I, Adam P. Mayer, hereby submit this original work as part of the requirements for the degree of Master of Arts in Sociology.

It is entitled: "The Fist in the Face of God": The Decentralized Diffusion of Heavy Metal Music through the Internet.

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“The Fist in the Face of God”: Heavy Metal Music and
Decentralized Global Cultural Diffusion

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“The Fist in the Face of God”: Heavy Metal Music and Decentralized Global Cultural Diffusion

Abstract

In 1980, roughly 3,200 heavy metal bands had ever been founded, primarily in about 45 countries in Western Europe and North America. By 2010 there were nearly 75,000 bands from 131 countries found in nearly all corners of the globe. The purpose of this paper is to explain the timing and location of the global diffusion of heavy metal music. I argue that the internet is the primary channel through which metal has diffused since 1990. This paper uses a database of heavy metal bands from an international archival website and data from the World Bank, the International Telecommunications Union, and the Polity Project. I employ Poisson regression techniques with country fixed effects to predict the population-adjusted rate of new metal recordings per country-year for the 1990 to 2008 period. I include time-varying controls for political regime, press freedom, and gross national income per capita. Results indicate that internet usage is positively associated with heavy metal diffusion during the time period under analysis and that this effect was stronger for countries with no history of metal music than for countries that had adopted metal prior to 1990.
# Table of Contents

**Introduction** 3

**Theoretical Background**

*Basic Concepts* 5

*Two Dimensions of Diffusion Systems* 7

*Typology of Diffusion Systems* 9

*Summary* 14

**Data, Measures and Methods**

*General Approach* 15

*Data* 16

*Dependent Variable* 19

*Focal Independent Variable* 21

*Control Variable* 22

*Findings* 25

**Summary and Conclusions** 25
In 1980, roughly 3,200 heavy metal bands had been founded in around 45 countries, mostly concentrated in Western Europe and North America, by 2010 there were nearly 74,000 bands from 131 countries found around the globe. The primary purpose of this paper is to understand how this global diffusion occurred.

In light of the ever-increasing economic and cultural integration of the world it is not surprising that popular artistic forms such as film, television, and mainstream popular music have spread in popularity to diverse locations throughout the world. However, the sonic, cultural, and economic dimensions of heavy metal music (hereafter, “metal”) are not consistent with other broadly diffused elements of culture. In brief, metal has diffused most rapidly during an era of music piracy and declining profits for record companies (Janssens, Vandaele, and Beken 2009), and during a period in which the sonic and lyrical trends in metal have pulled the genre further away from the artistic conventions of mainstream pop music.

Metal music emerged from the hard rock and blues but, especially since the late 1980s, has become sonically and musically far removed from the musical mainstream. Contemporary metal music often uses highly distorted guitars, bombastic drumming and growled, screamed or shrieked vocals instead of singing techniques more common in Western music (Chen-Gia et al. 2010). Consequently, the lyrics in many metal songs are unintelligible. Metal often explores atonal or dissonant musical structures which are unappealing to many listeners (Berger 1999). Although for metal enthusiasts and artists the sonic extremity of the genre may reflect personal attitudes about radical individualism and serve as a stress reliever (Henry and Caldwell 2007; Rafalovich 2006), other research has found that listening to metal music does not reduce stress as much as other types of music (Labbe et al. 2007).
Metal music currently explores lyrical themes and celebrates imagery and iconography that run counter to popular forms of media. Cushman (1991) discusses the diffusion of musical “revolutionary codes”—expressions of radical or subversive political ideas—in reggae in the United States or rock in the former USSR. In contrast, metal music has what might be termed a radically “oppositional code.” Metal music celebrates the iconoclastic or grotesque (Halnon 2006) and is often anti-hegemonic. This iconoclastic characteristic of metal is perhaps most clearly manifested in metal’s fascination with marginal religions like neopaganism and Satanism and confrontational stances against more established religions (Rafalovich and Schneider 2005). The actual nature of the alternative spiritual vision found in metal music varies widely and is not necessarily internally consistent. Rather, metal is a platform for expressing a marginal identity and the genre’s obsession with occultism, paganism and Satanism is a product of its general orientation towards opposition (Dyrendall 2008), not necessarily a clearly articulated alternative spirituality or religion. As the seminal Norwegian black metal band Darkthrone noted, “With my art I am the fist in the face of God” (Nagell 1993).

Finally, although metal enjoyed something of a commercial heyday in the late 1980s, since that time it has waned in popularity and therefore economic viability. This may be due simply to the vagaries of global cultural tastes or to the aforementioned sonic and lyrical extremity of the music. Whatever the explanation, the fact remains that metal diffused widely throughout the globe despite almost no pecuniary incentive to start a metal band. This, then, is the question this paper attempts to answer. How did metal diffuse so widely when it became sonically so distant from its pop music relatives and (and perhaps therefore) lost what commercial viability it had in the 1980s?
I propose that the key to solving this puzzle is the diffusion of global “digital capacity” during the 1990s and 2000s. I argue that the rise of personal computers and the internet catalyzed the diffusion of metal by capitalizing on a pre-existing and loose network of “tape traders” in South America, Europe and the United States (Ekeroth 2009). That is, fans of metal music had already been participating in a decentralized, organic process of diffusion, and the increase in global digital capacity supercharged that already existing process.

To test this hypothesis I rely on data from an internet site that exhaustively catalogs the founding dates and countries of origin of metal bands. The data set is organized by country-year spanning the 1990 to 2008 period. I expect to observe significant positive effects of increases in digital capacity on countries’ “metal rate,” or the population-adjusted count of metal recordings produced. Using regression techniques for panel data I test these hypotheses, controlling for a variety of confounding variables such as economic growth and political freedom. This research contributes to a sociological understanding of cultural diffusion and globalization and the role of information technology in decentralized diffusion systems.

