to investigate, Create, and Evaluate)
Group Flow	Specifies the type of creative communication, and conditions that lends itself to the best collaborative.	The task is distributed amongst the engaged group members. However, the study focuses on improvisational performances, and does not study music in a persistent form that allows for contributions from distant or future partners. However, musicians are expected to know and recognize musical ideas from past recordings that could be used by bandmates during their own performance, so that they can formulate an appropriate response	The instruments, language, and social practices that mediate musicians' interactions.	Each musical contribution is evaluated, if its accepted than the player builds upon that idea or provides his/her own interpretation. What is acceptable is driven by Csikzentmihalyi's systems view of creativity that there are gatekeepers that decide what is an acceptable creative contribution based upon their knowledge of past creative products in done in a similar style. Each theoretical concept is also demonstrated with examples from performing musicians.
Situated Action	Collaboration occurs between humans and machines.	N/A	Mediated by the language used by the user and machine.	States that all happen as an improvisational response to the events that are at hand. However there's no notion of actors being creative together.

Activity Theory	Collaboration happens between human - tools not seen as an equal partner.	Tools store the best practices of working on a task through time for all actors engaging (or potential actors).	People can only act through tools (but the theory states that the tool is subservient to the actor).	Operations (tasks that are built into/supported by the tool) are improvised. Roles, rules, and the tools are not specific to creativity.
Distributed Cognition	Humans and machines both seen as parts of a larger cognitive system.	Cognition distributed to all people and artifacts involved in a task.	Does focus on “tools” but doesn’t see them as being subservient to an actor.	N/A

Situated Action

Explanation of the Theory

Lucy Suchman’s (1987) studied humans interacting with an intelligent copy machine designed to explain its actions and operations. Her analysis of failed communication attempts between humans and the machine led to the formulation of situated action as a theory. Suchman first found issue with the view of cognitive science called the planning model, driving the intelligence of the copy machine.

The Planning Model in Cognitive Science

Proponents of this flavor of cognitive science believe that actions are prescribed and dictated by plans or pre-thought work processes. According to this model, providing the ability to execute these plans can create artificial intelligence. The problem with this line of reasoning is that human communication is often incomplete and relies on “common sense,” or a shared understanding of facts about the world, in order to work. At the time, developers tried to equip

intelligent machines with a databank of common sense to handle exceptional situations gracefully, and respond to shared concepts and social practices that humans take for granted. This body of common sense is always changing, and often adapts based on the moment-by-moment experience of other humans.

Situated Action: A Response to the Planning Model

Suchman concluded that actions happen via reactions to current circumstances and conditions, rather than being dictated by plans. Plans are only a representative model of these actions, generated before the action and reconstructed to describe the action after it has occurred.

She arrived at this theory by employing an ethnomethodological view that states understanding of the world (and common sense) is negotiated and constructed by interactions with other people, and is not static as the planning model assumes. Those interactions happen through conversation with the use of language. Language is indexical, and relies on references to common experiences and circumstances to efficiently communicate messages that are mutually intelligible.

The failure of the copy machine occurred because humans depend on references to shared and current circumstances to understand one another, and will expect the machine to have access to these conditions. However, human users didn't understand the actions of the copy machine because it depended on the plan to capture the user's actions. When the users acted in a way that wasn't captured by the plan, the machine only had access to a limited number of copy machine states, that did not accurately represent the user's circumstances.

A central tenet of situated action is that plans do not dictate action, but improvised reactions to circumstances and conditions do. Improvisation and creativity in problem solving are at the core of situated action, and are a critical part of creating music that should not be replaced by commonly-held notions and processes of how people write music. While scholars like Amabile (1983) have determined models or plans of how people create (e.g. problem identification, response generation, and evaluation), situated action says there is much to be learned by examining how, why, and when users deviate from the plan. Bardram was one of the first scholars to state that plans and situated actions are not a dichotomy, but work hand in hand.

He argued that the real-world circumstances handled by situated actions are often recorded and reflected in future versions of the plan, to make the process more accurate and communicate changes in the process to other team members (Bardram, 1997).

