Mapping Punk Music and its Relative Subgenres

by

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A Thesis Presented to the
FACULTY OF THE USC DORNSIFE COLLEGE OF LETTERS, ARTS AND SCIENCES
University of Southern California
In Partial Fulfillment of the
Requirements for the Degree
MASTER OF SCIENCE
(GEOGRAPHIC INFORMATION SCIENCE AND TECHNOLOGY)

December 2022

To my father, Ed – for introducing me to good music.

Acknowledgements

I am grateful to my thesis advisor, Dr. John Wilson, who single-handedly guided my thesis to what it is today. Throughout the Summer of 2022, Dr. Wilson juggled teaching multiple classes, guiding other thesis students, the ESRI User Conference, editing multiple articles for publication, tragic loss, and COVID-19 – all with a smile on his face. I would like to thank my employers, AgriCapture and Vanderbilt University, who allowed me to complete some of this work using my office computers. I would also like to thank USC's Spatial Science Institute for providing me with the knowledge and insight required to complete this thesis.

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Abbreviations

CA	California
CBGB	Country Bluegrass Blues
DIY	Do-It-Yourself
GIS	Geographic Information System
IPUMS	International Public Use Microdata Series
LA	Los Angeles
NHGIS	National Historical Geographic Information System
NJ	New Jersey
NY	New York
NYC	New York City
R&B	Rhythm and Blues
UK	United Kingdom
US	United States

Abstract

Geographic information systems (GIS) contain visualization and analytical tools that assist users to better understand the spatial and temporal relationships between mapped entities. The formation of music genres, for example, is a complex phenomenon that can be explored through spatial analysis using GIS software. The genre of punk music emerged in New York City, NY in the early 1970s with the appearance of bands such as the New York Dolls and The Ramones. Punk music is unique because commercial or mainstream success is most likely not the sole motivator for musicians who propagate the genre. The Do-It-Yourself (DIY) mentality of those who originally played punk music, coupled with the unique subcultures that stemmed from local groupings of popular bands raises questions as to the nature of the environment and people closest in proximity to the phenomenon. This study aimed to explore the spatial and temporal relationships between genre-specific punk bands and their local environments within the context of sociodemographics and time. A literature review was conducted to identify the temporal and spatial evolution of punk music. ArcMap and ArcGIS Pro were used to analyze, display, and prepare the spatial data, which included locations of band formation sites, venue openings, and census data from 1970. Point cluster and proximity analysis, along with historic census data quantification were employed to tell the story of punk music within the context of time and space. The people, environment, and spatial diffusion of locations (as well as attributes) associated with early punk music is characterized through the use of GIS. Findings revealed through this research exemplified the versatility of GIS and created a repeatable process for examining other music genres.

Chapter 1 Introduction

The GIS-based analysis conducted in this thesis aimed to explore the relevant locations and sociodemographic variables associated with the creation of the punk music genre (and relative subgenres) in New York City, NY and Los Angeles, CA beginning in the early 1970s. There are four research questions that this thesis answers: (1) When and where in the world did punk music originate? (2) When and where in the world did punk music venues pop up? (3) What kinds of neighborhoods did punk music arise in New York, NY and the Los Angeles area in the 1970s? and (4) Were the source neighborhoods of punk bands and punk music venues one and the same for both NY City and LA?

The spatial data used to pinpoint the earliest punk bands across the globe can be characterized as trimodal in nature due to the number of bands that have originated in New York City, Los Angeles, and London in the United Kingdom (UK). Because census data collected by the UK in the 1970s was unattainable, the region could not be analyzed at the same granularity as its American counterparts. As a result, the scope of this study only included the contiguous United States (US), and the cities from which the earliest punk bands hailed.

The research describes formation sites of source bands and locations of influential venues, and characterizes local regions with census information from intersecting and adjacent census blocks. Spatial data analysis was conducted to quantify findings and provide inferences about the spatial origins and spread as a whole. The use of GIS in this study provided visualization tools and analytical diagnostics for those wishing to explore the subject matter researched. The intended audience of this research is anyone interested in learning more about the origins of punk, or those who are interested in the role environment plays in the creation of music genres. The possible end-users of the data and subsequent diagnostics can range from the

casual listener to the academic in need of reference or comparative material.