**Theoretical Background**

**Basic Concepts**

There is a long and rather disjointed tradition of the study of diffusion in widely varying academic disciplines. As a result, some ambiguous terms need to be defined for the purpose of this study. First, **diffusion** is a dynamic “process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers 1983, p. 5). Rogers further defines an **innovation** as “an idea, practice,
or object that is perceived as new by an individual or unit of adoption” (p. 11). Wejnert (2002) says that “diffusion refers to the spread of abstract ideas and concepts, technological information, and actual practices within a social system, where the spread donates flow or movements from one source to an adopter (p. 297).” Similarly, Hudson (1972) says that the term diffusion “suggests movement, interaction, spread, contact, change, growth and a host of others” (p. 1). Katz, Levin, and Hamilton (1963) note seven components of diffusion: “viewed sociologically, the process of diffusion may be characterized as the: 1) acceptance; 2) over time; 3) of some specific item—an idea or practice; 4) by individuals, groups or other; adapting units, linked; 5) to specific channels of communication; 6) to a social structure; 7) to a given system of values, or culture” (p. 240, emphasis in original). Hence, for the purposes of this paper I define diffusion as the adoption of an innovation by a new social unit or the intensifying spread of an innovation within a social unit that has already adopted the innovation.

Diffusion studies have asked two basic questions. First, scholars have investigated who adopted the innovation within a predetermined geographic area, such as the classic study of the diffusion of hybrid corn in Iowa conducted by Ryan and Gross (1943). I refer to diffusion within a specific predetermined geographic area, social network, or other measurable unit with clear and distinct boundaries as vertical diffusion. In addition to the example of Ryan (1948), Duman (1979) discusses the diffusion of professional ideology among entrepreneurs in nineteenth century England. Vasi (2006) studied the diffusion of the Cities for Climate Protection Program within the United States by examining a variety of organization characteristics of city governments. Finally, Carr (1932) studied the diffusion of the automobile in a small town by cataloging advertising over a ten year period.
Other scholars have focused on the spread of an innovation into entirely new groups, such as the diffusion of microprocessors from country to country (Bothner 2003). I refer to this type as horizontal diffusion. Horizontal diffusion is the spatial diffusion of innovations into new areas, essentially asking “where did the innovation go?” Using a broad historical analysis that ranges from 1700 to 1975, Tshoegl (2010) examines the development and global spread of decimalized currencies. Some innovations may be designed specifically for international diffusion and may not even diffuse within the geographic region in which the innovation originated, such as Barrett, Kurzman, and Shanahan’s (2010) study of the diffusion of population control policies. In some studies, both of these processes occur simultaneously and deconstructing the diffusion process can be an intellectual challenge (Shin 2009).

In this paper I assess the extent to which metal grew in popularity both within countries (vertical diffusion) and between countries (horizontal). In addition, there are two other important dimensions of diffusion: the actors sponsoring or advocating for the diffusion (centralized or decentralized) and the type of innovation being diffused (economic or political-cultural). Below I discuss each of these dimensions separately and then discuss some implications of their cross-classification.

Two Dimensions of Diffusion Systems

Centralized and decentralized diffusion systems. Diffusion involves several different actors, institutions, and channels that form a system. Rogers (1983) argues that diffusion systems are either centralized or decentralized.

Centralized diffusion systems involve large institutional actors like nation-states or transnational corporations that wield substantial power to encourage the diffusion of a particular innovation. In some instances corporations or governments may also be the
source of an innovation (Rogers 1983). Wejnert (2002) explains that “high status actors”
like governments or large corporations often adopt an innovation and impose its adoption
upon less powerful actors. For example, the International Monetary Fund encourages a
specific policy agenda in developing countries by controlling access to credit (Chang,
Park, and You 1998). Another example is the aggressive marketing and subsequent
diffusion of tobacco products to African Americans (Sutton and Robinson 2004).

Centralized diffusion systems do not always involve the spread of dangerous or
unwelcome innovations. For example, van Niekerk and Salminen (2008) studied a South
African university that teaches Western classical music to impoverished African youth,
and Sugiyama (2008) discusses the diffusion of public social programs in post-dictatorial
Brazil.

In contrast, in a decentralized diffusion system none of the actors are coerced into
adoption decisions; that is, there are no obvious power imbalances between actors.
Decentralized diffusion systems typically require a decentralized mechanism through
which an innovation can diffuse; for example, heterodox economic ideas have diffused
through academic journals (Cronin 2008). The mechanism in decentralized diffusion
systems is typically not explicitly devoted to just the innovation in question and may
diffuse other innovations at the same time. Decentralized diffusion is generally
egalitarian in that power relationships between actors in the system are balanced. Also,
the innovation itself is likely to undergo localized changes. For example, Lopes (1999)
shows how jazz musicians straddled different approaches to music making—the highly
orchestrated and popular big band jazz and improvisational jazz with small ensembles
and limited popularity—and created new hybrid forms of music by introducing elements
of each seemingly irreconcilably approach into the other. Keeler (2009) notes the unique
adaptation of hip hop music in Burma that, even if unbeknownst by Burmese rap fans and artists, includes elements of traditional music.

Economic and political-cultural diffusion. Diffusion systems can also be classified according to characteristics of the innovation; these classifications typically are political-cultural and economic diffusion. Economic diffusion systems involve for-profit businesses and innovations that produce an economic return. Political-cultural diffusion chiefly involves innovations without overt economic incentives driving their diffusion.

Many of the aforementioned studies involve economic innovations and economic institutions, such as the IMF and access to loans (Chang, Park and You 1998) or tobacco in African-American neighborhoods (Sutton and Robinson 2004). Alternatively, heterodox economics articles published in academic journals represent political cultural diffusion (Cronin 2008). Both the innovation (journal articles) and the institutions involved (academic journals) are fundamentally non-economic.