Analyzing the difference between a plan and the actions that took place under real conditions can lead to understanding how musicians use plans as a coordination mechanism to:

- Divide labor
- Provide a status for all people working on a shared task
- Record historical changes to a task

Drawbacks

Suchman created a revolutionary way of creating artificial intelligence for machines. However, situated action was intended to be a way of thinking about the relationship between current conditions and actions, rather than a fully sketched out theory at the time of its release. It provides some guidance in looking at the difference between plans and supported features in software, and the improvised (and possibly unsupported) actions of users for features that should be added. However, the theory does not provide any other guidance to structure data analysis.

In addition, this theory requires intense analysis of small human-computer interaction episodes, captured on video /audio recordings to replicate Suchman's conversation analysis. This may not be possible with online teams of musicians, who may be spread all over a state, city or country.

Activity Theory

Some scholars in western psychology view society as an external set of (possibly static) environmental factors that the individual is subject to. Wertsch (1981) states that scholars subscribing to this view believe that people must adapt to society, like animals must survive by adapting to "their external natural environment." Activity theorists believe that the only way humans know the world is through interactions with it. The methods of interaction are encased in tools created by members of society that have interacted with the world in a similar way. People are also a part of society and can change or create tools used to interact with the world,

rather than just being subjected to it.

Components of Activity Theory

This process of using tools in a purposeful fashion is called an activity. An activity, in its most basic form, consists of three parts: a subject, tool, and an object. A subject is a person or a group of people that are actively aware of their reason for using a tool to accomplish an end. Subjects are able to engage in more than one activity at a time.

Tools are the physical (e.g. hammers, computers, and signs) and mental entities (e.g. ideas, plans, mental models, and language) that mediate our interaction with the world, and assist us in completing purpose-driven tasks. Leont'ev (1981) defines a tool as "a material object in which methods of operation...are crystallized" (p. 63). This is similar to the notion that a tool has affordances that offer clues as to how it can be used effectively. For example, a well-designed door that swings out will have a handle suggesting that it should be pulled rather than pushed. However, the concept of a tool also carries historical and social significance. Activity theory proponents believe that tools carry a history of its subject's attempts to fulfill a need, whenever it is used (Kuutti & Arvonen, 1992). A subject that encounters difficulty using a tool to accomplish a goal may change it to make the task easier for future subjects. For example, the keys on a typewriter were originally arranged in alphabetical order. However, users frequently complained that the keys jammed, and became stuck together. The layout of the typewriter was changed to the QWERTY configuration, because keys those that were frequently pressed were spaced far apart from each other, and jammed less often as a result. Tools also partially determine the way users act, because the design of the tool makes suggestions about how it

should be used (Leont'ev,1981). People that grab a hammer usually do not use the curved end to drive nails, because the hammer could slide off the nail head and injure them. However when people continue to use a tool in an unanticipated way to aid them in fulfilling a need, it's possibly a signal that the designer has not built a function critical to the user's task into the design of the tool.

The third component of activity theory refers to the purpose, motive, or need that is driving the subject to act, called the object. Each activity must have an object, and all actions that are a part of an activity are initiated with this central purpose in mind. Engestrom (1999) and Wertsch (1981) contend that all human activity is "object-oriented," and the purpose driven use of tools is a critical capability that separates human behavior from animals.

The Structure of an Activity

Humans strive toward fulfilling the need present in their object, by completing actions with the use of a tool's operations. The subject engages in a chain of actions, each of which has a specific goal that moves the subject closer to fulfilling the central need. While the action specifies what needs to be done to complete the activity successfully, the operations specify how the actions get done (Wertsch, 1981). The operations of using a tool that are built into its design and history (e.g. depressing a gas pedal or turning the wheel in a car), are done automatically, without thinking about what it should accomplish. While actions are driven by goals, the operations a subject picks to complete an action are determined by the surrounding conditions. For example, while driving down a street, a subject may choose to turn the wheel to the right and left to avoid a pothole. Drivers do not think consciously that they will turn right

then left to evade a pothole; they react instinctively to the road condition. If the pothole is fixed in the future, the subject will not need to employ the evasive set of operations. When trouble occurs and subjects become reflective about the purpose and goal of an operation to get it to work again, it becomes an action. For instance, most drivers only think about the inner workings and functions of their automobile if their car needs to be repaired. Actions can become operations once users have gained the skills to complete a task, automatically, without thinking about what they are trying to achieve. An activity can also become an action if it has lost its central purpose, and become one task amongst a chain of others intended to fulfill a different need.

