Telematics: A Case Study in the Co-creation of Music and Technology

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Table of Contents

1. Introduction ........................................3
2. Methods ...........................................6
3. Users of Technology ..............................11
4. Turning the Switch On ............................21
5. The Technology Soundscape ......................30
6. Conclusions .......................................42
References ...........................................45
Ethics Application .................................50
Documentation of Ethics Approval ............61
1. Introduction

Telematic music, the practice of live music collaboration from multiple locations via communications technologies, is a relatively unknown field. Using an internet connection or other means, musicians play together in real time using live audio streams in both directions. Despite its relative obscurity, however, it is a vibrant and growing field, and one that stands to contribute quite a lot to studies of technology and society. The huge effect of technology on music in the past fifty years is recognized by Pinch and Bijsterveld (2004) in a special issue of *Social Studies of Science* dedicated to ‘Sound Studies’, and Marshall (2014) chronicles the wider emergence of a “turn to sound” (pg. 948). The study of telematic music provides an obvious opportunity to continue this path of research into new areas, but additionally, I argue that it provides surprising insight into wider analysis of the co-construction of technology and society as well. Telematics speaks not only to the local situation and perception of technology; through music’s intimate relation with the construction of culture, it invites a dialogue about how technology contributes to the ‘network society’ (Castells and Cardoso 2006) and how technological perception becomes a part of large scale social movements.

First however, telematics ought to be fully introduced. While essentially all modern telematic music is connected over the internet, music was already being attempted only shortly after the invention of the telephone (Oliveros 2006, pg. 2). Since then, we can trace two major technical concerns which mark much of both the technological improvement and, as will be discussed further, musical use of the medium. First is audio quality, and in recent years, video quality as well. In addition to the technological choices made for any recorded music, the quality that can then be broadcast immediately over a distance depends on the transmission software and the bandwidth available. Latency, the second main concern, can be introduced more succinctly; for it is ultimately just a number: latency is a measure of the time it takes between sound creation in one location, and it being heard in another. To address these technological concerns, musicians usually use dedicated audio software packages, the two most common being SoundJack (Carôt 2014) and JackTrip (Caceres and Chafe 2008). Each
is slightly different, but both have evolved along the cutting edge of transmitting the best possible quality in the smallest bandwidth as fast as possible.

Technological capability is one side of telematics; who it connects, and what it produces is another. This study focuses in particular on telematics and Brazil, and the particular situation of technology and society there. The question of why Brazil invites several answers. First, Brazil as a whole is becoming increasingly important as an international player, and much of this has to do with its relationship with science and technology (Bound 2008). It is also a country with an incredibly rich musical history, and vibrant embedded musical tradition. Combining these two observations, telematics sits squarely at the focal point of the interaction of technology with society, and while the field itself is not large, the theoretical consequences and potential certainly are. It is then less of a surprise that Brazil is also a hotbed for telematic music programs, including what I consider many of the most innovative. Telematics has been swept along with the idea of technology as a means to make lasting positive social change in Brazil, and along the way provides an excellent lens to view this movement.

I’ve come to know Brazil in part through my own involvement in a sustainable technology project there over the past few years. Starting summer of 2012 I began working with the Pantanal Center for Education and Research (PCER), and later that summer co-founded the Pantanal Music Exchange (PME) as an extension of PCER. The Pantanal, for which both projects are named, is an enormous wetland located in the Brazilian states of Mato Grosso and Mato Grosso do Sul, and covering parts of Bolivia and Paraguay. It’s sparsely inhabited primarily by poor, isolated agricultural communities, but is also the site of a growing eco-tourism industry, as it is one of the best places in the world to see jaguars and many tropical birds. PME teaches beginning violin, viola and cello to children at Colegio Nazaré, a boarding school and orphanage on the outskirts of the small town Poconé, in Mato Grosso, as part of the larger goals of PCER to strengthen and educate the community in order to preserve the local environment and culture. Including a telematic music course
through PME seemed a natural way to use technology to create new musical possibilities, and create a larger music community for the children. Thus I was able to undertake an embedded field study of Brazilian telematics and its social implications as well.

After chapter two, which describes the methods of this study, the following chapters all blend together personal experience, broader findings on telematics and technology in Brazil, and commentary on STS theoretical work on technology and society, with the idea that each helps focus and provides interesting examples and commentary for the others. chapter three begins with a discussion of the users of telematic technology. The classical literature on how users shape technology is built around the theory of Social Shaping of Technology. Telematics, however, is built by largely overlapping user and developer groups, and heavy emphasis on innovation from all users, which creates new questions for this line of analysis.

Chapter four looks more specifically at how these users do actually use telematics. The construction of technique, both musically and technically is discussed. The concept of the cyborg is brought up to describe the close relationship between musicians, instruments, and music technology. Here again, innovation and especially improvisation emerge as important. This analysis is wrapped up by situating this in a specifically Brazilian context, demonstrating how telematics plays a part in wider attitudes towards technological progress and social change.

This is pushed further in chapter five, addressing more exactly what the place of technology is in Brazil, and what telematics is being used to say about this. Analysis begins with network theory and framing, demonstrating how telematics is explicitly tied to social movements in Brazil. To complete this, however, concepts are borrowed from sound studies, particularly the idea of the soundscape, to factor in perception and sensory response in order to discover how telematic technology actually interacts with society.
2. Methods

Since there isn’t an existing body of STS on telematic research, this project drew from a wide variety of sources. Most of the theoretical grounding comes from the wider STS literature on sociology of technology and in particular from the emerging subfield of sound studies. Trevor Pinch and Trocco’s (2002) book Analog Days, tracing the history of the development of the synthesizer provided a good model for the types of study and STS theoretical questions to be applied to music technology, though the particulars of the subjects differ. Since STS provides a platform of theory for analysis but not the subject matter, this project also draws on studies of music, music technology in a general sense, and cultural studies of Brazil as well.

Telematics does provide non-academic resources as well. Since ultimately telematic music is a type of artistic performance, most concerts and projects have produced additional sources ranging from program notes to artist interviews to promotional materials. While these did fill in many basic factual details regarding dates, collaborations, and technologies used, they were most valuable in providing personal and organizational perspectives on the purposes and meanings of these projects. Sources were too inconsistent and sparse to allow for any serious statistical analysis, but some basic coding was applied. This was used on program notes and participant descriptions to identify the types of music most commonly played in telematic projects, and was used on project descriptions and related statements to trace patterns in what project designers identified as the social purpose(s) of telematic music.

2.1. Fieldwork and Participatory Research. The second part of this study, and the more involved methodologically, consisted of participatory fieldwork running a summer telematic music course as part of a music education program Poconé, Mato Grosso, in Brazil. The program ran during June and July, 2014, and involved several live telematic sessions as well as local work preparing for these and discussing them afterwards. In Brazil, my music class consisted of about 10 kids (school schedules and the general local pace of
life made perfect consistency difficult) between ages 9 and 16, who had played either violin, viola or cello for up to three years, and none of whom had any previous experience with telematic music. During the telematic sessions, we were connected online with a class of 6 students in the Youth Orchestra of Los Angeles who had volunteered to participate in the telematics add on course designed for this study. The teacher of this course had worked with the Pantanal Music Exchange in Brazil previously, and was familiar to the students in both locations.

Leading up to, and continuing in-between the live telematics sessions, students in both locations learned basic descriptions of telematic music, and about the students with whom they would be playing via the internet. They prepared musically, which consisted of both practicing and polishing pieces they had already been studying to present during the sessions, and both groups learning the common Brazilian folk song *Asa Branca*. The sessions consisted of 30 minutes of connected time, with some additional preparation and follow-up on each side of this. During the sessions, kids performed for each other while the other side listened, played together in a call and response style, and played together with one side playing the bass line and the other the melody in a two part harmony. There was also additional time during which kids were able to ask each other questions, via my translation assistance. Each session had a schedule prepared beforehand, but was expected to (and did) adjust based on the successes of the methods used and any technological issues that came up.

The technological options were quite limited by the location. Colegio Nazaré had not previously had internet, and had a radio internet system installed shortly before I arrived. This meant that the maximum bandwidth was no more than about two megabits per second, ping (roundtrip latency to the local internet provider) was about 80 milliseconds, and latency to the classroom in Los Angeles and back varied in the range of 250 milliseconds. Locally, computers were connected directly to the internet router over ethernet, so as to avoid any further bandwidth or latency degradation over wifi. For software, we ran the programs SoundJack and Google Hangout to broadcast audio and video, with microphone and
speaker connections, and analog-digital conversion on a dedicated external audio interface connected via USB.

Data collection during field work consisted of three main parts: observation, local interviews and feedback, and interviews with other telematics practitioners. The teacher in Los Angeles and I discussed and noted down our observations immediately after each session, both personal experience and what we saw in how the kids interacted with the technology. Towards the end of the sessions I conducted semi-structured small group feedback sessions with the participating students to collect their perspective and experiences. Similarly, the teacher in Los Angeles collected feedback from the students there, which was then summarized for me. Finally, I also conducted several brief interviews with other telematic practitioners while in Brazil. Much of this was facilitated by conversations at and following the International Society of Music Educators World Conference in Porto Alegre, Brazil, which brought together a sizable number of people with music experience in both Brazil and Telematics. These were usually semi-structured conversations of around 5-10 minutes.

2.2. **Participatory Research and Ethics.** Undertaking this study as both participant, researcher, and organizer required additional considerations. Bergold and Thomas (2012) argue that studies which contain a social action aspect (this feature of telematics is discussed in chapter 5) stand to gain deeper insight and nuance by using participatory methodologies. Further, Lenz (2012) points to participatory research as a sign of increasing social engagement in post-dictatorship countries in Latin America in particular, and indeed outside of my own work many of those I interviewed were also doing their own participatory research as well. Unger (2012) and Cook (2012) discuss the varying levels of participatory involvement. In this study, while I did directly take part in the telematic sessions, I maintained the separation of being the teacher and organizer. As such, my own participation was primarily to engage and enable the experience locally, and not to personally engage telematically.
Accomplishing this in a methodologically and ethically sound way, however, requires extra care. Determining the level of control that research partners (in this case, the students) have is extremely important (Cook, 2012). While I personally set up the technology and ran the sessions, most decisions were made jointly. The music we played was based on student interest, and student feedback between sessions was incorporated into planning. Perhaps the most important, though, was live feedback during the sessions. Both the teacher in Los Angeles and I incorporated constant adjustments based on student response, and made a point of making this explicit as well. For example, during sessions we avoided making unilateral decisions about what was working and what wasn’t, and instead posed questions like “do you want to do that again?” and “how should we try it this time?”.

The methods of this study were pre-approved as ethically sound by both the UCL STS departmental review and by the UCL Research Ethics Committee. The departmental review, obtained separately so that parts of the project could begin before hearing back from the more involved Research Ethics Committee review, covered the low risk aspects of the study. This included interviews with adults involved in telematic music and observation of telematic experiences. All participants were informed of the nature of the study and their requested participation, and expressed their consent to participate, either written or verbally, in the case of shorter interactions. Additionally, all data collected in this study was exclusively held and used anonymously, under standard data protection procedures. Interviews, conversations, and interviews were all restricted to topics related to music, telematics, and related aspects of Brazilian culture.