Typology of Diffusion Systems

These two dimensions can be cross-classified into a four-fold typology of diffusion systems shown in Table 1 below. I use this typology to classify scholarly studies of diffusion and to discuss further the mechanisms by which diffusion occurs in the cell of primary interest for this paper—decentralized political-cultural. Obviously, this typology represents ideal-typical classifications and some diffusion systems may involve aspects of multiple quadrants. However, this abstraction is helps provide a coherent organization to a diverse cross-section of literature and classify mechanisms and actors in a diffusion system. Additionally, the typology reveals potential areas for new research.
Centralized economic. There is a broad swath of literature that examines centralized diffusion of innovations with economic consequences and motivations. In these studies, one or more actors are highly motivated by the possibility of profit or other material gain. Ferraro (1993) studied the resistance to Health Management Organizations among physicians; in this case many physicians resisted the diffusion of an economic innovation from larger and more powerful actors. Rossman et al. (2008) studied the effects of payola (essentially bribes given to radio stations) in encouraging the diffusion of a group of pop music songs, ultimately finding that bribing radio stations had very limited effects on what songs were played. Cushman (1991) compared the diffusion of reggae music in the United States to the diffusion of rock music in the USSR. In this study both types of music seem opposed to established power structures, but Cushman argues that “In capitalist societies, elements of culture, especially those elements of culture which express dissent and may cause trouble for the dominant classes, still maintain a social facility as commodities which provide large audiences with entertainment and the culture industries with profits” (Cushman 1991 p. 21). Despite its seemingly revolutionary musical nature, reggae in the United States is actually an example of centralized diffusion with economic consequences (Cushman 1991). For the corporation it is a source of profit and for the American consumer the cultural and political dimension of the music is typically irrelevant, devalued, or not understood. Conversely, Cushman presents rock music in the USSR as an example of decentralized political-cultural diffusion, discussed in more detail below.

Centralized economic diffusion does not necessarily mean that the innovation in question is uniform across all adopters. Cho and Chung (2009) discusses the efforts by the television network MTV to penetrate into various Asian markets by adapting to local
tastes in a process that, in the business literature, is known as “glocalisation.” In a related manner, Connell and Gibson (2006) found that Western consumers of “world” music often demanded that the music avoided fusion with Western styles and was presented as “exotic.” The great irony was that much of this exotic music was packaged, distributed and sold by large corporations. Similarly, Allenye (2000) argued that, once it was adapted to white consumers by business interests, reggae music lost its political and social commentary and was reduced to its “aesthetically appealing surface qualities” (p. 16). In contrast, Alvarez (2008) argues that reggae has served as an expressly politically and socially aware musical platform for indigenous or oppressed people globally. These diverging viewpoints suggest that diffusion systems may not always be consistent across countries.

Centralized political-cultural diffusion is often encouraged by large political actors like nation-states or other manifestations of government. For example, after World War II the Japanese government actively encouraged the diffusion of American country and western music to foster compliance with the occupying United States troops during reconstruction (Furmanovksy 2008). The most destructive and infamous example of this type of diffusion is the thoroughly documented distribution of films, posters, and music in fascist regimes (Grabowski 2009), such as the Nazi government’s use of classical composers like Wagner to legitimize the “master race” thesis and develop rabid nationalism (Dennis 2002). Clearly there are enormous advantages to be gained by large political actors if they can centralize diffusion systems and use these conduits to spread cultural goods that encourage consent to their agenda.

As part of a broad modernization effort, the government of Algeria pushed for the diffusion of soccer (Amara and Henry 2004). The Cities for Climate Protection, whose
diffusion was studied by Vasi (2006), is another example of diffusion among state actors. Crain (1966) examined the diffusion of fluoridation of municipal water supplies, Post (2005) examined efforts by developing countries to implement food safety standards; other research has studied the diffusion of human rights laws (Pegram 2010). Centralized political-cultural diffusion systems are defined by the nature of the actors and their relative power to each other.

Table 1: Typology of Diffusion Systems with Examples from Published Literature

<table>
<thead>
<tr>
<th>ACTORS ENCOURAGING DIFFUSION</th>
<th>TYPE OF INNOVATION</th>
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<tr>
<td>Centralized</td>
<td>Centralized Economic</td>
<td>Centralized Political-Cultural</td>
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<td>Decentralized</td>
<td>Decentralized Economic</td>
<td>Decentralized Political-Cultural</td>
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*Articles described in text.*

*Decentralized economic* diffusion systems feature pecuniary incentives, economically oriented institutions like businesses, and exchange in a market place. The rapid growth of microbreweries, which began in the late 1980s, was predicted by few leading brewing industry analysts and involved very small firms with small customer bases in a number of different locations; initially there were no large institutional backers
and limited distribution of microbreweries to mainstream retailers (Carrol and Swaminathan 2001). Reggae music came to Bali because local musicians found that tourists would pay to hear it performed live (Baulch 2010); as in the previous example these musicians did not have any large institutional backing but profit motives are very important in catalyzing the diffusion process.

The last type of diffusion in this framework is decentralized political-cultural. In this type of diffusion system the innovation is cultural or political in nature and there are very limited economic incentives driving its diffusion. The actors involved are generally of similar status and power; one actor cannot coerce another into adopting the innovation. As discussed earlier in this paper Cushman (1991) depicts the diffusion of rock music in the former USSR as largely decentralized, devoid of profit considerations, and heavily political. The diffusion of the KKK in North Carolina during the Civil Rights era is also another example of decentralized diffusion; Cunningham and Phillips (2007) found that the economic and demographic characteristics of particular counties predicted the incidence of KKK Klavern formation. In a similar analysis Hedstrom (1994) argues that Swedish labor unions diffused through interpersonal contact, revealing a spatial pattern of diffusion that did not rely on the support of powerful institutions like governments or big business.

Finally, Rogers (1983 p. 336) states that decentralized diffusion systems are more difficult to study than other types of diffusion often because of severe data limitations. When dealing with extremely decentralized systems, data can be difficult to locate. As a result, many studies provide results that may not be generalizable to other innovations or diffusion systems. For instance, Rupke and Blank (2009) discuss the diffusion of American pop music in western China through English language schools using Rupke’s
teaching experiences. Hedegard (2007) relies on ethnographic observations to explain the
diffusion of Capoeira, a Brazilian martial art, to the United States. In general, data
limitations probably explain why decentralized political-cultural diffusion is rarely
studied in the literature. Logically, data regarding diffusion that occurs outside the realm
of governments, corporations or similar large institutions would be very difficult to find
because collection of data often involves funding from a centralized power.