Internalization/Externalization of Concepts

People learn skills and the operations of tools (in this view) through a process called internalization. At first, learners must develop a skill by experiencing its use with another person. Once the person has mastered the skill, it can be internalized and executed only in their minds. When children learn how to count, they often are shown how to count on their fingers (an externalization of the process of counting) with the help of a knowledgeable adult. (Wertsch, 1981), Once the child has mastered counting, he/she is able to internalize the process and do it "in his/her head." Internalized skills or processes can be externalized again if the process becomes broken, or the person experiences an unexpected outcome, in an effort to analyze the process and fix it. For example, if someone makes an error doing a math problem "in their head," he/she often externalizes the problem by working it out on a piece of paper (Kaptelinin, Nardi, & Macaulay, 1999).

Activity Theory for Analyzing Distributed Creative Tasks

Collaborative activities also depend on the externalization of ideas, so that they can be shared amongst collaborators for consumption, reflection, and feedback. Creative tasks often require people to make such externalizations of ideas, so that they can be evaluated for creative merit. The externalization and evaluation of ideas are two stages that take place in many scholars' models of the creative process that all activity is mediated by tools. It allows for scholars using this framework to analyze the role a tool plays in an activity and impact on its subject, while trying to achieve a goal. This feature of activity theory is especially helpful, because distributed music composition is mediated by computers and musical instruments. The definition of a subject in activity theory, as a single person or group of people, helps scholars analyze tool use at the individual (e.g. recording software/hardware, musical instrument) and group (e.g. discussion boards, music file repositories, e-mail) levels.

Improvisation

The novelty and creativity in music is partially due to the fact that it is an improvisational act. Musicians often improvise on instruments to write music or to perform rehearsed songs in a new way, that is receptive and responsive to the playing of group members. In activity theory, the mechanism for action (operations) that moves a subject toward fulfilling this need is described as an improvisational (situated) act. The subject chooses operations by instinctually responding to the conditions it is experiencing. Although activity theory does not focus on how improvised operations impact the outcome and planning of a task like situated action does, its definition of an operation makes it supportive of improvisational activities.

Distributed activity theory indirectly supports the analysis of temporally-distributed tasks, in that scholars must study the historical development of a tool that has been used to accomplish a task. Users of the tool that have made refinements to it can be considered to be temporally-distributed collaborators.

Collaborative

The definition of human activity as a group or an individual using a tool to achieve a goal, located this theory as one that lends itself to analyzing collaborative/collective behavior. Tools, as defined by activity theory, are also built and refined by the collective effort of people engaged in similar tasks. Scholars using this theory must explain how people have developed a tool for their needs, and how a group has worked together with the use of a tool to achieve a goal.

Methodological Commitment

In order to track how a tool and its subject have changed during the course of an activity, and accurately define a subject's purpose for acting, a scholar must spend a sufficient amount of time observing a subject in the field. Capturing the use and development of tools and the definition of an object from the subject's perspective also requires an investigator to draw insights from interviews, video, documents, and observation (Kaptelinin & Nardi, 2006).

Uses of Activity Theory for Online Music Composition

The usefulness of activity theory for this phenomenon lies in its ability to provide thick

descriptions of a phenomenon, and frame online music composition as a collaborative activity that consists of actors, tools (e.g. digital audio workstations, instruments, and effects pedals), roles (e.g. performer/instrumentalist, lyricist, composer, and engineer), goals (e.g. making a rock song), and rules (e.g. norms for contributing appropriately to the group). This framing, though it may seem insignificant at the outset, connects online music composition to any other collaborative activity studied in the literature that has been framed with this theory. Though it has the tools to ground this phenomenon as a collaborative task, it has no power in examining the exchange and incorporation of creative ideas that must happen to make a creative work. The theory also does not provide a model of what conditions and social practices must be in place for a good exchange of creative ideas to take place and persist.