1.1. Punk Music

Punk music can be characterized as music with extremely fast tempos (4/4 prestissimo), overly distorted guitars, and harsh, aggressive (even snarling) vocals. Though technical talent can be found across the genre, it is not necessarily the cornerstone of many of its most popular acts. In fact, the rejection of solid musicianship appears to be a common sentiment embraced by the earliest punk bands observed in this study. The themes of punk lyrics can vary from irreverent musings to subversive and/or exceptionally anti-establishment compositions. Unlike many mainstream acts in the 1970s, punk musicians were aesthetically unkempt and did not fit the mold of their more popular counterparts (Clark 2021).

The earliest band observed during the data collection portion of this study was the New York Dolls (Figure 1), who were active from 1971 to 1976 in New York City. At the tail end of the disco era, and with the emergence of glam musicians like David Bowie gaining mainstream popularity, the New York Dolls entered the east coast music scene as a non-conformist alternative to what was musically accepted. While David Bowie was both eccentric and provocative, the New York Dolls provided a grittier option to those seeking unconventional music in the early 1970s. Another early punk band in New York City was The Ramones, who many believe is one of the most influential punk bands of all time (Goshert 2000). The Ramones came about in 1974, and were integral in the spread of punk music to the UK with bands like Cock Sparrer and the Sex Pistols emerging shortly after their tour of London, UK in the 1970s.

Figure 1 The New York Dolls, the earliest band observed in the research dataset (1971). *source: https://www.rollingstone.com/music/music-album-reviews/too-much-too-soon-246070/*

Within the same timeframe, bands like Black Flag (Figure 2) and The Germs were establishing themselves in the Los Angeles music scene. While both the east and west coast groupings of early bands played punk music explicitly, the actual music varied greatly between the two locations (Clark 2021). This difference is what defines the subgenres that have branched off of the parent genre. This research analyzed the spatiotemporal relationship between subgenres in order to better understand how (and where) punk music has changed and evolved over time and space.

Figure 2 Black Flag performing in Los Angeles, CA in 1976.
source: https://www.theatlantic.com/entertainment/archive/2016/06/black-flag/488906/

1.1.1 Subgenres

The following punk subgenres summarized in Table 1 were examined and used to characterize early punk music throughout the study.

1.2. Motivation

Although punk music and the musicians who play it rarely reach the level of commercial success and influence as their more radio-friendly counterparts, the genre itself is remarkable due to the subcultures and subgenres that originated from locations where the music was most popular (Goshert 2000). The parent genre has endured from the early 1970s, with the evolving music eventually branching into several subgenres that remain relevant today. This thesis project explored the geographic locations and local environments that sustain these subgenres and provided a specific sociodemographic profile for each formation site.

In terms of spatial research, conducting analysis that gives audiences insight into the creation of music genres allows for a deeper understanding of local cultures and the populations

Table 1 Early punk subgenres explored.

Subgenre	Earliest Instance Observed	Location	Characteristics	Early Bands
Anarcho	1975	London, UK	Politically inspired lyrics; themes that promote anarchism, anti-government movements, and animal rights	Sex Pistols, Poison Girls, Crass, Zounds, Icons of Filth
Crust	1978	Devon, UK	Politically inspired themes that touch on social ills; guttural vocals, extremely fast tempo	Amebix, Killing Joke, Rudimentary, Penti, Anti-Cemix, Antisect
Glam	1971	New York City, NY	Mix of punk music and glam rock; some of the earliest garage bands were glam punk bands	New York Dolls, Arrows, Slaughter and The Dogs, Adam and the Ants, Hanoi Rocks
Hardcore	1976	Hermosa Beach, CA	Themes that promote anti-commercialism and anything outside of the mainstream; known for influencing independent recording labels	Black Flag, Bad Brains, The Germs, D.O.A., T.S.O.L
Horror	1976	Sacramento, CA	Known for its horror-movie inspired aesthetic and violent lyrics	The Cramps, Misfits, 45 Grave, Christian Death, Screaming Dead
Oi	1977	South Shields, UK	Themes the promote working class values, anti-poverty, anti-police	Angelic Upstarts, Peter and the Test Tube Babies, Splodgenessabounds, One Way System, The 4-Skins
Pop	1974	New York City, NY	Known for upbeat melodies, catchy choruses, and fast tempo; most mainstream subgenre	Ramones, Buzzcocks The Queers, The Offspring, Green Day
Ska	1977	Coventry, UK	Fuses American rhythm and blues (R&B) with Jamaican folk; uses horn section (trumpets, saxophones and trombones); upbeat tempo and rhythms	The Specials, Fishbone, The Toasters, Sublime, Voodoo Glow Skulls
Skate	1977	Manhattan Beach, CA	Also known as pop hardcore; uses vocal melodies and	Descendents, Dead Kennedys, Agent