Other limitations of the current research specifically relate to the mechanism or
channel through which innovations diffuse. Diffusion studies often neither identify a
mechanism through which the innovation diffuses to new adopters nor explain how
adopters gained knowledge of a particular innovation. More specifically, there is limited
academic research in which the internet is a mechanism in a diffusion systems, and much
of the scholarship can be found in business literature, not the social sciences (Lynch and
Areily 1998). However, Rangaswamy and Gupta (2000) explain that “One way to view
the internet is as a vast repository of information that can be dynamically organized and
retrieved in a multiplicity of ways according to the needs of individual users” (p.77).
Sociology has approached the internet from a social movements perspective (Earl and
Kimport 2009, Burris, Smith and Strahm 2000) and has effectively studied the diffusion
of the internet itself (Wannava and Leiter 2009) but has rarely considered the internet as a
channel or mechanism for the diffusion of an innovation.

Summary

I have argued in this section that diffusion systems can be classified based upon
the actors in the system and the type of innovation undergoing diffusion: centralized
economic, centralized political-cultural, decentralized economic, and decentralized
political-cultural. Scholarly research has typically focused on centrally diffused
innovations partly because there is simply more readily available data for centralized diffusion systems and mostly concerns itself with economic innovations. The limited research on decentralized political cultural innovations has typically used qualitatively oriented case-study methods.

This paper addresses two gaps in the literature by studying the diffusion of metal. First, it provides one of the few rigorous quantitative analysis of decentralized political-cultural diffusion systems. Secondly, it is one of the first to include the internet as a mechanism in a diffusion system. The global spread of metal happened via a decentralized political-cultural diffusion system. Metal musicians have very little to gain economically from their efforts (many metal artists will invest more in instruments, software, and other equipment than they can ever hope to recoup through album sales) and there are essentially no large political or economic institutions actively encouraging the diffusion of metal. Because of the organization of decentralized political cultural diffusion systems they are difficult to study using rigorous quantitative method. This paper presents a unique opportunity to apply quantitative methods to decentralized political-cultural diffusion systems.

Data, Measures, and Methods

General Approach

Given that metal music has little support from large institutions like nation-states and multinational corporations, and given that the production of metal music is not typically a profitable enterprise, I expect that metal music has diffused globally chiefly through the internet. This study does not aim to explain why individual adopters chose to record metal albums; instead, I seek to demonstrate that contemporary information technology allows
for the decentralized diffusion of political-cultural innovations in a manner that could not have occurred in earlier eras. Specifically, I argue that the internet is the prime mechanism for diffusion of metal to new countries (horizontal diffusion) and that intra-country production of metal music also increases with increases in internet usage or availability (vertical diffusion).

I control for other country-level variables that could affect the diffusion of metal. Because of the aforementioned oppositional orientation of metal music and its extremely iconoclastic subject matter I expect that countries with more democratic political regimes will tend to have a greater incidence of metal production. Extremely autocratic, traditional, or otherwise controlling governments may resist internet diffusion, and therefore have low rates of metal diffusion, but these governments may also actively oppose all types of oppositional art or media. Also, I will control for the effects of economic growth; economic growth and internet usage are related and therefore I want to isolate internet-specific effects, very poor countries are unlikely to have much internet usage. In my most sophisticated model I will control for country fixed-effects, that is, time-invariant properties of countries that I cannot observe.

Data

The data used in this paper comes from www.metal-archives.com (hereafter, “the metal archives”). The metal archives exhaustively categorizes metal bands from throughout the world based upon a variety of criteria such as year of founding, year of first release, metal sub-genre(s), and lyrical content. From these data, provided by one of the webmasters of the site in personal e-mail exchanges, I constructed a database of new releases by country-year from 1990 to 2008 (see Appendix Table A for a list of countries). To these data I appended information on some 150 countries from sources like

Interestingly, the metal archives do not define what metal is, but do define what metal is not. In a “Rules & Guidelines” section the webmasters explain: “I do not except (sic) mall-core, also known as ‘nu-metal’ by some…. metalcore… glam rock… classic rock… progressive rock… hard rock… hardcore… grindcore… punk… gothic rock… industrial… cover/tribute/gimmick bands….,” (Metal Archives 2011a). This is indicative of subcultural processes in which members of a subculture create barriers to entry as a method of insuring authenticity (see Hebdige 1979; Dale 2008; Force 2009). The de facto result of this subcultural process is the exclusion of more economically viable, but sonically similar, types of music from the metal archives. There is not a single, clear definition of metal and much discussion on the metal archives message board centers around whether or not a particular band or album is authentically metal. In order to avoid confusion, for the purposes of this paper I only consider the bands listed in the archives to be metal.

The local and specific adaptations of metal’s oppositional code are also evident from a selective perusal of the bands listed in the archives. This code manifested itself in a number of ways (Harris 2000). For example, scholars have noted metal’s anti-Christian bent (Kahn-Harris 2004; Moynihan and Soderlind 1998). In addition to literally thousands of explicitly anti-Christian bands there are other manifestations of opposition. The Israeli band Arallu advocates for “Satanic War in Jerusalem” (Metal Archives 2011b); the Lebanese band Ayat recorded a song entitled “All Hail Allah the Swine” (Metal Archives 2011c); and the Iraqi band Janaza recorded a song entitled “Burn the Pages of the Quran” (Metal Archives 2011d). Metal bands run the political gamut, from
romantic nationalist sentiments expressed by Eastern European bands like Skyforger
(Metal Archives 2011e) and Drudkh (Metal Archives 2011f), to ideas about radical
environmentalism associated with U.S. bands like Wolves in the Throne Room (Metal
Archives 2011g) and Sacrificial Totem (Metal Archives 2011h) to extreme racist views
(Kurtagic 2010). As metal diffuses, its oppositional codes appear to be more varied based
upon the contexts of the new adopter (Avelar 2003).