More rigorous review was obtained from the UCL Research Ethics Committee in order that the higher risk portions of the project could be approved as ethically sound as well. Making the project higher risk was the fact that it involved children. In order to ensure that proper informed consent was obtained, both children and legal guardians (in many cases this was the orphanage director, not parents) were informed about the study and given the chance to opt in to participate. At no point were students required to attend, and some did come and go
for varying reasons. On top of informed consent, however, there are power-dynamic concerns when working with children. There was always a second adult present during interactions with the students, and I was not in a position of leadership for them outside the extent of the study. Further details of the ethical issues of this study and how they were addressed is included in Appendix A, with documentation of ethical approval.
3. Users of Technology

My first trip to the Pantanal three years ago left a lasting impression. Getting to the Cuiabá airport was uneventful: a brief layover in São Paulo where I crossed through customs and rechecked my bags in English, then a quick flight further west. I soon became aware, however, that Mato Grosso is quite a different place from São Paulo. I was picked up by a friend of a friend who spoke broken English, then handed off in Poconé at a car body shop to his friend, who didn’t. By the time I made it all the way to where I was staying, we had picked up two more construction workers, 200 liters of diesel fuel, and an 18 foot boat, which we tied to the top of the truck.

Me, the boat, and my now distinctly diesel smelling sleeping bag made it out in one piece. What I soon learned, however, is that despite the underdeveloped appearance of this part of Brazil, things are changing fast. There’s a clear desire to modernize, to update, to become connected to the rest of the world. The diesel fuel was a stop-gap for the backup generator while we built a new solar powered water and electrical system, and eventually a solar powered radio internet system. The boat was to be used in the ecotourism industry, showing high-paying guests from around the world the natural wonder and importance of what is still an excellently preserved wetland. There’s still much progress to be made—the multiple collapsed bridges we had to detour around left no question of that—but momentum is picking up.

As I began teaching music, and working more in the education community, the same mentality was there. Brazil has long lagged behind the developed world in education, but has been catching up fast. Brazil is now graduating ten times as many masters and PhD students as it did twenty years ago, and many of these in science and technology fields (Bound 2008, pg. 42). Public opinion that science and technology bring positive change to society is both high and increasing (pg. 89). Technology in Brazil is being constructed as a social good, and as the way forward. But Brazil is held back by itself. The OECD reports that science
education is 30% behind where it would be if Brazil’s level of inequality was lowered to the average across other OECD countries (OECD PISA 2007). It is in communities like Poconé and the surrounding area where inequality persists. Simple realities of distance, resources, and access make it difficult for the changes of education to permeate.

Music too is caught up in the same yearning for progress as technology. Two thirds of Brazilians name music as their biggest source of national pride and music and culture are integral part to the particularly Brazilian flavor of progress the country is trying to achieve (Falcão 2006). A recent Carnival float won second place for its dances picturing Brazilian technological achievements (Bound 2008, pg. 85). Numerous music projects throughout the country are trying to tap into the body of research demonstrated by El Sistema in Venezuela in which music is used as a community strengthening tool, raising education rates and leading students to success in a wide variety of fields (Majno 2012). And so when technology and music are spoken of in Brazil, it is not merely a matter of sounds and machines. There are clear social connotations and social intents. It is from this environment that telematic music arises.

3.1. **Brazilian Telematic Musicians.** Most Brazilian Telematic Musicians I spoke to share similar reasons for having first begun the practice, reasons not very different from my own. In rural and remote communities there’s simply a need for it, and a gap that traditional music cannot fill. Brazil recently passed a law requiring music education in schools (Narita, 2012). The law is widely viewed as having accomplished some good and a step in the right direction, but that sentiment is almost always followed up by the statement of reality that it’s also simply not happening in many places. Schools often don’t have access to qualified music teachers, and when they do, they don’t have the resources to support them. Students may learn a few traditional songs on guitar or sing at their local church, but in the interior, the Portuguese word for the rest of the country outside the major metropolitan areas, little else is available.
Rather than waiting for the resources and experience to arrive, some have instead turned to telematics as a way to skip over the problem of access. The inviting idea is that now music education and music collaboration only requires a computer instead of long journeys, money to support them, and experienced teachers distributed throughout every small community. It certainly sold me at first — I could offer high quality music instruction and perform throughout the community for the two months per year that I’d be present, and telematics offered that perhaps the interim ten months didn’t have to be void, at only the expense of a periodic video conference. For most, telematics began as a direct, surface-level solution to the problem that they simply couldn’t physically be in the same location as those they wanted to make music with.

There is one thing that should be established before going further, however: telematic music is still a small field. It is not the next wave of music education, it is an experiment in a handful of communities. The music loving public is not buying up recordings of telematic performances. There are few if any for sale should they ever want to. Even amongst other musicians the word telematic conjures up no more than vague thoughts of science fiction in all but a select few. I’ve played violin for most of my life, and, as in fact most who discover the field once did, only recently even heard of telematic music when my musical desires happened to line up in just the right way that it could answer. Just a slight change in my particular musical situation or even the wording of my internet search addressing it and I would have never discovered it.

This is where the culling down to those relevant to our study stops, however. Nearly all musicians I’ve talked to with an interest in telematics have some amount of actual experience themselves. Once one does stumble across telematics, it is discovered to be an active and thriving endeavor. What makes telematic music particularly interesting is that this trend of active users isn’t present just in terms of musicianship, but in terms of technological development as well. Almost every telematic project I came across had a ‘tech crew’, a person or team often from among the musicians, in charge of navigating the particular challenges
of that telematic installation. And more often than not, they were in direct communication
with the actual developers of the technology being used. Like many small fields, everybody
knows everybody. The developers themselves, Alexander Carót in the case of SoundJack
and the Soundwire Group in the case of JackTrip, are active telematic musicians, and both
delegate debugging, new feature requests, and general development help to their user forums
(Carót 2014, Caceres and Chafe, 2008).

The telematic projects that don’t use these two main specialized programs show even more of
a full overlap between users and technical developers. The choice to use generic (i.e. not high
quality audio or telematic specific) programs like Skype or Google Hangout instead usually
is made based on internet quality. The internet at Colegio Nazaré where I ran my project
was a radio connection, meaning the bandwidth was extremely low (around 200KB/s) and
the latency just to reach the wired network was already about 80ms before even attempting
to reach out of Brazil. Since we couldn’t take advantage of SoundJack or JackTrip’s high
bandwidth and low latency capabilities anyways, Google Hangout was simply the easier
option, and is also better built do deal with inconsistent internet quality (Google 2014). Projects I talked to with similar internet quality issues often made similar choices. Nearly
always, most or all members of the project were part of the implementation, and many
had themselves built some of the gambiarras, or improvised solutions to get internet and
telematics up and running at all. The construction of telematics hinges crucially on those
who build these technologies as something for telematic use.

While the word gambiarras is unique to Brazil, the concept it describes is not. In America
at the beginning of the 20th century, the newly invented automobile caught on quickly in
urban areas. Rural parts of the country, however, disliked the technology as dangerous and
threatening to animals (Kline and Pinch 1996). It was only when improvised uses, such as
using it to run a corn sheller or converting the back into a truckbed, were found that the
car caught on there too. These haven’t gone out of style, either; the generator at PCER is
still just an old tractor engine mounted on a tire. What is interesting about the Brazilian
gambiarra, and the gambiarra of telematics, is that unlike the history of the car, where improvised uses eventually bleed some influence into the mainstream, improvisation is the primary, and even the only method of use. In the Pantanal I first learned countless tricks for when the right parts or tools are missing, but slowly caught on that parts and tools are always missing, and no one expects otherwise. Similarly, telematic software and hardware usually exists in a raw form, with the expectation that some innovation on the part of the user will be required.

The small but tightly bound grouping of users and developers of telematic technology provides an interesting study of how technology interacts with its users. Science and Technology studies traditionally provides examples and discussion of how users can also shape the development of a technology. The telephone, for example, was initially conceived as a business instrument, but was soon also embraced as a way to bring rural women out of isolation (Fischer 1992). And in fact telematics itself played a small part in the development of the telephone; the early roots of the field involved playing music over phone lines, and pushing the boundaries of what the medium could do (Oliveros 2006, pg. 2). While a technology may be created with specific intentions, it is free to pick up new uses as soon as it is released to the world. This new use in turn feeds back onto its development. Telephone access was aggressively pushed out, even to rural areas (Fischer 1992). Better audio quality capabilities, not necessary for voice but crucial for music, were eventually developed (Oliveros, 2006). This analysis is largely grouped by the heading Social Construction of Technology (SCOT) (Pinch and Bijker 1984).

SCOT studies later came to study the reverse interaction as well, by which technology can redefine its user group (Bijker 1995). While some of the specifics of the technological constraints on telematic music making will be discussed later, the technology certainly plays a crucial role in shaping the music being played and the musical directions taken by its users. Oudshoorn and Pinch (2003) shape this into the technological version of Jasanoff’s (2004) concept of co-production of knowledge, where technology and groups of society are constantly
and simultaneously redefining each other based on their interaction. Extending this SCOT analysis, Akrich’s (1992) metaphor of technology as a film script is particularly fitting, where technical concerns such as bandwidth, latency, and non-verbal communication means frame what can happen, but the musicians themselves create their own realization.

Studying telematics in this way is accurate, but it leaves a certain amount of depth lacking, and the reason is precisely because telematic music is such a dense, overlapping field of both musicians and technicians. Returning to Akrich’s (1992) description, she points out how developers of new or evolving technologies attempt to anticipate future uses and interests of users in building the technological script guiding their use. Telematic music certainly doesn’t falsify this approach, but rather trivializes it. The developers of telematic software and the users of it are, if not the same people, involved in the same projects. Of course they are anticipating what they might want for the next project. Note, however, the results of SCOT-style co-creation do manifest, even if the explanation for it is insubstantial. Telematic technology is in constant development, and in response telematic music is one of the most dynamic and experimental areas of music performance. But this can’t be explained by a misalignment of technology user and developer interests.

The problem is that the field of telematics doesn’t split up into ‘relevant groups’ in the way that Pinch and Bijker describe in their initial work on SCOT. Bijker describes the first step of his method as “rolling a snowball” (1995, pg. 46). As the snowball rolls, one gradually accumulates all relevant parties involved in the particular technology, and then categorizes them into groups based on interests and uses. This has been criticized as being too algorithmic and formal (Marshall 2014, pg. 949), as well as questioned on how one is to know when all relevant groups have been found and how to divide them (Klein and Kleinman 2002, pg. 32). Bijker’s response is to invite researchers to exercise judgement on this point (1995, pg 49), and while this does weaken the method somewhat, it does seem a fair point in practice. It is reasonable, for example, to here exclude Google or Microsoft from serious analysis despite their video conferencing products being used in telematics,
since they seem unconcerned or even unaware of these developments, and have not entered the co-construction dialogue. But the main critique remains, that amongst those who are relevant to telematics, how does one pick out specific interest groups?