Distributed Cognition

Edwin Hutchins created distributed cognition out of a need to accurately capture and analyze the behavior of task-focused groups using the tools of cognitive psychology (Hutchins, 1995). The traditional application of cognitive psychology limited Hutchins to study group tasks, by analyzing the mental processes of individuals involved in the task. However, Hutchins noticed that there were many entities outside the mind of the individual that played a part in the completion of a task, or influenced the way people went about doing it. The contribution and influence of cultural, historical, and social phenomena could not be accurately grappled using traditional cognitive analysis. Tools and artifacts used to facilitate a task also could not be taken into account. These critical objects existed outside the mind of research subjects, and were off limits to scholars employing traditional cognitive psychology analysis techniques. To solve this

problem, Hutchins expanded the unit of analysis from the individual to a “functional system,” which includes all people, artifacts, and tools involved in completing a goal oriented task (Hutchins, 1995).

Components of Distributed Cognition

Once Hutchins drew a boundary around the task rather than individual, he used classic cognitive analysis techniques to better understand the work practices of his research subjects (Hutchins, 1995). His analysis involves describing the flow and storage of information during a task.

Distributed cognition also tends to focus on describing knowledge involved in completing a task, detailing what person or artifact knows, and how information is transformed, communicated, or stored throughout the task. Scholars employing distributed cognition as a theoretical lens also describe the role of each person and artifact in the completion of a task, and the amount of access each party has to task relevant information. Describing the flow, storage, and distribution of information is also known as capturing the “propagation (and at times transformation) of representational states across media.” Systems analyzed with the use of distributed cognition are typically described using the two terms emphasized above.

Representations are ideas, concepts or pieces of information, and representational states are the changes in some medium (e.g. screen, paper, and memory) that temporarily store the idea or concept. For example, the representational state of paper changes when a person writes a musical idea. Each medium carries with it a level of durability and persistence. Paper can hold onto an idea until it’s erased or physically altered in some way, while an idea in short-term memory can disappear at any time.

Information is propagated (or flows) across different media (such as moving from memory to paper) by communication methods, such as talking, typing, or using an artifact to save state information (e.g. turning an oven knob stores the temperature setting from one's memory until it's moved). Representations are often transformed as a necessary part of a task (providing feedback on an idea and changing it), or as an unintended side effect of the medium.

Distributed Cognition and Utility for Analyzing Distributed Creative Tasks

Creative

Musicians often must create representations of musical ideas in their head so that they can be shared with collaborators for feedback. Collaborators will often look at the sheet music or listen to the musical idea, and record a modified version of the idea (transform the representation) if it's in need of refinement, or simply suggest what can be done to improve it. Music collaborators will trade ideas back and forth until they are pleased with the product. This cycle of creating representations and evaluating them is a central part of most creative tasks, not just those within the domain of music. Understanding the most effective medium for communicating and transforming representations of musical ideas may be a key part of facilitating the activity of distributed music composition.

Artifact-Focused/Tool-Mediated

The strength of distributed cognition lies in its ability to expose the role of an artifact (or a human actor) in the completion of a task. Distributed cognition does not see artifacts as tools, because this implies that tools or artifacts are subservient to humans. Any object with the

ability to store, modify, or propagate is seen as an equal part of a functional (cognitive) system. Scholars using this theoretical perspective must detail every piece of information required for the completion of a task, and describe how (and why) each person or artifact in the system stores, changes, or communicates that information to other actors. Although this theory does not specifically support “tool mediation,” since musical instruments and computers both help to create and communicate musical ideas to others, they are considered to be a part of a functional system (for the task of collaborative music composition). Distributed cognition’s recognition of the impact of culture and society on tasks leads Hutchins to dictate that scholars must use their domain expertise to understand what bits of information are task relevant (Rogers & Ellis, 1994).

Distributed

Much like activity theory, distributed cognition supports the analysis of tasks that are distributed amongst different people and segments of time. Distributed cognition handles temporal distribution in past studies when information is stored on durable media like paper and screens, for use by collaborators who need access to the information at a later time, such as velocity settings for plane landings stored on reference cards (Hutchins & Klausen, 1992) or whiteboards storing the location of heavy imaging equipment (Rogers & Ellis, 1994).

Improvisational

Distributed cognition recognizes that actions are situated and representations are interpreted using knowledge about the current situation and history of the actors engaging in the task.

However, distributed cognition does not explicitly recommend how situated improvisation impacts communication and the execution of the task, like Suchman's theory of situated action.