Data limitations. There are some limitations to the metal archives data. For one,
the data have not been maintained and catalogued by professional social scientists or
statisticians and may suffer from various biases. Any individual can create a username
and, with the approval of the webmasters, submit a new band to the archives.

However, the data is probably not as biased as one might initially assume, partly
because of the deep involvement metal enthusiasts. Emma Baulch, in her study of the
death and thrash metal scene in Bali, Indonesia noted that, among metal musicians and
fans “there was an enduring stress on archival knowledge, which enthusiasts fetishised”
(Baulch 2003 p. 195). Other scholars have also commented on the obsessive tendency of
metal fans (e.g., Arnett 1996). This research suggests that metal enthusiasts take their
music very seriously and are willing to invest a significant amount of time into cataloging
and analyzing metal bands and metal albums. Because metal enthusiasts are unlikely to
approach their music casually and emphasize encyclopedic knowledge of the genre I
believe that the records from the Archives are an accurate reflection of empirical reality.

Moreover, scholars from many disciplines have used internet databases in
research published in peer-reviewed journals. For example, Liu et. al. (2003) examined
internet job listings for information technology positions to determine what types of skills
employers were seeking. Steiger and Burger (2010) used data from the Internet Movie
Database (IMDB) to analyze the relationship between the height of actors and occupational success; Dodds (2006) also used the IMDB. Social scientists have been especially interested in online dating and have used data gathered from dating websites (Tsunokai, Kposowa, and Adams 2009; Gibbs, Ellison, and Heino 2006; Glasser, Robnet, and Felciano 2009).

Dependent Variable

The metal archives database has a significant amount of missing data for the years that bands are founded; this information is likely to be unreliable, for determining when a particular band was “founded” and what constitutes a “founding” of a new band is difficult. Essentially, anyone at any given time can claim to “found” a band if they intend to make music. Because of the extreme vagueness of using “founding dates” as a proxy for adoption of metal as an innovation, I operationalized the diffusion of metal by calculating another measure based upon the date of each band’s first release. The archives require that each band have at least one material album that has been pressed and released by a record label. While some albums may have very limited quantities (some numbering only 50 copies) the archives does not accept bands whose music is only available through bootlegs or internet downloads. Therefore, each band in the archives has released at least one album and that album has a specific release date.

I developed a population adjusted metal rate. The metal rate was calculated by dividing the number of new releases by the population associated with each country-year and then multiplying by 100,000 to derive the number of new releases per 100,000 population. Population data were obtained from the World Bank. As shown in Table 2 below, for many country years the population adjusted metal rate is at or near zero, while
in others it is substantially higher. For example, in 2005 Finland had the highest metal rate in the data set at 4.4 first albums per 100,000 people.¹

A number of new nations that emerged during the period under analysis, especially in Eastern Europe. Fortunately, the metal archives data set is organized by a fairly current list of countries. For example, if a band recorded a first release in 1986 in what is now Latvia, that band is listed under “Latvia” not “Soviet Union” (in fact, the archives contains no country designation for the Soviet Union). A few countries are combined with others. For example, the metal archives do not list Hong Kong separately from China; therefore the predictor variables for Hong Kong and China are combined. The final data set contains 206 countries over 18 years for a total of 3,654 observations of the possible 3,708. As mentioned, I eliminated some possible countries from the analysis because they were missing too much data on any one of the indicators. Fortunately, most of the deleted countries were smaller nations with very low populations. After the deletions, there were 150 clusters of country-years for a total of 2,704 observations.

| Table 2: Descriptive Statistics for years 1990-1993 and years 2003-2008 |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                            | 1990 to 1993                |                              | 2005 to 2008                |                              |                             |
|                            | Mean | SD  | Min | Max | Mean | SD  | Min | Max |
| Metal Rate                 | 0.06 | 0.22| 0   | 3.4 | 0.17 | 0.47| 0   | 4.40|
| Digital Capacity           | 0.70 | 1.9 | 0   | 13.2| 21.2 | 23.2| 0   | 88.9|
| GNI per capita (in $000)   | 6.4  | 10.3| 0.12| 74.6| 8.6  | 13.8| 0.086| 106.5|
| Regime                     | 1.3  | 7.2 | -10 | 10  | 3.5  | 6.5 | -10 | 10  |

¹ Missing population data were imputed by averaging the two years closest to the missing observation; only 44 observations were imputed.
Focal Independent Variable

The focal independent variable for this study is a composite index labeled *digital capacity* that was created from a measure of personal computers per 100 people and internet users per 100 people. Internet usage data were downloaded from the World Bank website (www.worldbank.org) but the data are developed by the International Telecommunications Union (ITU). The ITU is an UN-sponsored agency that collects a variety of data related to communication technologies such as radio, telephones, and the internet. To be counted as an internet user an individual must have used the internet within the past 12 months. The ITU data set has a number of missing data points. Fortunately, the missing data points tended to occur between two observations for a given country year. For example, a country might have internet usage data for 1999 and 2001 but the data for 2000 is missing. Because the rate of internet users per 100 people tended to increase linearly over time, I imputed the missing value by taking the average of the preceding and following years. In total the data set contains 3,654 observations of internet usage, with imputed values for 829 of these observations.

Personal computers per 100 people was retrieved from the United Nations (2011) and compiled from several international organizations. There was some missing data for this measure and when possible these data were imputed using procedures similar to those previously described. Personal computers per 100 people and internet users per 100 people correlated strongly with each other (r = .85) so a composite was created by averaging the variables for country-years that had both observations for both indicators. This composite has a raw Cronbach’s alpha of .94. The regression analysis uses the digital capacity composite as the focal independent variable for most country-years. If a country-year has a missing value on the composite score (because the personal computer
data was missing and could not be imputed) than internet usage was used as an independent variable instead. Comprehensive cross-national panel data that directly captures the amount of time an average member of a population in a particular country-year spends on the internet does not seem to exist; such data would have probably provided a better indicator of internet usage and given better results. Given these and other data limitations the Digital Capacity variable is the most effective operationalization of internet use at the national level.