What telematics helps to clarify in this complaint, is that it might not be just the difficulty of correctly identifying them, but in fact the framing of SCOT as an intergroup dialogue that turns out problematic. Classic examples of SCOT analysis consist of a technology situated in an industry producing it with an intended purpose. A second group with different interests shows up, makes a different purpose of the product, and eventually the producer responds, evolving the product. Similarly, the public adjusts in their use of the product, evolving alongside it. This can be seen in the Kodak camera (Bijker et al. 1987) or in countless other examples. Telematics may lack clear group divisions, but more importantly, it lacks this back and forth discussion between technology and society. The technology is being built by the same people who are then finding new ways to use it.

Consider, for example, an online percussion course hosted by the Universidade Aberta do Brazil (Open University of Brazil) (Universidade 2014, Narita 2012). The instructor described to me how the content of the course involves live telematic sessions as well as a whole range of other technology-enabled capabilities. Interactive written material is available alongside, and when live interaction is not scheduled, students and teachers can prerecord material to listen to and play along with later. But the capabilities are often added without specific uses in mind. It is not as if file upload was added with the express purpose of turning in work, and then students started sharing videos, prompting this to become an embedded part of the course. Instead, student and teacher together explore their own creation with primarily only the broader goal of allowing music making where it could not otherwise be. There do not appear to be groups with specific purposes or use patterns, but rather all are exploring what their use pattern might be in order to achieve their wider goals, and actively responding to their own creation as much as to that of others.
3.2. **Emerging Technology and Innovation Studies.** Emerging technologies and innovation studies better account for this situation. Hippel’s Democratizing Innovation (2005) considers the case that many, nearly even most users alter the technologies they use, or ‘innovate’ (pg. 20). In it, he considers the concept of lead users, the users on the cutting edge of product use, and who stand to directly benefit from their own product modifications or repurposing (pg. 22). Telematic music practitioners certainly fit these two qualities. He goes on to describe in chapter 10 how technology developers often seek out lead users, and directly implement their designs into their own future designs. Companies employing this strategy demonstrate better product improvement efficiency, resulting in significantly better product success than those who don’t (Lillen et al. 2002). The direct line of communication between developers and lead users, rather than leaving unaddressed where the impetus for development comes from, explains the quick pace of change in telematic music.

Telematics, as an extreme example, however, points out some of the inconsistencies of this approach. Beginning semantically, it is not so accurate a term when the vast majority of users fit the profile of ‘lead users’, as do nearly all telematic musicians. In a large field of study such as cell phone operating systems or the internet as a broader concept this doesn’t pose as much of a problem and the model tends to work itself out. But where factors of scale are less overruling, we see that the designation of ‘lead users’ is often only identified after the fact, based on who’s direction the product ends up taking. The idea of technology as a ‘democratizing’ concept is meant to dissolve the dualism between lay users and expert developers (Callon 2009), but Hippel instead gives us a third class of preferred lay users. Small cases like telematics, where developer and user dichotomies don’t quite exist to be broken down and technological evolution flows freely through a tight-knit community fit the rough picture of an evolving socially situated technology, but don’t quite fit the explanation. Telematics doesn’t contradict this analysis, but it does show that it sometimes lacks definition.
To address this further, Marshall (2014) makes the case that sound and sound technologies should not be just considered additional case studies to run through STS analysis as above, but that in fact sound “presents an opportunity to better sensitize STS approaches to the contingent socio-technical shaping and distribution of embodied perceptual modalities in general” (pg. 948). The newly developing field of Sound Studies, presented in works such as (Pinch and Bijsterveld 2012, Sterne 2012) initiates a turn to a more nuanced study tailored to track the importance of perception in the study of sound and sound technology. Telematics proves to be an example of this, where the cultural nuance of what it means to make and study music precludes an analysis which divides technology users into simple social headings.

Where SCOT fails, argues Marshall, is in the scale of its look at social situation. Analysis rounds people out into groups, such as ‘female rural telephone users’ or ‘lower socio-economic class Brooklyn commuters’ (Winner 1980). This unifies socially situated technological evolution into a clean narrative, but at the expense of smoothing over differences in individual perceptions. Telematics, as described above, problematizes this analysis first of all for the obvious reason of scale. The field is neither big enough nor stratified enough to warrant much of a meaningful division into a handful of differently situated groups. Even the most basic division into users and developers can’t really be done, for in any practical sense, these overlap more than not. Hence a group-based analysis simply has little to go on, and thus concludes very little as well.

Telematic music represents just one small study of how technology and scientific advancement is socially situated in Brazil, but its analysis does reflect some light back on the larger picture. The reasons that brings most to telematic music are the same reasons bringing health technologies to remote river communities (PCER, 2014), bringing new startup hubs to the northeast (Bound 2008), and working to bring improvements to Brazil’s education system in general. But just as telematic musicians themselves are the ones reinterpreting their own creations, there is perspective to be gained by considering not just how Brazilian
technology is redefined as it bounces between varying interests, but also how self-reflection, and the willingness to explore one’s own creations actively reshape the technological landscape.

There’s an interesting cultural phenomenon I found in Mato Grosso. Whenever plans or intents are laid out, there is both a confidence that it will not actually go as expected, and a confidence that things will work out some way or another. This ranges from telling someone what time you will meet them for dinner to driving directions, to large construction projects. It’s not an assumption that difficulties will come up, for that’s seldom why people are actually late for dinner, it’s an acknowledgement that perception of time and needs may very well change. The main road to the Arena Pantanal In Cuiabá only managed to get paved one day before the first world cup game, but the four games hosted there went off with out a hitch. Certainly some of this is just Brazilian optimism no matter how bad or unlikely the situation. But I think we can see a bit in views towards science and technology as well. Technologies don’t just become redefined in society when they run into different, unexpected adaptations. Sometimes too they are released with no permanent definition at all, with a guiding intent but a concession that the specifics will change. A concession that as one uses one’s own creation, perception alone will continuously reconstruct it, before any outside influence can.
4. Turning the switch on

Around 9 pm I unlocked the music room, then brought the kids over from the dorm where they lived. It was a late night for them to be out, but that was the earliest time slot we could work out to correspond with the class in Los Angeles, three hours behind. I had done a sound-check with just the music teacher on the other end a few hours earlier, and now it was just a matter of tuning instruments, warming up, and hoping everything still worked. In my nervousness that it might take a while to group up the kids, or that we would need to review everything we were going to play before doing the real thing, I had brought the kids over a full half hour before we were supposed to go live. I should have known better. By 9:29, I was desperately staring down the ‘offline’ icon on my chat window with one eye, watching two kids sword fight with their bows out of the other, playing *Asa Branca* as loud as possible hoping someone was still listening, and alternating yelling in Portuguese and quietly cursing in English. I knew what this telematic experience was supposed to be, what the kids, the other teachers and I had designed it to be: an exciting, eye opening, multicultural beginning jam session. I was about to find out what it would actually be.

While the backgrounds and motivations of those who take up telematic music are often quite similar, resisting an analysis which splits them into identifiable subgroups, the results of telematic playing do exhibit quite a variance, and, crucially, turn out to often take on a different meaning than the musicians originally thought. There is clearly a socially based construction of the technology taking place, it is just that traditional SCOT approaches seem not to be looking in the right place. It is not a group dialogue, but a more individual one. Take, for example, the stories told by *Telematic Music: Six Perspectives* (Oliveros 2006), and corroborated by my discussions with other telematic musicians. It’s not merely that each person presents their own story, for of course there will always be some level of individual variation, it’s the fact that many of these stories rest crucially on deeply personal events and experiences. Mark Dresser discusses how he experienced his own direction and meaning in telematic music meditating during a telematic rehearsal while wild fires threatened his house.
This is certainly neither a common experience nor one Dresser personally thought might relate to his telematic work, and yet having been through it he describes it as foundational. This requires a deeper, cognitive look at the technological experience.

Many of the musicians I talked to described a moment early on, though usually not right at the beginning of their telematic work, when things ‘clicked’ and ‘the technology disappeared’. My own experience was similar; what I felt to be the most successful parts of the telematic classes I ran were when the technology was not the main thing I was thinking about. One might be inclined then, to think that this is a study of musical experience, of how individual creativity in a pure artistic sense develops and changes, going above and beyond any bounds of technology. And there is certainly an element of that; it would be ridiculous not to take some direction from the study of music itself. Perhaps in the moment it is even mostly that. But once one steps back out of the moment, telematic music is sharply back in the realm of a technological study. To musicians the technology may indeed disappear, but any audience member would need one glance, only one quick listen to know something different is most certainly present. The heart of the matter is resolving these perspectives.

From the musician side, despite the use of ‘disappeared’, it might be more accurate to say that musician, music, and technology merged so closely as to make it difficult to distinguish one from the other. When I asked musicians to describe the moment in detail, it was not that they forgot about the technology or were able to ignore it; instead what had begun as unnatural seemed to suddenly blend in as a natural part of the music making experience. John Marshall (1977) provides an excellent framework for this viewpoint, surprisingly pre-dating the development of sound studies, arguing that the commonly used metaphor describing the mind as a machine is actually a quite robust one for serious analysis. For example, a piano is certainly a machine in its own right, but the goal of the pianist is to form from their own mind and body into a machine to fit with it (pg. 482). Thus to account for the technology disappearing, we actually focus on not just the computer, microphone, and other electronics but also the musician themselves as pieces of technology. Not being used to each other, they
grind and conflict at first until the gears eventually mesh. At this moment, the computer and the musician are one smooth synced technology, and the external technology appears no different from the body technology.

I considered more closely my own personal experience of the disappearance of the technology, and then cross checked this against post-session discussions with the music teacher in Los Angeles and with some of the students. The first, obvious observation is that before the technology disappeared, it was present. In our minds, we were playing music for a microphone and a computer screen. This alone was excitement enough for the kids on my end at first; as soon as they came in and saw the new set-up, they all wanted to (and did) run up to the front and yell something right into the microphone. (I hung it from the ceiling for the second session, so as not to come under ethics investigation for making a group of children on a different continent deaf.) It’s no surprise that technology appeared at first as a barrier compared to a standard musical collaboration; concert goers report that while physically present, even viewing a concert through their phone while recording a video “removes you...from the moment” (Lingel and Naaman 2012, pg. 338). This perception didn’t immediately fade either. As we began, I was of course consciously aware that there was a similar classroom present at the end of a very long wire, but was still only instinctively making music with the people physically present.