Methodological Commitment

Capturing the transformation and communication of representational states from each actor involved in the completion of a task requires an investigator to directly observe his/her research participants using a number of methods. Many studies that have employed distributed cognition have used video and direct observation as a data collection tool, to capture the state of screens and artifacts during the task, and record how actors interact to complete a task (Halverson, 1994; Hutchins & Klausen, 1992; Hutchins, 1995). Investigators also use interviews to verify the role of artifacts and actors, and ensure that they are capturing the task from the eyes of the research participants (Rogers & Ellis, 1994).

Appendix B: Raw Groove Data from Judges

Song 1: <http://www.Kompoz.com/music/player/85689?isPopup=true>

Song 2: <http://www.Kompoz.com/music/player/446375/530527/1?isPopup=true>

Song 3: <http://www.Kompoz.com/music/player/408800/410989/1?isPopup=true>

Song 4: <http://www.Kompoz.com/music/player/460498/465209/5?isPopup=true>

Song 5: <http://www.Kompoz.com/music/player/416397/589005/2?isPopup=true>

Phil's Data

Here's my data. I'm gonna put Jen on it tomorrow. Song 1

0:18 - start moving 1:28 - stop moving, but listen more intently 1:45 - start moving 4:02 - stop moving

4:56 - start moving 5:42 - stop moving

Other notable times where I was moving more emphatically: 3:12 - drums, hi-hat 3:27 - drums, toms

Song 2 0:04 - start moving 1:26 - stop moving 1:45 - start moving 2:27 - stop moving 2:48 - start moving 4:03 - stop moving 4:20 - start moving 5:54 - stop moving Song 3 0:20 - start moving

0:28 - stop moving 0:42 - start moving 1:50 - stop moving 2:15 - start moving 4:04 - stop moving

Other notable times where I was moving more emphatically: 2:28 - breakdown 3:10 - end of keys solo and brief drum fill

Hey man, here's 4 and 5. Definitely didn't feel either of these songs as much as the last few. Particularly on song 5, it was like a full sound assault coming at you the entire time...very few changes in volume, tempo, or other factors that would allow you to build up with the music. Not sure if that helps, but I figured I would vent because that crap kills me when I hear people play.

Song 4 0:13 - Start moving 1:33 - Stop moving 2:14 - Start moving 3:15 - Stop moving Other notable times where I was moving more enthusiastically: None, didn't feel this song as much as songs 1, 2, 3

Song 5 1:03 - Start moving 1:40 - Stop moving 1:45 - Start moving 2:15 - Stop moving Other notable times where I was moving more enthusiastically: None, didn't feel this song as much as songs 1, 2, 3

Parker's Data

Song 1: <http://www.Kompoz.com/music/player/85689?isPopup=true>

Song 2: <http://www.Kompoz.com/music/player/446375/530527/1?isPopup=true>

Song 3: <http://www.Kompoz.com/music/player/408800/410989/1?isPopup=true>

Song 4: <http://www.Kompoz.com/music/player/460498/465209/5?isPopup=true>

Song 5: <http://www.Kompoz.com/music/player/416397/589005/2?isPopup=true>

Man, you're trying to kill me with this sh*t, aren't you?

1. I want to move at :18 when the groove settles. Picks up around :35 with the bass line added. Groove goes down around 1:35 when bass takes over melody. Back up at 2:36 with original groove restated. Back down at 3:10 with weak sax solo, down even more at 4:10 when drums drop out. Back up at 4:57 to end.
2. Really didn't dig this one at all. Sounds FAKE. Disliked it more as I listened. Lyrics were bad, and even the horn line sounds disinterested. The Mary Had a Little Lamb quote near the end with the following gun shot was so over the top. Didn't even tap my foot.
3. Started to move at 0:20, mostly because of bass line. Decreased at :45 when horns came in. Just not tight or together. Up at 2:18 for keyboard interlude, but back down at 2:30. Horns RUIN the groove. Pretty flat feel overall.
4. The lyrics to this one were HORRIFIC. Not feeling anything remotely making me want to move. Would like to hear the groove minus vocals. Increased slightly at 2:15 with the half time groove, but vocals just killed this one.
5. Wanted to move at 0:55 when vocals stopped. Went down when vocals came back, and got better around 1:44 with the bass line. Groove died at 2:28 with lame guitar solo, and even worse at 3:20 when guitar destroyed the entire track. Just being honest here. Hope this helps. Now I need to listen to some PFunk to clear my head!