**Control Variables**

*Gross national income.* The levels of internet usage within a country are related to its economy (Kenny 2003, Choi and Hoon-Yi 2009, Noh and Yu 2008). Therefore, it is important to isolate internet-specific influences on metal rates because at least some increase in metal rates could be associated with increases in GNI per capita. Producing metal music and releasing metal albums requires at least some investment in guitars, amplifiers, drums, and possibly various kinds of recording equipment and music software. Consequentially, countries with very low GNI per capita throughout the period under analysis are unlikely to have a positive metal rate simply because few people in those countries can afford to purchase the equipment necessary to make metal music.

GNI per capita data were acquired from the World Bank website, which explains that the measure

is the gross national income, converted to U.S. dollars using the World Bank Atlas method, divided by the midyear population. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad ² (www.worldbank.org).

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² I used GNI per capita adjusted with the Atlas method which is designed to reduce the impact of exchange rates.
There was some missing data in the GNI per capita measure. If a majority of a particular set of country-years was missing GNI per capita data the cluster was deleted from the analysis. More often however, I imputed missing GNI per capita scores based upon the average of the three years after the missing data or a weighted average of the three years before the year with the missing data. In total, only 339 out of 3,654 possible observations for this variable were imputed.

*Political regime.* As noted above, metal music is profoundly oppositional and is typically opposed to the cultural and political status quo of its nation of origin. Because of this, it is necessary to control for variables related to the degree of democracy and general freedom in a particular country. Rigidly totalitarian countries are likely to curb efforts to produce subversive art or, at the very least, state censorship may create an environment that discourage musicians from producing deviant or oppositional art forms like metal music, even if it is not expressly forbidden by the state. Also, state censorship often involves effort to censor internet content (Palfrey 2010) and metal-related websites may be censored. If metal chiefly diffuses through the internet, this lack of access would also put downward pressure on the metal rate. Scholarly research has indicated that music is often deemed subversive by totalitarian regimes (Keller 2007). Metal music in particular may agitate these concerns, as indicated by moral panics and state-sponsored backlash in Malaysia (Liew and Fu 2006) and parts of the Arab world (Levine 2009).

Data from the Polity IV project were used to control for the political climate of each country year. The Polity data set contains a variety of political variables in a country-year format stretching back for over a hundred years. Most relevant to this analysis, the Polity project codes the authority characteristics of many country-years. To do this, the developers of the Polity project developed a scale that runs from -10 to +10; a
-10 represents a hereditary monarchy or “fully institutionalized autocracy” and a +10 represents an open democracy while scores in the middle range have mixed political systems. Most economically developed nations tend to rank on the higher end of the scale. (Marshall, Gurr, and Jaggers 2009). The Polity IV data have been used in a number of social science publications (e.g., Carlton-Ford 2010; Johnstad 2010; Boehmer 2008).

The Polity IV variable captures three distinct processes: individuals may be less willing to produce oppositional art in an autocratic political milieu, autocratic states may deliberately inhibit the spread of the internet, or they may attempt to alter or censor internet content. The Polity IV data set also includes special codes for nations that are experiencing a political transition. Nations which are in a transitional phase for only a few years during the period of analysis were coded with a “0” but nations that are transitioning for most of the period were dropped from the analysis to avoid biasing the results. Similarly, some countries did not exist in 1990, the year that the period under analysis begins. If only the first few years of a country year cluster were missing Polity IV data (as is the case with many former Soviet countries) the earlier score was simply applied to the missing years. In total, 903 of 3,654 observations were imputed. This variable is hereafter referred to as Regime.

Early adopters. Countries that had adopted metal music early in the history of the genre may be more likely to have a higher metal rate simply because they were early adopters and have a developed metal subculture. To isolate this effect I created a dummy variable, coding countries with a non-zero metal rate in any year from 1980-1990 as 1 for “early adopters” and countries with a zero metal rate from 1980-1990 as 0 for “non-early adopters.” In the following analyses I interact digital capacity with this dummy variable

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3 I use this term instead of “late adopters” because a non-trivial fraction of the countries never adopted metal, at least as operationalized in this paper.
to test whether the effect of growing digital capacity is different for early versus non-
early adopters.

Methods

This paper uses an unconditional Poisson regression model with country dummy
variables for fixed effects as described in Allison and Waterman (2002). I use Poisson
regression because, although the variance of the metal rate is slightly greater than its
mean, diagnostic tests indicate that the distribution is not significantly over dispersed. I
use a fixed effects approach because, although I control for two time-varying
characteristics of countries (GNI per capita and political regime) there are probably
unobserved fixed country-level factors that are correlated with both digital capacity and
the metal rate. The fixed effects approach controls for all time-invariant covariates, even
without explicitly including them in the models. I elected to use an unconditional fixed
effects approach with country-specific dummy variables because in some countries the
metal rate is time invariant because there are no first release metal albums in that
country from 1990-2008; thus, metal rate has a zero score throughout. A conditional
fixed effects model estimated in Stata/SE 11 drops clusters (countries in this study) in
which the dependent variable has no variation. Hence, I used dummy variables to
represent the country fixed effects. Finally, I accounted for the clustering of observations
within countries in estimating the standard errors.\footnote{I conducted the standard multicollinearity tests and found no evidence of multicollinearity in the model.}

Findings

The results of the Poisson regressions are shown in Table 3 below. All of the models
assume a one-year lag of the effect of digital capacity on metal rate. In other words, I
don’t expect that an increase in digital capacity instantly causes more debut metal albums to be released. The choice of lag time was somewhat arbitrary as neither the data nor my review of the current literature suggested a readily apparent lag. Each model builds upon the previous model introducing new variables.