The next stage towards the disappearance of the technology was curiosity. We had not yet bridged into the other classroom yet, but we had become subconsciously aware that the technology in front of us opened onto a pathway leading somewhere. In what I think was a good choice to acclimatize to the new conditions, and one that I used in future sessions as well, we began not by actually playing together, but with each localized group of students presenting a piece they had prepared for each other. My students played the popular Brazilian folk song *Asa Branca* (Gonzaga, 2009), and the students in Los Angeles played a song from the beginning Suzuki repertoire. This was my first moment of relief that we were getting somewhere. After my disastrous mistake of starting the kids much too
early before the joint session and losing any remnants of focus by the time we started, they were suddenly the quietest I had ever seen them, telematic session or otherwise, when the class in LA played for us. I don’t think they or I entirely understood yet what we were experiencing in more than a superficial sense, but we could tell it was something. We could sense that the technology of our minds and instruments might have the right pieces to line up with the technology on the table in front of us, and through that to the people on the other side. We hadn’t actually gotten the joint machine in gear yet, but we now recognized the possibility and were now eager to try.

This concept of merging musician and music technology into the perception of one machine gains some additional traction from cyborg anthropology. Initiated by Haraway’s essay *A Cyborg Manifesto* (1991), the field considers the social and often political implications of dissolving traditional divisions of humans and machines. This is put in a sound context by Kincheloe’s (2012) paper on cochlear implants, and how this technology assists in the identity construction of deaf individuals. There are many similarities to the initial telematic experience. Television and film portrayals of people with cochlear implants often focus on the ‘click’, a sentimentalized moment when the implant is first turned on and the patient suddenly responds to the sounds of their close friends and family around them. The step where musician and technology align and activate together in telematics is of course not so extreme, but many did report a noticeable change in their perception of sound. They went from listening, as one would to recorded music, to hearing in an inclusive and responsive way that put them there with the music.

Here, the technology-enabled new perception of sound is much less of a fundamental identity moment as it is for those with cochlear implants, and Kincheloe goes on to describe how the over sentimentalization of the moment can be harmful for the deaf community, but I would argue that it is still a good perspective to consider. We are inclined to miss the nuance of the interaction if we leave telematic technology as a distinct, imposing gate-keeper of musical interaction. There is no way that such a technology could disappear in the way
users describe. In an interview, cyborg anthropologist Amber Case claims that “today’s technologies amplify our humanness” but that “humans don’t evolve as fast as machines” (Root 2014). It takes an adjustment period for us to find how to interact with technology, and in the interim it may indeed seem cold and non-human. But as we learn and adjust, we see on the other side of the technology not something new entirely but an amplified version of what we put in. The construction of music and technology through telematics is an extremely intimate and personal kind of co-construction.

Pinch and Trocco’s later work on the Moog Synthesizer (Pinch and Trocco 2002, pg. 306-308) touches on this same concept in different language, asking when an object is designated a musical instrument versus just a machine. They leave it as an open question, despite it coming up in a court case determining which import tax category certain Casio devices fell into. The synthesizer seems at first much colder and distinctly different than, say, the flute or violin, but it is still both enabled and limited by the person using it. This is just the latest round of this discussion, following the invention of the piano-forte then the player piano, each time bringing both fears that it would kill off the art and passion of music and optimism that it would create new possibilities. I will not fall conclusively on the side of declaring telematic networking equipment itself an instrument (and I think nor would Pinch and Trocco), but there is a clear indication that music technology presents a unique closeness between man and machine, and that the perception of this closeness will be particularly important to analysis.

Missing from their analysis, however, is an actual definition of what a musical instrument is. The court’s legal definition is given, but it’s clear this isn’t sufficient for deeper analysis. It’s implied throughout the above discussion that a musical instrument is like a machine or piece of technology, but that it in some way forms a closer bond with a musician than a normal technological artifact might. A cyborg-influenced definition clarifies this quite well. It is consistent with what Pinch and Trocco do argue to say that a musical instrument is a piece of technology that becomes a cyborg-like extension of the human body in the context
of music making. Telematics is then, if not an instrument, not cognitively very far off. In fact one can even “play the network” as if it were an instrument itself stretching between the connected sites (Oliveros, pg. 28). Just as one perceives of a musical instrument as a cyborg extension of the body allowing for direct, personal creation of sound, so too can this perception eventually travel out through the network, so that the creation and reception of sound happens in one co-located space.

4.1. **Network Music.** What kind of music can one play on the network instrument? Just as one can create different sounds depending on whether he or she is playing a trumpet or violin, and each carries its own musical and cultural context, so too will telematic music have its own distinct abilities and meaning. The abilities of the instrument depend on how its particular machine meshes with the machine of the human mind and body. But as we’ve seen, the way these mesh is a mix of both physical properties of the machine and the socially situated perception of the machine. Traditional musical instruments again provide an excellent example of this. A cello will never achieve the piercing clear tone of a trumpet, nor will a trumpet reach the low range of a cello, simply because of their physical makeup. But equally important is looking at what each actually does play, and what it means. A cello can transpose and play a trumpet’s part, and while it will be the same music in one sense, it may invoke a different experience. Even a wood saw, not typically used for music at all, can earn the right to be considered a musical instrument solely based on use and perception of purpose (Ingold 2011).

In the telematic performances and projects surveyed, latency is consistently the most notable factor defining how music can be made. Tolerance for latency varies quite widely by musician as well as by the particularities of the music being played, but typically latencies up to 20-50 milliseconds can be tolerated as no different than in person collaboration (Carot, ch. 3). This means that, depending on the internet connection, distances up to around 1000km will allow for telematics with little noticeable latency, but that above this distance (and certainly for any connection across multiple continents), it becomes more of a serious concern, and one
that will have to be incorporated into playing style. A nice rule to put this in perspective is that the speed of sound through air works out to traveling one meter every 3 milliseconds, and so baseline latency is not zero, but even as high as 10-20 milliseconds even just for members of a small band listening to each other through non-electronic means.

One might note then that the natural latency across a large symphony orchestra or a marching band may easily exceed the 20-50 milliseconds threshold, which is part of the reason why groups like these almost always have a conductor or a hierarchy of leadership, so that visual cues, which for practical purposes over these distances (in contrast to distances between continents) propagate instantly. The speed of light has a large, but not infinite, advantage over that of sound. Hence, larger groups already naturally apply solutions to issues of latency so that everyone can remain perfectly in sync. This points to the second most common defining factor of the telematic experience. When not present in person and only visually connected through a video screen, usually with even higher latency than the audio due to the higher intensity of video codecs (Weaver 2011, ch. 2), the natural cues and visual communication one employs while making music require additional thought and creativity.

A variety of musical techniques have been demonstrated to mesh well with these characteristics of the technology. Carôt (pg. 113-123) provides a theoretical overview of how many of these work, and there are many examples in practice as well. Eric Whitacre writing telematic choral pieces where timing need not be precise (Whitacre 2014). Some pieces actually increase latency artificially so as to exactly match one bar length (Oliveros 2006). Sarah Weaver, a prominent telematic composer and performer, often uses sound painting, a technique developed by composer Walter Thompson which directs music using anticipatory gestures (Oliveros 2006, Weaver 2011, ch. 3), By far the most popular style of telematic playing, though, is playing music which relies heavily on improvisation. Improvisation can mean many things, and does often still require a strict adherence to concurrent time (take bebop jazz, for example). In telematic music, however, improvisation means a style free from an underlying set of timings and rules that must be agreed upon from all sides.
Music is often thought of as a form of expressive communication, and the way in which telematic musicians often describe improvisation in this context is particularly interesting. Telematic improvisations often take aim at more contemplative or meditative concepts such as “changing states of water” (Oliveros 2006, pg. 11). Note and rhythm level specifics are not simply dropped, instead the perspective is turned away from these to make higher order idioms and musical ideas first, and improvise the specifics as this takes form. Music is being boiled down further and further to its basic communicative nature.

Once this is understood, the two main technical factors, latency and visual communication, which in a traditional music context would be framed as problems, simply disappear as they fade naturally into the background. Discrepancies of a handful of milliseconds don’t even register in the mind of the performer or the listener because they are inconsequential against the primary level of ideas which may span several minutes. Visual communication too is freed from latency worries, but also is simply no longer needed as a strict organizational tool. Anything that must be communicated can be communicated at the pace of the music, and will work its way out at the level of natural conversation. Sarah Weaver describes this experience:

“Almost exclusively through this communication across distance Mark and I were able to develop an intensive collaboration with presence that is on par with any local collaboration I have been involved with. In some ways I feel that communicating telematically took the effectiveness and depth of the collaboration far beyond what could have happened locally. This to me is indicative of the level of communication and artistry that can become possible for telematic music” (Oliveros, pg. 11).

Telematic music is thus constructed as more of a philosophical conversation than as music in a traditional sense, and the network constructed as an instrument of this.

Before moving on to discuss the topic of this telematic conversation, it’s interesting to note how naturally this fits Brazilian culture. Improvisation is central to two of the most important elements of the Brazilian identity: music and football. Often it is even what brings
them into discussion together: a footballer might describe a particularly clever self-created play as a samba dance (Buarque de Hollanda 2011). More so than improvisation being present in both, though, it’s also culturally important. The seleção, or Brazilian national team, certainly values innovative play, but even more so do my music students in our pickup games. It’s an unwritten rule that you never simply shoot the ball with full force. Rather, you creatively work your way around every player until you can nearly walk the ball into the net.

Beyond football or music, improvisation is simply the Brazilian spirit of adaptation and the ability to find solutions. This is not so different from the gambiarras discussed in the previous chapter; the idea that often the use of technology is expected to be at least partly improvised as needed. What, then, is needed, and what might improvisation communicate? Telematics is inviting an answer through music. Musical improvisation is often a representative tool of social change (Dean and Bailes 2010). Telematics in Brazil, then, stands to have quite a lot to say.
One of the funniest, at least retrospectively, moments of my own telematics program came during our last session, just as I was starting to feel like I was beginning to understand and control the new medium. Early on in the session, after a little bit of introductory playing, we had stopped to give the kids a chance to ask questions to one another and perhaps form more personal relationships to go along with the music and the technology. As I was looking elsewhere, one of my students, a boy around ten years old, held up his middle finger right to the camera. Of course all the kids in Los Angeles saw immediately, and the teacher there quickly attempted to cover by explaining that the gesture doesn’t mean the same thing in Brazil.

That’s actually only partly true; while the middle finger gesture isn’t as common in Brazil, nearly everyone recognizes it and knows its meaning from having seen American movies, or other bits of foreign culture. Despite my initial panicked reaction, though, it was actually quite an endearing moment, as it was clear from his attitude that the boy had none of the anger or animosity towards the other students that it might imply. He was simply joking around, picking up something he had recently learned, and something he thought the American students would recognize, and showing it off. He was pretty spot on too; despite our best efforts as teachers to smooth everything over, all the kids in LA thought it was hilarious. I had designed the telematics course with the intention that it would be a medium for cultural exchange, and in a way I hadn’t possibly imagined, it was.