			technical guitar rhythms; extremely fast tempos	Orange, Bad Religion, The Vandals
Street	1977	Stoke-On-Trent, UK	Rebellious antithesis to early British punk; started classic punk archetype (leather jacket, mohawk, etc.)	Cock Sparrer, Sham 69, UK Subs, Discharge, Charged GBH

Source: Clark 2021

living in and around their creation. Often, music plays a significant role in defining meaningful characteristics of individual societies and cultures (regardless of their size) (Treloyn 2016). Though the study only illustrated the formation of punk music specifically, the spatial and environmental variables used to exemplify its creation can serve as reference parameters for further studies focused on music and urban society.

NY City and LA are large metropolitan areas with diverse ethnic populations of varying ages and education levels. Even in the early days of punk music, both cities had several areas within their geographic boundaries with widely varying median annual incomes. Studying the origins of punk music can also serve to allow a greater understanding of the affluence in these places relative to the surrounding areas (Cross 2001). The results may benefit those interested in human landscape and the production of culture.

This study details both the spatial and temporal representations of punk music from its inception through various subgenres. The reader can see where the earliest bands came from and how and where the music has evolved over time. They can also learn about the demographics of the formation sites, as well as explore live music venues that have propagated the genre since 1970 to the present-day.

1.3. Thesis Organization

The remainder of this thesis is organized as follows. Chapter 2 reviews the related work and the foundational musical and spatial knowledge that this thesis builds upon. Chapter 3 describes the methods used to explore punk music through the lens of GIS. Chapter 4 details the results and Chapter 5 concludes the thesis and discusses the steps that could be taken to expand this particular study of music and geography.

Chapter 2 Related Research

The relevant spatial science and sociology literature used to bolster the research for this study focused mainly on various music mapping studies, the use of GIS in musical research, and punk music within the context of its local environment. Since there are limited studies that my thesis work can build upon, the following literature was used to combine credible knowledge of music culture and GIS technology to illustrate both in terms of space and time.

2.1. Musical Geography

Considering the presence (and largely the significance) of distinctive music in almost every culture around the world, the music people listen to can be used to characterize boundaries of similarity in human terrain. Having a strong research foundation based on music and location assisted with characterizing New York and Los Angeles not only within the context of punk music, but within the context of the people that resided in these locations during the rise of punk. The following articles were used to gain insight into the role geography plays in deciding the type of music that exists at a particular location.

Sara Cohen's article "Bubbles, Tracks, Borders and Lines: Mapping Music and Urban Landscape" investigates the connection between music and the urban environments in which it originates through pointed demographic research. Geography, age, ethnicity, and economics play a significant role in shaping the genres of music that exist in a specific area (Cohen 2012a). The main ideas expressed in the article illustrate how the material environment in which musicians play creates meaning for those particular locations, the obvious correlation between genre, race, and economics, that musicians from different genres view and map the musical landscape around them differently, and that age, class and locality shape music subcultures.

While Cohen's (2012a) article addresses the human terrain within the context of music and location, it does not acknowledge the influence of music industry sites located within a particular environment. In the article, "Music Scenes to Music Clusters: The Economic Geography of Music in the US, 1970–2000," Florida, Mellander, and Stolarick explore the nature of economics as it pertains to the clustering of localized music scenes (of various genres) and their associated industries (Florida et al. 2010). The role of scope and scale economics were used to identify spatial distribution patterns connected to music industries within larger populations. Much of this study focuses on how population and income dictate an area's suitability for musical economics, comparing areas based on lagged variables to see their success in fostering such an environment, and the ratio of musicians and music industry professionals to the larger populations in which they exist (Florida et al. 2010).