Appendix C: IRB Documents

ELECTRONIC INFORMED CONSENT FORM



SCHOOL OF INFORMATION STUDIES
343 Hinds Hall, Syracuse, New York 13244-1190 Phone: 315-443-2911

My name is David James, and I am a Doctoral Candidate at Syracuse University's School of Information Studies. I am inviting you to participate in a research study. Involvement in the study is voluntary, so you may choose to participate or not, and can withdraw at anytime without penalty. This page will explain the study to you and please feel free to ask questions about the research if you have any by e-mailing me at dljame01@syr.edu.

I am interested in learning more about how members of online music making communities are able to lock into a groove together (jam or have an optimal creative experience) while collaboratively writing/performing a song. If you choose to participate in the study you will be asked:

1. To complete a 10 – 15 minute survey
2. Permission to write about the music and conversations in the projects you reference.
3. Follow up questions to clarify responses on the survey. (if needed)

All information will be kept confidential. I will assign a made up for you, and only I and my dissertation committee will have the key to indicate which assigned name belongs to which

participant. In any articles I write or any presentations that I make, I will use the assigned name, and I will not reveal any details that will allow someone to determine your identity. Data collected from the survey will be stored in the Qualtrics secure database until it has been deleted by the primary investigator. Data from the projects and any follow up questions will be stored on a password protected machine that only I have access to.

Whenever one works with e-mail or the internet; there is always the risk of compromising privacy, confidentiality and/or anonymity. Your confidentiality will be maintained to the degree permitted by the technology being used. It is important for you to understand that no guarantees can be made about the interception of data sent via the internet by third parties.

There are no specific benefits to you in taking part in this study. Subjects who participate in this study are at minimal risk. At any point, you have the right to refuse to be observed and/or refuse to be interviewed and without entirely removing yourself from future participation in the study.

If you have any questions, concerns, complaints about the research, contact the investigators David James at dljame01@syr.edu or 718-928-5195, or Dr. Steven Sawyer at ssawyer@syr.edu or (315) 443-6147. If you have any questions about your rights as a research participant, concerns, or complaints that you wish to address to someone other than the investigator, or if you cannot reach the investigator, contact the Syracuse University Institutional Review Board at 315- 443-3013.

By clicking “Yes” below I certify that all of my questions have been answered, I am 18 years of age or older, and I wish to participate in this research study.



Sample Online Survey Questionnaire

Date: July 10 2014

Title: Sharing and Refining Ideas in Online Songwriting Groups Investigators: David James

Steven Sawyer PhD

I am interested in learning more about how musicians are able to lock into a groove together (jam or have an optimal creative experience) in an online collaboration. The benefit of this research is that you will help us advance the current understanding of virtual music collaborations and groups of distant peers in other creative disciplines that use technology to collaborate. To pursue this goal I will ask about how you use skills, tools, and social agreements inside and out of your online music community, and ask to look at projects where you have experienced a groove with others.

[The electronic consent document will be listed here and must be signed by clicking yes before participants are allowed to start the survey. Please see the attached consent document for more details.]

Please read the following descriptions of experiences creating music with others (and continue to the questions below):

“Every jazz musician wants to be locked in that groove where you can’t escape the tempo,” ... “You’re locked in so comfortably that there’s no way you can break outside of it, and everyone’s locked in there together.

“He can interpret things I play in the hippest way, hearing things in what I did that I never even thought of... I’ll hear myself do something because of what he played and say, ‘How did I ever think of that?’ I just played the way I play, and he played his thing against it, and we came up with a new thing together” (Berliner, 2009, Kindle Locations 9109-9112)

...I wouldn’t give up anything for some of the experiences I have had playing this music. There’s a feeling that you just can’t buy... It’s a beautiful, floating feeling that is hard to describe in words. It’s a wonderful

feeling, almost like getting out of your body. I never know when it's going to happen, but when everybody is there and it happens, it really happens. ... It's almost like there's a oneness. You and your instrument are one, there's no separation. And it's like a oneness with the music. It's like you're intune with the universe.

Have you had an experience like that described above creating with other musicians on Kompoz.com?

Yes/No

If you answered No to the previous question answer *only* questions in Section A.