The previous chapter examined the connection between musician and machine. There is also a much broader context present, however. Music and technology are co-created locally, as one navigates the challenges of latency, sound quality, and use of screen, speakers, and microphone. Once this is in progress, however, once the musical signal is moving not just between person and computer but then through thousands of kilometers of wire and numerous routing points and out to interact with a person on the other side, something much
bigger is happening. The music then does not stand alone, but carries with it its own cultural significance. We now set aside the local details, and look at how telematic technology interacts with this cultural significance.

As Marshall (2014, pg. 950) describes, the STS response to the over-emphasis and generalization of social groups in analyzing co-construction was a turn towards network-based studies of technology, most widely known through Bruno Latour’s Actor Network theory (Latour 1987). Rather than large groupings, individuals can be analyzed based on their connections to other individuals as well as to technologies and ideas. Cultural meanings are then explained by the comparative strengths and weaknesses of different associations. This avoids the blocky and heavy-handed description of the players involved in telematic music critiqued earlier, and allows nuanced wider cultural conclusions to emerge out of the wide variety of individual experiences.

The validity and importance of network-style analysis can be seen even just by comparing the telematic experience of my kids in Brazil with that of the kids studying music in Los Angeles. Despite having the same instruments, the same technology, and a symmetric lesson plan, discussions with the students before, during, and after the telematic course revealed different meanings. In Brazil, my kids were most excited to perform; to have someone listening to what they had worked on. The kids in LA, meanwhile, were more than anything interested in learning about those in Brazil. There are no orchestral concerts, and essentially no music education community in Poconé, and so telematic technology acting as a midpoint to bridge my kids to an interested audience of peers was an important development. In LA, where a large music education program and regular concert schedule exists, the tie between technology and performance was a weak one. Instead, the association of Brazil with new, exotic, and exciting things, and the ability of telematics to directly access this ruled the day.
While a network approach does seem to do better, a few weaknesses do still emerge. One of the fundamental principles of this type of STS approach is that no component has existential meaning outside the network, so that all meaning is derived from, and can be traced to network connections. In particular, this means that everything is given equal footing at the beginning of analysis. Law (1987, 1992) makes the stipulation, which Latour also takes up, that “the same type of analysis should be made for all components in a system whether these components are human or not” (1987 pg. 132). The idea that a technological artifact can act as its own network point is indeed valuable, for we see that in the above relations, telematic technology is the lynchpin holding both sides together. But the insistence on the equivalence of people and technology turns out to be a hinderance as one pushes analysis further. It limits the agency that can be attributed to human actors to only that which can also be attributed to technology itself.

This in part follows some of the general STS criticism of ANT and Latour’s philosophy. Amsterdamska, for example, bluntly criticizes the relativism of the theory, concluding that taken to its full extent, the theory cannot actually demonstrate anything of significance, and only merely describe the current situation (1990). In a related critique, Collins’ and Yearly’s ‘Epistemological Chicken’ debate questions if the theory can actually conclude instead of descending into further and further relative relations (1992). Indeed it can be difficult using network theories to answer why telematics creates the cultural experiences it does or address their significance over merely answering the ‘what’.

ANT also overcorrects from the fallbacks of SCOT analysis when it comes to describing who the important players are. Where as SCOT groups user types or producers of technology and headlines them all under one overreaching agency, ANT instead pulls out only the powerful leaders and single influential ideas, because these drown out the masses with their much more powerful networks (Bonneuil et al. 2007, pg 205). This does identify important movements and people, but it misses when the overall result is instead the result of many
small parts together (Rogers et al. 2001). Typically this criticism is more or less an accusation of tautology: important ideas arise from important scientists because this association is essentially what the working definition of important is, and the network is merely filled in afterwards to match what we already know to be true.

Telematic music, however, shows more fundamental problems in this. As discussed before, the small, and well connected nature of the field of telematics means that it doesn’t divide up into competing contingents or uses. There is then no need to make the conclusion that the purposing of the technology that wins out depends on which is networked the strongest, even if this is only observational after the fact, because there is often no competition to begin with. The shocking thing is that, despite having no competition, the seemingly constructed social situation of telematics doesn’t always win. Often, including in my own program, even mutually agreed upon uses and purposes of the technology result in entirely unexpected results. Particularly at the symbolic level, projects are usually designed with specific intents for their meanings, and for what this use of technology will accomplish. But what meaning is actually conveyed, and what is really accomplished can end up distinctly different.

To trace this unexpected change, we begin with a framing analysis, to discover what telematic technology is being set up to mean. The important observation motivating this is that telematic projects are seldom allowed to begin from a clean slate of importance and symbolism. Even when, for example, my students and I came to telematics for the first time, we brought specific ideas about what its significance will be, though the specific techniques of how we will reach that may be unclear. Framing is particularly studied in the context of Scientific and technological controversies (Irwin 2008, pg 590). While there is nothing in telematic music as controversial as in Genetically Modified Organisms (Bonneuil et al. 2007) or DNA evidence in court (Lynch and McNally 2003), some of the classic studies of the importance of framing, the method does provide valuable insight. Indeed telematics is
often framed to fit into the narrative surrounding wider social movements. Competing movements many not also manifest through telematics, but the framing of telematics certainly contributes to the larger social construction of technology in these contexts.

Most telematic projects split into two main categories of framing: peace and sustainability. Peace framings, the more common of the two, are often clear even from the names of projects. Consider titles such as ResoNations’, a series of “International Telematic Music Concerts for Peace” (Weaver 2010) or ‘Deep tones for Peace’ (Marmer 2010). Beyond the titles, these and other projects share remarkably similar press materials as well. Telematic technology is framed as primarily novel and important for its ability to allow new collaborations. The general thought is that conflict tends to divide across geographic borders, and if technology can begin to erase the significance of these borders, peace moves one step closer. Deep Tones for Peace, for example, was designed to address conflict in the Middle East, and presented pieces conspicuously composed to combine musical forms from multiple different cultures and traditions. Thus telematic peace projects aim to bring together people from cultures, places, or ideologies that might not otherwise interact, and create one mutual musical goal.

While the language of peace is not always employed, this framing, in which technology is associated with new connections and collaborations, is part of Brazil’s wider framing of scientific development in general. In 2005, the Brazilian government passed the so-called innovation law. The law, controversial for its use of public funds in the private sector, legalizes and encourages collaborations between public universities and private industry on research and development (Ryan 2010, pg. 1090). New technology, and new scientific discoveries are framed as the path to open up economic prosperity (Romer 1986). The Brazilian context is more specific than just promoting general growth, however. The biggest problems facing much of Brazil are problems of inequality, with large portions of the population living in conditions of exclusion from education, goods and services, and even basics such as
food and housing (ECLAC 2010). Much of the push towards new technological collaborations has been through what are called Technologies for Social Inclusion (TSIs), primarily organized through the *Rede de Technologia Social*, a network which pulls together NGOs, universities, and private enterprise (Thomas et al. 2012, pg. 585). While studies of effectiveness have shown mixed results, there’s a clear desire in Brazil to equate technology with bridging social gaps.

Sustainability or environmental concern themed telematics work represents different priorities and goals, but also demonstrates a different way of framing the technology. Rather than viewing these projects as collaborations that would have been impossible without telematic technology, they’re viewed as projects that could have, and perhaps even did occur before the use of telematics, but required musicians to travel and meet up in person. The value of telematic technology, then, is framed as erasing the need for frequent long distance travel, and as saving the associated energy and pollution associated with transportation. The focus is not on who is collaborating, but on how they are doing so. Mark Dresser’s 2013 project, *Virtual Tour: A reduced carbon-footprint concert series*, takes this approach. From press material, “By rehearsing via the internet over a period of many months, the musicians developed a body of music that would normally require multiple flights, saving thousands of dollars, scores of travel hours, and much fossil fuel” (Dresser 2013).

It is important to note that one shouldn’t jump straight to the narrative of competing uses of technology, and technological controversy that often goes with differences in framing. While the two frames are distinctly different, so are the projects employing them. Some of the musicians did collaborate before telematics, others didn’t. Some purposely confront and merge foreign musical forms, others work together precisely for their coherent tastes. The important point, rather, is the role of agency in the social construction of these technologies. Actor-Network Theory, which disallows network nodes to carry their own internal agency (Jasanoff 2004, pg. 20), is alone not enough to account for this. The initial network structure defining what telematic technology means is moulded at the start of the project, with each
connection only present with specific intent. But no more is the SCOT approach, which associates full agency to specific user groups, accurate. The network is hand designed at the start of each project, but this is only the start of the continuing social construction of these technologies. The evolution is often far from a linear course following one intent, and instead continues to mutate as users experience and respond to their own creation. Initial framing is only the first step in the process of co-construction of technology and society.

The frame is set, the technology is turned on, and musician and computer slowly converge locally, but what happens next? What in a broader sense is accomplished? To answer bluntly, one must wait and see. Or rather, hear. Marshall (2014) asks, “what would [it] mean for a particular social group to ‘hear’ a problem being solved?” (pg. 951). The end of the last chapter discussed how telematic music becomes a medium to get at the basic communicative nature of music. If it is framed to be a conversation about social issues, then the socially constructed meaning of telematics will also require listening to what the conversation actually says. This might seem obvious, but presents quite a new challenge for STS. Telematic technology is not constructed by its framing, its use, or its musical product alone. Rather, it is in the space between them, where intent, perception and response all merge, where it can take unexpected significance.

Borrowing from the area of Sound Studies within STS, this system of technological, societal and cultural interaction can be described as a soundscape. Thompson (2012) describes a soundscape as “simultaneously a physical environment and a way of perceiving that environment; it is both a world and a culture constructed to make sense of that world” (pg. 117). The concept dates back much further to Schafer (1977), who discussed how the new sounds of the industrialized word brought about questions of what noise means. With the recognition of the new range of sounds came the realization that people could, and sometimes should assert technological control over the auditory experience. Thompson (2002) picks this up further, analyzing how the now widespread use of technologies such as acoustic
design, artificial reverb, and noise blocking have in turn reshaped the listening experience, and what people expect from sounds.

I argue that STS as a whole would benefit from expanding soundscape-style analysis even further beyond the traditional boundaries of music and listening. Soundscape study focuses on the signal nature of sound, and looks at differentiation between signal and noise, and how this shaped by the environment while shaping our overall auditory landscape (Thompson 2012). Telematics already demonstrates how music can bridge mere sound into larger cultural meaning through technology; if the soundscape of telematics is then studied, the result is a study of how, through sound, technology is constructed as having social meaning through its simultaneous use and perceived meaning. Thus the missing pieces from SCOT and network analysis begin to come together. Agency frames the initial landscape of sound and its social meaning. But since those framing the project are the very same musicians who then participate, each immediately begins working to reshape that landscape based on what is musically communicated. This is the soundscape of telematics, but so too can it describe how technology is socially constructed in general.