The cataloging of spatial data to assist in visualizing global music distribution is another essential step in analyzing the creation of punk music. The article "Globe of Music-Music Library Visualization Using Geosom," provides an excellent example of locational, web-based development that centers on the subject of the music itself (Leitich and Topf 2007). The article outlines the creation of a global music library that serves as an interactive map showing the geographic positions of popular musicians on Earth. The author's methodology and development of the musical visualization tool in GIS is the main topic addressed throughout the article.

Leigh Michael Harrison's article entitled "Factory Music: How the Industrial Geography and Working-Class Environment of Post-War Birmingham Fostered the Birth of Heavy Metal" explains how geography, politics, and economics encouraged the birth of heavy metal music in Birmingham, England during the 1960s. Harrison describes how living in a post-war, working-class environment affected Birmingham youth, and how it fostered the perfect atmosphere for the

creation of heavy metal (Harrison 2010). The main ideas expressed throughout this article discuss the geographic and social conditions of post-war Birmingham, the mentality associated with living in highly populated industrial neighborhoods, the changing youth culture of the 1960s, and the phenomenon of place-specific genres of music. The limitations of this article include the fact that GIS was not used for the study, and that the research was time (1960s), place (Birmingham, England), and genre (heavy metal) specific.

Jorge Leal's article entitled "Mapping Ephemeral Music Forums in Latina/o Los Angeles" examines the musical subcultures that stem from local music scenes in the city of Los Angeles. This article explores the observed sense of belonging that music venues gave to Latin-American youth in the early 1990s in Los Angeles, CA (Leal 2020). Interestingly, the author uses hand drawn maps of Los Angeles to draw conclusions on music and personal identity. Youthful participants in this study used musical boundaries (originating at venue locations) within the city to create maps that visualized areas to which they believed they belonged.

Significant in supporting arguments that note the importance of music and local populations, Sally Treloyn's article, "Music in Culture, Music as Culture, Music Interculturally: Reflections on the Development and Challenges of Ethnomusicological Research in Australia," examines the importance of music as an element of individual culture (Treloyn 2016). Throughout this study, Treloyn delves into the significance of music as it pertains to cultural identity and characterization. The spectrum of music associated with cultures around the world are singular to those from which each music originates – a distinct identifier that can be attributed to distinct populations.

In summation, acknowledging similar research into music, culture, and geography sets a strong foundation for the analysis and inferences conducted throughout this research. Since

music is a universal outlet, created and appreciated by people worldwide, it is important for this research project to recognize the role local culture (however similar to that of surrounding populations) plays on deciding the type of music that forms in specific places across the globe. The related research associated with music and geography set the stage for the sociodemographic analysis conducted in Chapter 3, and served as a continuous (and referenceable) reminder of how important culture is to the creation of new music genres. The next section explains how GIS has been involved to help explore the connections between music and place in specific locations.

2.2. GIS and Music

The use of GIS in anthropological studies (such as the research conducted for this thesis) is an interesting approach to capturing and analyzing spatial data about music and local cultures. These works usually start by attributing vector data with music-related information, but the treatment of the spatial data afterwards (as well as the type of analysis conducted) varies tremendously from one study to the next.

An article by Cohen (2012b) entitled, "Live music and urban landscape: Mapping the beat in Liverpool," illustrates this point with its use of GIS to map the human terrain in an urban city. Her work was particularly helpful with lending insight into how to structure the spatial data used to explore punk music's origins. Cohen (2012b) draws conclusions between live-music venues and local culture in Liverpool, England by documenting how music that is consistently played in a particular location creates analogous cultural archetypes. The majority of this article focuses on the challenges experienced specifying the locations of the live-music venues to describe their spatial distribution within the study area, and the subsequent social classifications assigned to musical subcultures in urban Liverpool (Cohen 2012b).