If you answered Yes to the previous question answer *only* the questions in Section B.

Section A

What about the collaboration(s) made the experience(s) less than ideal? What is your Kompoz

Username?

Please list your contact information (e-mail, Skype, Google Hangout) if you're open to some follow up questions in the future.

Thank you for your participation and your insights!

Section B

Can you list the collaboration(s) on Kompoz where you've had that experience?

Please describe the differences between the collaboration(s) you've listed and others that did not bring about a similar experience.

What is your Kompoz Username?

Please list your contact information (e-mail, Skype, Google Hangout) if you're open to some follow up questions in the future.

Thank you for your participation and your insights!

Sample Recruitment Messages

Sample Discussion board Message sent through the Music Composition Community

Greetings fellow Kompozers,

My name is David James (username: SoulFanatic), and I am a Doctoral Candidate at Syracuse University's School of Information Studies, and I'm conducting a study for my dissertation. I am interested in learning more about how musicians in online communities are able to lock into a groove together while collaboratively creating a song. If you choose to participate in the study you will be asked:

1. To complete a 10 – 15 minute survey
2. Permission to write about the music and conversations in the projects you reference.
3. Follow up questions to clarify responses on the survey. (if needed)

There are no specific benefits to you in taking part in this study (but you will be helping a fellow Kompozer to graduate!). If you are interested in participating please view the consent document https://syracuseuniversity.qualtrics.com/SE/?SID=SV_0uKbFMkNGkXLzsF listed before the first survey question and send me a message on Kompoz or contact me via e-mail at dljame01@syr.edu if you have any questions. Thank you in advance for your consideration and time.

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[53349177757&partnerID=40&md5=750a1c74d45dbb5bc6200db0505a149f](http://www.scopus.com/inward/record.url?eid=2-s2.0-53349177757&partnerID=40&md5=750a1c74d45dbb5bc6200db0505a149f)

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Vita

David L. James

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EDUCATION

Ph.D., Information Science and Technology, May 2017
Syracuse University, School of Information Studies
Syracuse, New York

M.S., Information Management, May 2009
Syracuse University, School of Information Studies
Syracuse, New York

B.S., Computer & Systems Engineering, May 2006
Rensselaer Polytechnic Institute
Troy, New York

INDUSTRY EXPERIENCE

The Center for Research on Collaboratories and Technology Enhanced Learning Communities

Systems Admin, Syracuse, NY

September 2007 – May 2009

- Maintained the research center's content management and database management systems
- Designed websites for the NSF funded AGEP Collaboratory research project

Assistant Provost for Equity and Inclusion at Syracuse University

Database Developer, Syracuse, NY

August 2008 – December 2008

- Developed a database for assistant deans to keep track of all diversity supportive programs at Syracuse University
- Constructed reports to display programs that support undergraduate, graduate and pre-college students

Center for Digital Literacy at Syracuse University

Web Developer, Syracuse, NY

September 2007 – April 2008

- Gathered requirements from the center's director for the layout of the site
- Designed and deployed a website for the center

Lehman Brothers

Technology Analyst, New York, NY

July 2006 – August 2007

- Developed a Java Based information retrieval engine in a group of 20 programmers
- Provided production support for the Global Prime Brokerage Trading System

Goldman Sachs & Co.*Technology Analyst, New York, NY*

May 2004 – August 2004

- Participated in the development of a global investment products application
- Created stored procedures in Sybase to display the application's data
- Interacted with users frequently to satisfy their requirements for the application

RELEVANT SKILLS

Java, C++, Python, PHP, Pure Data (musical programming), T-SQL, SQL Server, Sybase, HTML, CSS

TEACHING*Theories and Applications of Digital Technology(CTA 103)*

Anne Arundel Community College, Computer and Information Systems Dep't

Full Time Faculty

Instructor of Record, Aug 15 2015 – Present

Computing and Information Technology(CTA 100)

Anne Arundel Community College, Computer and Information Systems Dep't

Full Time Faculty

Instructor of Record, Aug 15 2015 - Present

Making sense of Big Data(CTA100/MAT135)

Anne Arundel Community College, Computer and Information Systems Dep't

Introductory course developed in collaboration with the Math Dep't

Aug 15 2015 - Present

Programming Module (Python and Musical Instrument Development)

iSchool Inclusion Institute(i3)