The wider soundscape of Telematics does take on specifically Brazilian cultural aspects, and this can provide commentary on Brazil’s general attitude to technology as well. The *Antropofagismo*, meaning cannibalism, creative movement in Brazil in the 1920s commented on the tendency for Brazil to embrace and absorb outside cultural traditions, only to then re-present them to the world as transformed into something distinctly Brazilian (Bound 2008, pg. 95). Musical genres such as *Bossa Nova*, *Tropicalismo*, and *Fado* all began simply borrowing the jazz, rock, and folk traditions from elsewhere, but emerged as Brazilian icons, and widely recognized as such throughout the world. Carnival, with its dances and extravagant decorations, is practically the face of Brazil to the outside world, despite its roots and continued grounding in European religious tradition. Brazil does not merely borrow outside ideas at face value, but nor does it isolate only its own intentions and cultural contributions.
Rather, the soundscape is continually reshaped by the distinctly Brazilian perspective which uses, sees, and hears everything which crosses into its borders.

This same attitude carries over to technology as well. The same music which Brazil redefined is now being distributed for free through the Canto Livre project or sold through other independent markets which experiment with new philosophies towards digital intellectual property. Unlike other countries on the cusp of development, Brazil hasn’t ignored environmental concerns to focus all its effort on growth and production. Instead, “the alternative trajectory it offers is one in which growing scientific and technological capability is not separate from, or in opposition to, natural resources and endowments, but integrally linked to them” (Bound 2008 pg. 16). Brazil is, for example, the world’s largest producer and consumer of biofuels, with over 86% of cars sold in Brazil capable of running on biofuels (pg. 14). While much of this is simply the combination of outside technology with Brazil’s large sugar cane crop, the country is now using this demand to kick-start its own advanced research into new generation biofuels. Similarly, the country’s incredible bio-diversity is being used for competitive advantage in pharmaceuticals research (pg. 36). This is not to say that Brazil’s track record on environmental protection is stellar, for it isn’t, but there is a clear environmentally conscious perspective present in the soundscape of Brazilian technology.

I actually got to watch the sustainability framing of telematic technology evolve through my own project. Since the project was organized under PCER, which works generally on sustainability and education goals, it seemed initially to be a natural step to embrace the environmentally friendly telematic collaboration narrative and promote the project as such. PCER does in fact run telematic medicine and language education projects as well, out of combined concern for both the monetary and environmental costs of doing these in person. Indeed, if Brazil as a whole values sustainable growth, then the Pantanal region does even more so. Arena Pantanal, the new world cup stadium built in Cuiabá, is described by FIFA, saying “it is no surprise that sustainability has been a central theme of the construction and maintenance of the new arena from the project’s very beginning” (FIFA 2012). This
all seemed coherent and attracted positive feedback while planning the project, so I was interested to discuss this association with people in Brazil to learn more exactly what this association meant to them.

What I first learned is that sometimes what sounds good in a grant proposal or in FIFA press material is just that. One of my first nights in Brazil my host took me to see the new (actually not quite finished, despite being less than a week from opening) stadium. We joked that *O Verdão*, the big green, the nickname that FIFA insists that the stadium has, was probably given for the bright green light panels running the length of the stadium, and still conspicuously lighting up the entire block at 11pm. Supporting 41,000 fans in an environmentally responsible way is less relevant when it might only ever hold a few thousand again after the world cup for Cuiabá’s third division team. Similarly, the environmental significance of my project didn’t pan out like I expected. People still supported the idea, but no point did the thought of how much jet fuel had been spent or saved seem to enter into the body of ideas which we communicated through music. As the soundscape concept points out, the all the pre-planning and meticulous situating of science and technology is insufficient if live perception is not also included.

The common ground of technology, music and sustainability didn’t simply disappear, however, as a network analysis might indicate. Instead, it changed. Despite the region’s general cultural association with the wetlands of the Pantanal, few have actually ventured far into the Pantanal or know very much about it. Rather than explicitly protecting the Pantanal, my project was building the infrastructure for a stronger cultural identity based on it, and importantly, providing the technological means to communicate this far beyond the region itself. Another telematic practitioner I met part-way through my trip described to me how his project in the Amazon has helped tie together people through music to better create a unified society to resist outside logging projects. They abandon the telematic framing which compares the impact of virtual collaboration to that in person as largely irrelevant, and instead return to the framing of telematics as a means for new collaboration. Thus on the
surface level telematics is just expanding the music community, but in a community whose local culture is ecologically situated, as both the Pantanal and the Amazon are, this does end up implicating telematics with conservation after all.

When analyzing how technology and society co-create each other, telematics itself actually provides a good metaphor. One does not just play their own musical passage, let the full signal travel, then wait for the other players to respond. Listening and playing happen simultaneously, and at no point can one defer entirely to the other. Playing is guided by what one hears from the other side so as to fit both together, and the interpretation of what one hears is shaped by the context of their own current playing and ideas. For music technologies, this means that their social meaning is intimately dependent on both the particular technique of use and how one hears the result of that use. It is ultimately not too far, I think, an intellectual jump to expand hearing to sensory and symbolic perception more broadly, and to conclude that the social meanings of many technologies are built by the interplay between not just designers and users, but also how each of these then experiences what they have created or used.

Finally, we can return to the errant middle finger of my last telematics session. It’s an American gesture, but in the spirit of Antropofagismo, was being presented back to the American students from my Brazilian students. The Americans got a kick out of it, but even more, my students loved the chance to show off their coolness (as only ten year olds can). By studying perception, even a rude gesture can appear as a legitimate moment of cultural exchange, enabled by technology. The same spirit extended to the rest of our playing as well. My kids were curious to hear their colleagues in LA, but shined most in their pride to show that they could make music at the same level. Telematics meant that, for the first time, they had an audience, and a place in the wider world. Ultimately it was this feeling—the focusing of local culture to present back to the world—that defined what the technological experience meant to us. The soundscape of telematics is one of
technologically enabled cultural collaboration, mediated by a reflection on the particular ideas being communicated musically.
Looking towards the future, promising things are happening in Brazil. The circumstances discussed earlier, where low bandwidth and high latency require new musical techniques and technological improvisation may not always be the case. In 1991 Brazil began building the *Rede Nacional de Ensino e Pesquisa* (RNP) (in English, the national teaching and research network), a high-capacity fiber-optic network connecting major institutions throughout the country (RNP 2014). The RNP is designed for similar capacities, and actually connected to the Internet2 in the United States, the academic network of choice for university supported telematic music projects (Internet2 2014). For telematics, such a network means that one can stream many channels of cd quality audio and hd video in realtime, and additionally benefit from the latency improvements of a direct, dedicated connection.

The RNP is already quite advanced, and exhibits capability on a similar playing field to that of Internet2 and other academic networks in the developed world. It is, however, currently concentrated in only the major urban centers of the country, particularly in the southeast. But not for long. The 2012 *Veredas Novas* (New Paths) initiative aims specifically to extend high-speed fiber connections to educational institutions in the *interior*, the parts of the country outside of the primary urban hubs, and further provide digital inclusion to the surrounding communities as well (Knight 2014, pg. 79). Of course like many Brazilian projects, Veredas Novas is not expected to meet its goal of completion this year, but it is making progress. The Universidade Federal de Mato Grosso in Cuiabá already has a 3Gb/s connection to the RNP, and it may only be a matter of time until an interior branch makes it all the way to Poconé.

In many ways the development of the RNP serves as an accurate picture of what is happening in both telematics and technology throughout Brazil. Since its inception, the project has been quite aggressively pursued by the Brazilian government and major public universities. There’s a clear unwillingness to settle for a network anything less than on par with the most
advanced in the world. But what is an internet network? As just an object by itself it’s very little; it’s much more valuable for its potential to enable all kinds of communication and collaboration to take place. As this demonstrates, there are two levels to the social purposing of technology. On the one hand, there are clear general intents. The network, here and in telematics specifically, represents the ability to form new collaborations throughout the country and with the outside. Communities that were once excluded and marginalized in the interior can no longer be. To quote the movie *Field of Dreams*, “If you build it they will come;” Once the network connections exist, and once the ability to create new music collaborations exists, the cultural implications will follow. When it comes to technology, Brazil is quite clear on framing it as the path to progress.

The other level of how technology is socially constructed concerns exactly what cultural implications do follow. This functions quite differently, with an expectation instead that it will work itself out in the moment. This can be seen in the cultural significance of *gambiarra* and improvisation, and the way that even established outside traditions emerge as something new and different through Brazil’s *Antropofagismo*. The RNP was not built, and is not being expanded solely to meet needs that are already present. Despite the 3Gb/s capability at Cuiabá’s node in the network, the current average use sits around only 50Mb/s (RNP 2014). I have little doubt, though, that this will soon fill up with new and unexpected uses.

Put together, these two different levels are what constitute the soundscape of technology. The landscape is set out, as the network is built and the general intents for its social purpose are described. But the soundscape is not complete without simultaneously considering the perception of this landscape. As soon as it exists, users of the technology respond, and find new meaning in it, redefining what it is and represents. It is through the interplay of both these factors that technology and society are created together.
I learned quite a bit from my experience with telematics. The questions I had about how users deal with quality and latency issues turned out to be important, but only as stepping stones to the more general question of what kind of cultural communication the technology enables. Similarly, my questions about the environmental significance of telematics did turn out to yield interesting results, but not in the way I expected. Having a first-hand perspective during my fieldwork was incredibly valuable for a study that turned out to be an investigation of the importance of the nuances of perception of technology.

This leaves a number of possibilities going forward. Locally, there are high hopes for the expanded possibilities new and improved internet connections will bring. Since it’s never a good idea to rely on a project deadline in Brazil, however, I’m also working towards creating telematic courses at Universidade Federal de Mato Grosso, where RNP is already connected. This would allow for greater participation, including from more advanced university students. With a larger palette for musical improvisation and communication comes obvious musical possibilities, but also the possibility for broader first-hand research.

Theoretically, this work sets out new directions for the application of a soundscape-type analysis to the co-construction of technology and society, and provides a critical analysis of existing techniques. I invite here that the soundscape not be limited to just technologies of sound. It would be interesting to undertake this, and to re-evaluate some of the classic studies of co-construction, as well as provide new examples. Ultimately, telematic music compensates for its obscurity with an incredible density and overlap of technological development, cultural significance, and constant reconstruction of both, and serves as an excellent case study for technology in the wider world.
REFERENCES


APPLICATION FORM

SECTION A
APPLICATION DETAILS

<table>
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<th>Project Title:</th>
<th>Telematics: A Case Study in the Co-creation of Music and Technology</th>
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<td>Course Number:</td>
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Principal Researcher

Please note that a student – undergraduate, postgraduate or research postgraduate cannot be the Principal Researcher for Ethics purposes.

| Full Name: | Dr. Jack Stilgoe |
| Position Held: | Lecturer in STS Department |
| Address: | 22 Gordon Square |
| London, WC1E 6BT |
| Email: | j.stilgoe@ucl.ac.uk |
| Telephone: | 0207 679 1328 |
| Fax: |

Declaration To be Signed by the Principal Researcher

- I have met with and advised the student on the ethical aspects of this project design (applicable only if the Principal Researcher is not also the Applicant).
- I understand that it is a UCL requirement for both students & staff researchers to undergo Disclosure and Barring Service (DBS) Checks when working in controlled or regulated activity with children, young people or vulnerable adults. The required DBS Check Disclosure Number(s) is: Not required
- I have obtained approval from the UCL Data Protection Officer stating that the research project is compliant with the Data Protection Act 1998. My Data Protection Registration Number is: Not required
- I am satisfied that the research complies with current professional, departmental and university guidelines including UCL’s Risk Assessment Procedures and insurance arrangements.
- I undertake to complete and submit the ‘Continuing Review Approval Form’ on an annual basis to the UCL Research Ethics Committee.
- I will ensure that changes in approved research protocols are reported promptly and are not initiated without approval by the UCL Research Ethics Committee, except when necessary to eliminate apparent immediate hazards to the participant.
- I will ensure that all adverse or unforeseen problems arising from the research project are reported in a timely fashion to the UCL Research Ethics Committee.
- I will undertake to provide notification when the study is complete and if it fails to start or is abandoned.