Juho Hänninen's article entitled "Urban DIY Enclaves? The 'Alternative' Cultural Spaces of Helsinki's Music Scenes 2000–2019" focuses on the social connotations (i.e., race, income, education level) associated with alternative music ideologies and space (Hänninen 2020). This thesis sought to identify the mentality connected with alternative DIY music scenes and the sociodemographic environments that accompany Helsinki, Finland's musical subcultures. The DIY attitude towards recording, branding, promotion, and even venue selection is essential to punk music's lasting notoriety – something that appears to be replicated in Helsinki's alternative music scene. Much of this thesis deals with defining spaces within Helsinki's urban environments that can be deemed cultural enclaves that foster DIY music (Hänninen 2020).

Stan Renard's purpose in "Mapping Music Cities: A Case Study of the Musical Landscape of San Antonio" was to assess the impact that San Antonio, Texas' live-music sector has on the city's economy. Live music, as an industry, has grown globally to the point that money and resources around the world are being used to study the value of maintaining it within city limits (Renard 2018). The article focuses on mapping the musical landscape of San Antonio, location intelligence associated with GIS mapping and analysis, and the musical (cultural) tastes of the local environment.

Hunter Shobe's and David Banis' 2010 article entitled "Music Regions and Mental Maps: Teaching Cultural Geography" examines the perception of music and culture in geographic terms via mental visualization (Shobe and Banis 2010). Study participants labeled maps of the contiguous US with music genres based on where they believed each particular genre was most prevalent. The authors argue that music is an excellent vehicle for delineating cultural understanding and identity.

Taylor et al. (2014) explore the shifting dynamics of musicians and live music venue locations in Sydney and Melbourne, Australia. Over time, the music genres and performance locations for both city's music industries have changed dramatically. These authors created a personalized historical geodatabase to analyze gig dates, locations, and band genres in GIS. The results show an increase in live music events in Melbourne, notwithstanding the city's decrease in size and the fact that the performance locations are far more dispersed than in Sydney. The scope of this article was modest given the use of just three variables – city-size, population, and the collected gig listings, and its focus on Sydney and Melbourne.

The data collection and data structuring elements in each of these aforementioned articles were particularly helpful in creating the data used in this study. While there was some focus on creating complex geodatabases to house and maintain music-related spatial data over time, the composition of the feature classes themselves appeared to be similar across most of the contributions (creating a helpful template for the punk-related data). Hänninen's (2020) treatment of sociodemographic information bolstered many of his arguments, which was the aim of including census data from 1970 for NYC and LA. All of the studies in this section provided great examples of how GIS can be used to better understand or communicate musical environments, with Hanninen's (2020) approach serving to guide the sociodemographic analysis outlined in later chapters of this thesis.

2.3. Punk Music

Punk music was a definite outlier in comparison to the mainstream music that was popular in NYC and LA in 1970. Aggressive or explicit music at any time is rarely the most popular, making the groupings (and subcultures) formed by those who have embraced the genre all the more interesting. To explore these groupings, researching the genre of punk music itself

was a necessary step in defining the study areas and timelines chosen for this study. The cluster analysis described in later chapters was motivated by the desire to characterize these groupings by their spatial distribution, with the hope of also uncovering the distributions by subgenre. The related work detailed below was the informational source for much of the spatial data used and drove the underlying narrative throughout the research.

Differing from the previous articles that employ GIS for musical research, Paula Guerra's (2018) article entitled "Raw power: Punk, DIY and underground cultures as spaces of resistance in contemporary Portugal" lends insight into punk music subcultures that extend beyond NYC and LA. Guerra delves into the social subsets and resistance ideologies that have arisen over 37 years within Portugal's various punk music scenes. The article focuses on punk music's DIY methodology and the social, political, and economic influence that non-English speaking people have on the music genre (Guerra 2018).

The article entitled, "Punk: The do-it-yourself subculture" by Ian Moran investigates the individual genre-specific attributes that are unique to punk music. Stripping away the politics, ideology, and fashion, Moran focuses on how punk musicians were able to foster the genre through self-reliance and entrepreneurship (Moran 2010). The article is relevant because it highlights how the music has spread from local epicenters to satellite-like communities where the parent genre is maintained (and subgenres are formed in their own right). Nearly all of the academic articles on punk music point to the resourcefulness of its contributors, and the emergence of punk music as a social phenomenon.