Model 1

Model 1 demonstrates the effects of digital capacity and year on metal rate with no control variables. In the absence of controls a one-unit increase in digital capacity results in a 5.2% increase in the metal rate.\(^5\) Also, the effect of year (the secular trend which results from moving forward in time) is statistically significant and negative in the absence of controls. This means that net of growth in digital capacity, there is a downward time trend in the metal rate.

Model 2

Model 2 introduces the GNI per capita, early adopter and regime control variables. Compared with model 1 digital capacity loses some of its predictive power. Net of controls, the independent effect of a one unit increase in digital capacity is a 2.0% increase in the metal rate. A one unit increase in regime (in other words, becoming more democratic) increases the metal rate by 12.2%. Most importantly, however, the early adopter effect is very powerful. Early adopters have a metal rate than is 11 times higher than non-early adopters.\(^6\) Year is not statistically significant in this model, indicating that there is no independent time trend when controls are introduced.

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\(^5\) To convert the regression coefficients generated by Stata/SE 11 into percentages I used the following formula: 100 x (exp(\(b\)) - 1).

\(^6\) I use the term “non-early adopter” rather than “late adopter” because some countries had a zero metal rate during the entire 1990-2008 period. In other words, these countries never adopted metal.
Table 3: Coefficients and Standard Errors from Poisson Regressions of Metal Rate on Digital Capacity and Control Variables

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Model 1</th>
<th></th>
<th>Model 2</th>
<th></th>
<th>Model 3</th>
<th></th>
<th>Model 4</th>
<th></th>
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<tr>
<td></td>
<td>Coeff.</td>
<td>SE</td>
<td>Coeff.</td>
<td>SE</td>
<td>Coeff.</td>
<td>SE</td>
<td>Coeff.</td>
<td>SE</td>
</tr>
<tr>
<td>Digital capacity</td>
<td>0.051**</td>
<td>0.005</td>
<td>0.020*</td>
<td>0.008</td>
<td>0.072**</td>
<td>0.015</td>
<td>0.029*</td>
<td>0.014</td>
</tr>
<tr>
<td>Year</td>
<td>-0.071**</td>
<td>0.023</td>
<td>0.005</td>
<td>0.027</td>
<td>-0.006</td>
<td>0.005</td>
<td>0.079**</td>
<td>0.010</td>
</tr>
<tr>
<td>GNI</td>
<td>—</td>
<td>—</td>
<td>0.019</td>
<td>0.015</td>
<td>0.019</td>
<td>0.015</td>
<td>-0.022</td>
<td>0.026</td>
</tr>
<tr>
<td>Regime</td>
<td>—</td>
<td>—</td>
<td>0.115**</td>
<td>0.030</td>
<td>0.113**</td>
<td>0.028</td>
<td>0.027</td>
<td>0.019</td>
</tr>
<tr>
<td>Early adopter</td>
<td>—</td>
<td>—</td>
<td>2.44**</td>
<td>0.273</td>
<td>2.780**</td>
<td>0.294</td>
<td>1.978**</td>
<td>0.094</td>
</tr>
<tr>
<td>Early adopter x dig. cap.</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>-0.052**</td>
<td>0.014</td>
<td>0.027*</td>
<td>0.014</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.475</td>
<td></td>
<td>-5.477</td>
<td></td>
<td>-5.807</td>
<td></td>
<td>-5.925</td>
<td></td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.224</td>
<td></td>
<td>0.353</td>
<td></td>
<td>0.355</td>
<td></td>
<td>0.479</td>
<td></td>
</tr>
<tr>
<td>No. of cases</td>
<td>2,704</td>
<td></td>
<td>2,704</td>
<td></td>
<td>2,704</td>
<td></td>
<td>2,704</td>
<td></td>
</tr>
</tbody>
</table>

Model 3

Model 3 includes the same variables as model 2 with the addition of an interaction term. The interaction term is the product of digital capacity and early adopters. This variable should differentiate between the effects of digital capacity for early adopting countries and late adopting countries.

This model indicates that digital capacity has a stronger effect for non-early adopters than early adopters. For non-early adopters a one-unit increase in digital capacity causes a 12.6% increase in the metal rate but for early adopters that same figure is only 7.5%. GNI per capita remains insignificant as in the previous models. Year is not statistically significant in this model.
Model 4

Model 4 adds the country specific dummy variables (effects not shown) to control for fixed effects. The results suggest that the country fixed effects explain a large portion of the variation in metal rate. Introducing the fixed effects control reduces the coefficient of digital capacity from .0724 to .0287 and attenuates the statistical significance of regime. This model suggests that digital capacity has a much stronger effect for late adopters than for early adopters even when controlling for time invariant country effects. Also, the effect of early adopters is still powerful but diminished from model 3: The average metal rate for early adopters was more than six times higher than for non-early adopters. Additionally, the secular trend (year) regains its statistical significance and has a comparatively large effect on metal rate. Moving forward in time one year results in an 8.2% increase in the metal rate.

Summary and Conclusions

This paper investigates the role of the internet as a mechanism in a decentralized political-cultural diffusion system. These types of diffusion systems are difficult to study because of data limitations, and diffusion studies often do not specify a particular mechanism for diffusion. Model 4 is by far the most sophisticated and powerful model and is the focus of this summary. Indeed, Model 4 is substantively different from the first three models because it controls for country fixed effects.

The regression results reveal that digital capacity had an important effect on the diffusion of metal music, and that there is evidence for both horizontal and vertical diffusion. The strong effect of the internet for non-early adopting countries is suggestive of horizontal diffusion. For non-early adopters, a one-unit increase in digital capacity
causes a 2.9% increase in the metal rate. I cannot directly ascertain how musicians in these countries initially learned of metal music. However, the strength of digital capacity as a predictor of metal rate and previously discussed theoretical concepts related to decentralized political cultural diffusion point to an important role for the internet. With few exceptions metal had no large institutions encouraging its diffusion to non-early adopters and, therefore, probably did not diffuse through more traditional mechanisms such as record stores, music television, and mainstream radio. My hypothesis that the internet is associated with the horizontal diffusion of metal is supported both theoretically and statistically.