SIGNATURE: ___________________________ DATE: 23/5/14
Applicant(s) Details (if Applicant is not the Principal Researcher e.g. student details):

Full Name: Alexander J Carney
Position Held: MSc student, Dept. Science and Technology Studies
Address: 797 Wandsworth Road
London, SW83JH
Email: alexanderjcarney@gmail.com
Telephone: 07592599556

Sponsor/ Other Organisations Involved and Funding

a) Sponsor: □ UCL □ Other institution
   If your project is sponsored by an institution other than UCL please provide details: I have partial travel funding from The Marshall Aid Commemoration Commission, via my tenure as a Marshall Scholar.

b) Other Organisations: If your study involves another organisation, please provide details. Evidence that the relevant authority has given permission should be attached or confirmation provided that this will be available upon request. My study will involve the Instituto Ciranda in Cuiabá, Brazil and the Pantanal Music Exchange in Poconé, Brazil. Both are music education and youth orchestra organizations which I have worked with in the past (independently of UCL) and have agreed to the work I plan to do.

c) Funding: What are the sources of funding for this study and will the study result in financial payment or payment in kind to the department or College? If study is funded solely by UCL this should be stated, the section should not be left blank. Travel funding is being provided by the Marshall Aid Commemoration Commission. While in Brazil I will be supported by the two organizations listed above, as well as personal funds for expenses. There will be no payment to UCL.

Signature of Head of Department or Chair of the Departmental Ethics Committee
(This must not be the same signature as the Principal Researcher)

I have discussed this project with the principal researcher who is suitably qualified to carry out this research and I approve it. The project is registered with the UCL Data Protection Officer, a formal signed risk assessment form has been completed, and appropriate insurance arrangements are in place. Links to details of UCL’s policies on data protection, risk assessment, and insurance arrangements can be found at: http://ethics.grad.ucl.ac.uk/procedures.php

UCL is required by law to ensure that researchers undergo a Disclosure and Barring Service (DBS) Check if their research project puts them in a position of trust with children under 18 or vulnerable adults.

*HEAD OF DEPARTMENT TO DELETE BELOW AS APPLICABLE*
I am satisfied that checks:

(3) are not required
If checks are not required please clarify why below.

Chair’s Action Recommended: □ Yes □ No

A recommendation for Chair’s action can be based only on the criteria of minimal risk as defined in the Terms of Reference of the UCL Research Ethics Committee.
### B1

Please provide a brief summary of the project in **simple prose** outlining the intended value of the project, giving necessary scientific background (max 500 words).

Telematic Music is the concept of connecting musicians in different locations over the internet in order to allow for live collaboration playing music. The image to have in mind is two musicians playing with each other over Skype, though in practice specialized software is used for better audio quality. This is a small but growing field of interest within music technology. It allows many unique opportunities, not the least of which is the ability to collaborate on live rehearsals and concerts without physically being in the same place. There are many technical details, however, that differentiate telematic music from normal collaboration including delays, sound quality issues, and other limits on interaction. I intend to study how this technology interacts with the cultural role of music, and how the specific technological aspects affect and are affected by the creative directions taken by musicians.

As a significant part of this study I will be implementing telematic music in a music education program in Brazil, the Pantanal Music Exchange in Poconé, with which I have worked previously. I will be first linking them with the Ciranda Institute, a partner music institution in Cuiabá, Brazil, and then with a similar youth music program in Los Angeles, California. Students will have the opportunity during their usual music classes to play and practice with students working on similar things in the other locations. Currently the telematic music community consists mainly of professionals with a long career in experimental music, and this research will provide a new perspective on how musicians without this background respond. Since these students are still developing their own musical identities, it will be a chance to see how the new opportunities telematics allows can shape this identity.

Brazil, and particularly the area in which I will be working is especially interesting for this study. There is little opportunity for music education outside of the Pantanal Music Exchange and Ciranda Institute, and little outside collaboration. Telematics' ability to open up collaborative opportunities will be particularly noticeable there. It is an area of Brazil that is also environmentally sensitive. Telematics has been billed in the past as a 'green' alternative to in person collaboration, and I am interested to see how this aspect of the technology interacts with the local culture.

### B2

Briefly characterise in **simple prose** the research protocol, type of procedure and/or research methodology (e.g. observational, survey research, experimental). Give details of any samples or measurements to be taken (max 500 words).

My methods will consist of two parts. First, the implementation of telematic technology during students usual music lessons. Scheduling varies but lessons average to about three times a week for about 1.5 hours each. I will likely use 0-1 hours of this time. Students will play one at a time or in small groups in front of a microphone connected to my computer, while the rest of the class listens. Part of the time will be spent in these telematic sessions and part will be spent practicing and learning music for them. The program will run for one month.

The second part, data collection, will be done in the form of observational data and informal focus group discussions. These will also be done during the usual lesson times, interspersed between the telematic sessions. Observational data recorded will be limited to a music, music technology, and music education context, and focus group discussions will center on these topics as well. I will record observational notes after the sessions and will audio record the focus groups. Discussions will be informal and will not follow a set questionnaire, but an example might be “what seemed different from playing music here with the others in class?” An example observation could be “the students had particular difficulty with rhythm at first, but improved after deciding to designate one student as the leader.” Data will be kept strictly anonymous and names will not be recorded at any point.

*Attach any questionnaires, psychological tests, etc. (a standardised questionnaire does not need to be attached, but please provide the name and details of the questionnaire together with a published reference to its prior usage).*
Where will the study take place (please provide name of institution/department)?

If the study is to be carried out overseas, what steps have been taken to secure research and ethical permission in the study country? Is the research compliant with Data Protection legislation in the country concerned or is it compliant with the UK Data Protection Act 1998?

The study will take place at the Pantanal Music Exchange in Poconé and the Ciranda Institute in Cuiabá, both in the state of Mato Grosso, Brazil. I have discussed the ethical considerations with the music teachers and directors of both programs, who will be present during all my work, and they have assured me that it is acceptable per local standards. As data will be completely anonymous this is also compliant with the UK Data Protection Act.

Have collaborating departments whose resources will be needed been informed and agreed to participate?

Attach any relevant correspondence.

Both collaborating music programs have agreed to participate. I have worked with both in the past, and both are fully briefed on the additional research details of my planned work with them this summer. This discussion has been carried out in person and over phone and Skype calls, so there are no relevant formal agreements to attach.

How will the results be disseminated, including communication of results with research participants?

Results of this study will appear in my MSc dissertation and will be presented in a talk at the International Society of Music Educators world conference in Porto Alegre, Brazil, July 20-25, 2014. After these it may be considered for publication in an academic journal. I will verbally sum up my initial findings to the programs and the students before leaving, and will send both final results afterwards as well. I will likely continue to do music work with both programs in the coming years and will share and use what this study has learned then.

Please outline any ethical issues that might arise from the proposed study and how they are be addressed. Please note that all research projects have some ethical considerations so do not leave this section blank.

The highest risk component of this work is that it involves participants under the age of 16. First, written consent will be obtained from children’s legal guardians. The children in the Pantanal Music Exchange reside at the Nazaré orphanage, so this will involve getting consent from the orphanage director rather than parents. The work has already been verbally approved by the orphanage director. When parents are relevant this will be on an opt out basis, i.e. unless parents tell me they do not approve of their child participating the child will not be barred from doing so. Second, I will obtain verbal consent from the children, with the project explained at an appropriate level. This will be opt in, and it will be made clear that not opting in will not affect their standing in the rest of their participation in these music organizations.

All interactions with children will be strictly within the context of music, and will take place during their usual music lessons with their usual music teacher present. I will never be alone with any of the children, and their usual music teacher will maintain their role as overall leader of the lessons. All data collected on the students will be strictly anonymous and limited to a musical context, and will be held encrypted and password protected.

Also of concern is that the work will involve live streaming audio of the students over the internet. This will be done over a private, secure connection, and the music teacher leading interaction on the other end will be one with whom the children have worked with before (both the teachers in Cuiabá and in Los Angeles have taught in Poconé previously).

SECTION C

DETAILS OF PARTICIPANTS

Participants to be studied

<table>
<thead>
<tr>
<th>C1a. Number of volunteers:</th>
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<tr>
<td>Lower age limit:</td>
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C1b. Please justify the age range and sample size:

These are the ages of the children in the music education programs where I will be working. The size is the full size of the music course currently running, and while participation will be on an opt-in basis, the students' music teacher assures me that most or all of the students are interested in participating. This size will be manageable but large enough to provide a variety of perspectives.

C2

If you are using data or information held by a third party, please explain how you will obtain this. You should confirm that the information has been obtained in accordance with the UK Data Protection Act 1998.

No third party data will be used.

C3

Will the research include children or vulnerable adults such as individuals with a learning disability or cognitive impairment or individuals in a dependent or unequal relationship? □ Yes □ No

How will you ensure that participants in these groups are competent to give consent to take part in this study? If you have relevant correspondence, please attach it.

The research will include children. Written parental consent will be obtained, as well as verbal consent from the children, explained to them at an appropriate level. Verbal consent has been obtained already from the music teachers in whose class I'll be working, and I will obtain written consent when I arrive.

C4

Will payment or any other incentive, such as gift service or free services, be made to any research participant? □ Yes □ No

If yes, please specify the level of payment to be made and/or the source of the funds/gift/free service to be used.

Please justify the payment/other incentive you intend to offer.

C5

Recruitment

(i) Describe how potential participants will be identified:

Participants will be recruited from the current ongoing music class at the Pantanal Music Exchange in Poconé, Brazil.

(ii) Describe how potential participants will be approached:

The project will be explained ahead of time to students by their current music teacher, and then by me when I arrive, during a group music lesson.

(iii) Describe how participants will be recruited:

Students in the music course will then be able to opt-in to participate in the research.