University of Pittsburgh, School of Information Sciences

Teaching Fellow, June 5th-20th 2014*Library Services to Students with Disabilities (IST 553)*

Syracuse University, School of Information Studies

Dr. Renee Franklin Hill, Course Instructor

Teaching Assistant, Fall 2013

Reference and Information Literacy Services (IST 605)

Syracuse University, School of Information Studies

Dr. Renee Franklin Hill, Course Instructor

Teaching Assistant, Fall 2013

Information Presentation (IST 444)

Syracuse University, School of Information Studies

Dr. Susan Bonzi, Course Instructor

Lecturer, Fall 2011

Information Management in Schools (IST 553)
 Syracuse University, School of Information Studies
 Dr. Renee Franklin Hill, Course Instructor
 Teaching Assistant, Spring 2010

School Media Practicum (IST 972)
 Syracuse University, School of Information Studies
 Dr. Renee Franklin Hill, Course Instructor
 Teaching Assistant, Spring 2010

Introduction to Information Management (IST 621)
 Syracuse University, School of Information Studies
 Prof. Dave Dischiave, Course Instructor
 Lecturer, Fall 2009

RESEARCH

Invited Talks, Guest Lectures and Panels

Hip Hop and Computer Science. Invited Presenter. I'm Determined Conference (Virginia Dep't of Education) Charlottesville, VA June 15-16 2015

Pipelines and Pathways into the Information Professions. Invited panelist. iConference. Newport Beach, CA, March 24-27 2015

Beats Rhymes & Lines – Recording Musical Thoughts over Instrumentals. Invited Presenter. Writing Our Lives Conference. Nottingham High School, Nov 16, 2013

Refining and Evaluating Ideas in Online Musicmaking Groups. Invited Presenter. School of Information Sciences. University of Tennessee at Knoxville, Sep 20, 2013

The Revolution will Not be Televised: Making Music for Social Change. Invited Presenter. Writing Our Lives Conference. Danforth Middle School, May 5, 2013

Making Hip Hop with Computer Science: Developing Virtual Turntables. Invited Presenter. Rensselaer Polytechnic Institute, Feb 2, 2012

Hip Hop and Computer Science. Invited Lecturer. The Howard University Middle School of Mathematics and Science, Nov, 20 2011

Bibliographic Databases and Article Management. Invited Presenter. Maxwell School of Public Policy – Political Science Department, Syracuse University , Feb, 22, 2011.

Organizing Digital Literature. Invited Panel Participant. Minority Graduate Student Orientation Program, Syracuse University, March, 3, 2009.

Research Projects

Researcher, VOSS: Developing a Comparative Meta-Analytical Model for Evaluating and Facilitating Accessible CI-Enabled Virtual Organizations.

Spring 2009-Fall 2009

Syracuse University, School of Information Studies

Researcher, **Enhancing the Cyberinfrastructure for National AGEP Integration: Rapid Prototyping and Evaluation of a Pilot NY AGEP Collaboratory**

Fall 2008 – Spring 2008

Syracuse University, School of Information Studies

Dr. Derrick Cogburn, PI

Paper /Poster Presentations to National Organizations & Conferences

James, D., StJim, J (2011). *Beyond being (t)here: the social and personal implications of making music at a distance*. Poster presented at the iConference, Marriott Hotel, Seattle, WA.

Cogburn, D., Espinoza, F., James, D (2008). *Exploring the Impact of Virtual Organization Structures on Geographically Distributed Collaboration in University-Based Diversity Efforts in the STEM Disciplines*. Paper presented at International Association for Media and Communication Research (IAMCR), Stockholm, Sweden.

SERVICE

Reviewer, Journal of Information Technology, July 2012

Reviewer, iConference Poster section, 2010

Local Professional Memberships

Syracuse University, Minority Graduate Student Network

GRANTS AND AWARDS**2009-2015**

Science, Technology Engineering and Mathematics (STEM) Doctoral Fellow, Syracuse University, \$21,000/yr

Principal Investigator, Dr. Gina Lee Glauser

2009

Technology Access in Resource Limited Environments, **National Institute on Disability and Rehabilitation Research (submitted)**

Principal Investigators, Michael Morris and James Schmeling