Digital capacity is also associated with vertical diffusion. Vertical diffusion, for the purposes of this study, is the diffusion of metal within countries that were early adopters. For early adopters, a one-unit increase in digital capacity results in a 5.6% increase in the metal rate. Clearly, these countries did not learn of metal music from the internet because they had already produced metal in the pre-internet era. However, the development of the internet, and its increasing availability within the population, intensified metal production with the early adopters. My hypothesis that the internet resulted in vertical diffusion is corroborated.

Model 4 suggests that unobserved fixed effects of countries explain a great deal of the variance in the metal rate and therefore a great deal of the diffusion of metal music. These fixed effects are not the same for each country. In other words, perhaps one nation has an unusually low metal rate because of geographic features like a mountain range that limits international contact and another has a higher metal rate because of proximity to another nation with an existing metal subculture. Regime and GNI per capita may have been poor approximations of fixed effects that are better captured by the dummy
variables. In many country-year clusters regime does not change or only changes marginally. GNI per capita does change year by year but few countries change radically in their relative position to other countries; in other words a high GNI per capita country in 1990 is still a high GNI per capita country in 2008. The secular time trend (year) puts a strong upward pressure on metal rate in model 4. This may represent an effect in which the presence of previous metal bands increases the likelihood that new bands will be formed and therefore, new debut albums will be released.

This study makes important contributions to the existing diffusion literature. In a general sense, the results suggest that the internet is a viable mechanism for global diffusion. This paper adds to our limited understanding of decentralized political-cultural diffusion systems. In particular, the manner in which metal is adapted to country-specific preferences suggests that social units that seek to diffuse an innovation to other social units, but have little power or access to centralized mechanisms of diffusion, may do well to relinquish some control over their innovation. For example, politically marginal actors like environmental groups who want to encourage ecologically-conscious public policies may find more success if they allow their policy innovation to be adapted to local preferences. In other words, innovations that are adaptable may be more likely to diffuse.

Additionally, this paper adds to the discussion of the overall direction of global culture. I did not explicitly control for the cultural preferences of the citizens of any given nation because of data limitations. However, variables of this type are partly captured by the fixed effects of the country dummy variables as some cultural preferences are time-invariant or at least slow to change. Metal music may not fit into the broader cultural milieu of the country and not attract enthusiasts or musicians. For example, most of the highest metal rates are concentrated in European countries, and specifically the
Scandinavian nations of Finland, Norway, and Sweden. These countries, in addition to having a high digital capacity, high GNI per capita, and open democracy, may have cultural characteristics which are conducive to the diffusion of metal music. Counties which are politically, economically, and technologically very similar to the Scandinavian countries, such as Switzerland and the United States, may have a cultural make-up that is not as conducive to metal. As mentioned earlier, Finland’s top metal rate was 4.4 in 2005; during that same year the U.S. recorded a metal rate of .39 (also that country’s top metal rate).

As previously mentioned, decentralized diffusion systems are difficult to study with quantitative methods because of lack of data. The internet may change this, as information about all sorts of decentralized diffusion systems may be more easily available than in earlier eras. Scholars should turn more attention to the online world to help get information about decentralized diffusion systems.

There are several reasons why these results should be approached with caution. For one, the dependent variable, metal rate, does not fully capture the global diffusion of metal because the metal rate is calculated from physically released metal albums. Certain countries may have a large number of metal bands who chose to offer their music available for download on the internet and completely eschew traditional recording media such as CDs or cassettes. This scenario may be especially likely in developed countries in which albums sales have been declining for years and the internet is easily accessed. However, a similar process may occur in more autocratic nations. The internet may offer the guise of security and digitally stored files are much easier to conceal than traditional media. Under autocratic rule, metal musicians may have no venues to sell their music and operate on an internet-only basis. The metal rate does not include internet-only
recordings. Long-term autocratic rule may create a permanent atmosphere of conformity in which individuals are unlikely to produce oppositional art; this effect could create a permanent culture of fear that still persists even after a nation has democratized. Also, the metal rate does not adjust for new bands which are formed from members of previous bands and then release a debut album. Hypothetically a small cadre of metal musicians might continually form and reform metal bands and subsequently increase the metal rate in one or more countries.

Digital capacity, as calculated in this paper, is not the optimal focal independent variable. Recall that the internet usage data measure counts anyone who has accessed the internet within the past year as a user. A better measure would have captured the amount of hours that the average citizen of any country spent on the internet over the course of a year, but such data were unavailable for many countries. It seems unlikely that sporadic internet usage will lead to the diffusion of metal music.

Unfortunately, data limitations may not allow for future scholars to develop a better measure of internet usage. However, future research could test for threshold or saturation effects. In other words, more rigorous statistical methods might reveal that internet usage has to reach a certain threshold to cause positive changes in metal rate. Also, my statistical model assigned a one year lag to digital capacity, but the actual lag may be longer or shorter.

This paper explains much of how metal diffused through the mechanism of the internet but does not explain why metal music diffused globally. While I have demonstrated that metal is adapted by new adopters to express an oppositional code, I cannot explain why this process occurs. What drove Norwegian metal musicians in the early 1990s to create sonically extreme music and engage in church burning? Why are so
many Eastern Europeans using metal as a platform for far-right white nationalist political and cultural ideas? Why do almost all metal artists, regardless of national origin, adopt an overt hostility towards organized religion? These questions, and many others, should be investigated by scholars seeking to explain the enigmas of global cultural diffusion.
The Global Diffusion of Heavy Metal

### Appendix Table A: Countries Included in Analyses

<table>
<thead>
<tr>
<th>Albania</th>
<th>Croatia</th>
<th>Indonesia</th>
<th>Montenegro</th>
<th>South Africa</th>
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</thead>
<tbody>
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