Attach recruitment emails/adverts/webpages. A data protection disclaimer should be included in the text of such literature.
**C6** Will the participants participate on a fully voluntary basis?  
[ ] Yes  [ ] No

Will UCL students be involved as participants in the research project?  
[ ] Yes  [ ] No

*If yes, care must be taken to ensure that they are recruited in such a way that they do not feel any obligation to a teacher or member of staff to participate.*

Please state how you will bring to the attention of the participants their right to withdraw from the study without penalty?

It will be explained to students that they can individually opt-out of the project at any point, and that this will not affect their participation in the rest of the music program. Data from student interviews and focus groups will be kept completely anonymous, preventing individual withdrawal, but the current music teacher, who will be present during all sessions, will be given the discretion to withdraw individual interviews or focus groups (by date and time, with my help identifying the relevant session) until July 31.

**C7** CONSENT

Please describe the process you will use when seeking and obtaining consent.

As the children I work with reside at the Nazaré orphanage consent from their legal guardian will be through the orphanage director. I have verbally obtained this already, and will go over a written project information and consent sheet when I first arrive. Children have been briefed on the project already by their music teacher, but I will explain the project and the opt-in, and obtain verbal consent from those who do opt-in during the first music lesson I am present for. Students over the age of 16 will sign their own consent forms. Drafts of the written consent form and information sheet are below. The final version will match these in meaning but will be translated to Portuguese as this is the first and often only language of those involved.

In cases where it is not proposed to obtain the participants informed consent, please explain why below.

**C8** Will any form of deception be used that raises ethical issues? If so, please explain.

No deception will be used.

**C9** Will you provide a full debriefing at the end of the data collection phase?  
[ ] Yes  [ ] No

If ‘No’, please explain why below.

**C10** Information Sheets And Consent Forms

Attached below. Final versions will be translated to Portuguese as this is the primary language of the relevant persons.
I am inviting you/the child in your care to participate in a study on Telematic music. Telematic music is when two or more people in different places play music together live over the internet. This project is related to my research at the University College London (UCL) and has been approved by the UCL research ethics committee, project ID 5864/001.

What participation will involve:
This research will take place entirely during your usual music lessons at the Pantanal Music Exchange. Your teacher and I will first explain and rehearse music for the project with you, and then you will have the opportunity to play music connected over the internet with other similar students in Cuiabá and in Los Angeles. Murilo Alves and Roxanne Kieme, whom you worked with last summer, will direct things on the other ends. We will do a few short sessions of this per week lasting from June 20-July 20.

You/the child in your care are/is not required to participate and can decide to stop at any time. This will not affect the rest of your music lessons at the Pantanal Music Exchange.

I will write down my observations of your participation, and after we have done a few sessions we will have discussions about what it was like. With your permission, I will record these discussions. The recordings will not be published directly, only my analysis. I will tell you my research findings at the end of the project and send you the final version of my report when completed. Your name or identifying details will not appear in any data.

Purpose and Benefits of the Study:
Telematic music is a cool new way to play music with people anywhere in the world. I intend this to be a fun experience, and one that will make your music education more interesting and varied. I hope to use what I learn from this project to allow Pantanal Music Exchange to do more collaborative music projects in the future and to become part of an international music community.

For Further Information:
Please feel free to discuss this with others and ask me any questions you may have. I will be happy to discuss the project and your participation at any point during this summer as well. I can be contacted in the following ways:
-In person, during Pantanal Music Exchange lessons.
-Through your music teacher
-By email: alexanderjcarney@gmail.com
-By phone: (Brazilian number TBD, will appear in final version)
Informed Consent Form

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Project: Telematics: A Case Study in the Co-Creation of Music and Technology

This study has been approved by the UCL Research Ethics Committee (Project ID Number): 5864/001

Thank you for your interest in taking part in this research. Before you agree to take part, the person organising the research must explain the project to you, and give you an information sheet.

If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you to decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

Participant/Participant's Guardian Statement

I, _______________________

• have read the notes written above and the Information Sheet, and understand what the study involves.
• understand that if I decide at any time that I no longer wish to take part in this project, I can notify the researchers involved and withdraw immediately.
• consent to the processing of my personal information for the purposes of this research study.
• Understand that some of my participation will be audio recorded and I consent to the use of this material as part of the project.
• understand that such information will be treated as strictly confidential and anonymous and handled in accordance with the provisions of the United Kingdom Data Protection Act 1998.
• agree that the research project named above has been explained to me to my satisfaction and I agree to take part in this study.

Name of Participant:
Name of legal guardian for Participants under the age of 16:

Signed: ______________________ Date: ______________________
SECTION D DETAILS OF RISKS AND BENEFITS TO THE RESEARCHER AND THE RESEARCHED

D1 Have UCL’s Risk Assessment Procedures been followed?  ☐ Yes ☐ No

If No, please explain.

D2 Does UCL’s insurer need to be notified about your project before insurance cover can be provided?  ☐ Yes ☐ No

The insurance for all UCL studies is provided by a commercial insurer. For the majority of studies the cover is automatic. However, for a minority of studies, in certain categories, the insurer requires prior notification of the project before cover can be provided.

If Yes, please provide confirmation that the appropriate insurance cover has been agreed. Please attach your UCL insurance registration form and any related correspondence.

D3 Please state briefly any precautions being taken to protect the health and safety of researchers and others associated with the project (as distinct from the research participants).

I will conduct all work at music institutions with no unusual health or safety concerns. I will not be alone at any point and will be in cell phone contact throughout. I’ve registered my travel details with my research supervisor at UCL and scholarship secretary (Marshall Aid Commemoration Committee), and my daily local whereabouts will be made known to others at the institutions where I will be working.

D4 Will these participants participate in any activities that may be potentially stressful or harmful in connection with this research?  ☐ Yes ☐ No

If Yes, please describe the nature of the risk or stress and how you will minimise and monitor it.
D5 Will group or individual interviews/questionnaires raise any topics or issues that might be sensitive, embarrassing or upsetting for participants?  
No.
If Yes, please explain how you will deal with this.

D6 Please describe any expected benefits to the participant.
   The project is meant to be both an enjoyable experience for the participants and one that will help the long-term goals of their music education. The telematic technology that I will be introducing will hopefully allow for new creative possibilities and a more interesting musical experience. Long term, the organizations I am working with are interested in the wider exposure and potential for more outside collaborations that telematic technology may bring.

D7 Specify whether the following procedures are involved:
   Any invasive procedure(s)  □ Yes  □ No
   Physical contact  □ Yes  □ No
   Any procedure(s) that may cause mental distress  □ Yes  □ No

   Please state briefly any precautions being taken to protect the health and safety of the research participants.
   The health and safety concerns for the students I will work with will be no different than during their usual music lessons. Their music teacher, who takes responsibility for these concerns, will be present during all of my work as well.

D8 Does the research involve the use of drugs?  □ Yes  □ No
   If Yes, please name the drug/product and its intended use in the research and then complete Appendix I

   Does the project involve the use of genetically modified materials?  □ Yes  □ No
   If Yes, has approval from the Genetic Modification Safety Committee been obtained for work?  □ Yes  □ No
   If Yes, please quote the Genetic Modification Reference Number:
D9 Will any non-ionising radiation be used on the research participant(s)? □ Yes □ No
If Yes, please complete Appendix II.

D10 Are you using a medical device in the UK that is CE-marked and is being used within its product indication? □ Yes □ No
If Yes, please complete Appendix III.

CHECKLIST

Please submit either 12 copies (1 original + 11 double sided photocopies) of your completed application form for full committee review or 3 copies (1 original + 2 double sided copies) for chair’s action, together with the appropriate supporting documentation from the list below to the UCL Research Ethics Committee Administrator. You should also submit your application form electronically to the Administrator at: ethics@ucl.ac.uk

<table>
<thead>
<tr>
<th>Documents to be Attached to Application Form (if applicable)</th>
<th>Ticked if attached</th>
<th>Tick if not relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section B: Details of the Project</strong></td>
<td>□</td>
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<tr>
<td>• Questionnaire(s) / Psychological Tests</td>
<td>□</td>
<td>□</td>
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<tr>
<td>• Relevant correspondence relating to involvement of collaborating department/s and agreed participation in the research.</td>
<td>□</td>
<td>□</td>
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<tr>
<td><strong>Section C: Details of Participants</strong></td>
<td>□</td>
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<tr>
<td>• Parental/guardian consent form for research involving participants under 18</td>
<td>□</td>
<td>□</td>
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<tr>
<td>• Participant/s information sheet</td>
<td>□</td>
<td>□</td>
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<tr>
<td>• Participant/s consent form/s</td>
<td>□</td>
<td>□</td>
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<tr>
<td>• Advertisement</td>
<td>□</td>
<td>□</td>
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<tr>
<td><strong>Section D: Details of Risks and Benefits to the Researcher and the Researched</strong></td>
<td>□</td>
<td>□</td>
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<tr>
<td>• Insurance registration form and related correspondence</td>
<td>□</td>
<td>□</td>
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<tr>
<td><strong>Appendix I: Research Involving the Use of Drugs</strong></td>
<td>□</td>
<td>□</td>
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<tr>
<td>• Relevant correspondence relating to agreed arrangements for dispensing with the pharmacy</td>
<td>□</td>
<td>□</td>
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<tr>
<td>• Written confirmation from the manufacturer that the drug/substance has been manufactured to GMP</td>
<td>□</td>
<td>□</td>
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<tr>
<td>• Proposed volunteer contract</td>
<td>□</td>
<td>□</td>
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<tr>
<td>• Full declaration of financial or direct interest</td>
<td>□</td>
<td>□</td>
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<tr>
<td>• Copies of certificates: CTA etc…</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td><strong>Appendix II: Use of Non-Ionising Radiation</strong></td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td><strong>Appendix III: Use Medical Devices</strong></td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

Please note that correspondence regarding the application will normally be sent to the Principal Researcher and copied to other named individuals.
Dr Jack Stilgoe  
Department of Science and Technology Studies  
UCL  

23 June 2014  

Dear Dr Stilgoe  

Notification of Ethical Approval  
Project ID: 5864/001: Telematics: a case study in the co-creation of music and technology  

I am pleased to confirm that your study has been approved by the UCL Research Ethics Committee for the duration of the study i.e. until June 2015.  

Approval is subject to the following conditions:  

1. You must seek Chair’s approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the ‘Amendment Approval Request Form’.  

The form identified above can be accessed by logging on to the ethics website homepage: http://www.grad.ucl.ac.uk/ethics/ and clicking on the button marked ‘Key Responsibilities of the Researcher Following Approval’.  

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.  

Reporting Non-Serious Adverse Events  
For non-serious adverse events you will need to inform Helen Dougal, Ethics Committee Administrator (ethics@ucl.ac.uk), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair of the Ethics Committee will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.  

Reporting Serious Adverse Events  
The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.
On completion of the research you must submit a brief report (a maximum of two sides of A4) of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.

With best wishes for the research.

Yours sincerely

[Signature]

Professor John Foreman
Chair of the UCL Research Ethics Committee

Cc:
Alexander Carney, Applicant
Dr Simon Werrett, Director of Research, STS