In Alastair Gordon's 2005 dissertation entitled "The authentic punk: An ethnography of DIY music ethics," punk music as a culture is examined as its own separate phenomenon within local music scenes in Leeds and Bradford, England. The author acknowledges genre-specific

ethea, such as artist's self-reliant proactivity towards self-recording, promotion, and venue selection that are not prevalent in many other musical subcultures (Gordon 2005). Gordan's treatment of punk music throughout his research is similar to that of differing cultures around the world – lending validity to his ethnographic approach. The dissertation evaluates local punk music scenes in the framework of counter-communities with their own individualized ethics and identifying characteristics (both politically and ideologically) and describes sub-genre formation and the spreading distribution of punk music (and influence) over time.

The arguments made by Rebecca Johinke in her article entitled "Take a Walk on the Wild Side: Punk Music Walking Tours in New York City" support claims that NYC is the epicenter of punk music (Johinke 2018). This article focuses attention on a lower East Side punk music walking tour in New York City that seeks to explore the "psychogeographic" importance of connecting location and music history. The results were useful for the thesis research project at hand because they provide a credible source of location information dealing with the birthplace of punk music in New York City.

Dave Laing's 1978 article entitled "Interpreting punk rock" provided an insightful look into the subversive nature of punk music's overarching ideologies that have been foundational since the music genre's inception. The political and social implications of punk music are examined through the lens of Marxism and are often contradicted by the actions of the musicians and general participants themselves (Laing 1978). The author exemplifies the burgeoning movement as pockets of "social bases," which serves to cluster similar attitudes, musical preference, and aesthetics.

In terms of related research, the articles published on punk music were helpful in speaking factually about the genre and in thinking about how to create the necessary data. The

people and places discussed in this section told the story, but the locations of punk music bands and venues and the accompanying census data for NYC and LA in 1970 gives another dimension to what can be understood about early punk music. These data and the various methods used to analyze and visualize the data are described in more detail in Chapter 3.

Chapter 3 Methodology

This study aimed to analyze the sociodemographics of New York City, NY and Los Angeles, CA during the early stages of punk music's creation in the 1970s. The specific locations of band formations and historic venues were identified and used to characterize the variables that most likely contributed to an environment where subversive music could flourish. The two areas examined in this research were chosen due to the number of bands that formed in New York City and Los Angeles, CA. Although the earliest punk bands arose in NYC, several early bands formed in the LA area at about the same time as their east coast counterparts. In looking at the actual number of bands from each location, the data set appears to be bimodal, which is a phenomenon that should be explored to properly represent the genre.

Like many other music genres, punk music can be subdivided into several subgenres that have branched off the parent genus throughout the years (Lena and Peterson 2011). Initial observations showed a greater degree of subgenre diversity in the Los Angeles area, which may answer questions regarding individuals who are directly involved in the subgenre's inception (influential band members), as well as whether similarity in subgenre branching can be attributed to location. To evaluate the spatiotemporal distribution of punk bands, subgenres, and venues, spatial autocorrelation and point clustering analysis was employed to test whether these phenomena were randomly dispersed.

Given the two study locations, the census data were used to characterize the types of individuals living within the intersecting tracts. The ethnicity, age, education level, and household income of each census tract was displayed and the point data representing specific punk locations were used for cluster analysis, to query census tracts, and visualization. Essentially, the point data were used to choose census tracts and to describe the parts of the two

cities where punk music flourished within this study.

3.1. Data Description

The data required for this study was researched and collected from various credible online resources. Historic and current census data were found at https://www.census.gov/ and https://www.ipums.org/. The spatial and tabular data described in Table 2 were fundamental to the work at hand.

Census data were collected and analyzed in ArcGIS Pro to determine the spatial positioning and demographics of each punk-related census tract. Individual punk bands representative of specific subgenres were researched in order to create a more comprehensive dataset. Census data that allowed for site profile characterization included attributes such as age, race, gender, education, and annual household income. The location data researched and compiled included sites where subgenre-specific bands have formed, and popular live-music venues where the subgenres were most prevalent.

The self-authored datasets (PunkBandPoints and PunkVenues) were gathered and verified using Google search and various online resources to cross-reference individual bands (i.e. Cooper 2018, 2019). Both self-authored datasets have been published on ArcGIS Online at https://services1.arcgis.com/ZIL9uO234SBBPGL7/arcgis/rest/services/PunkBandPoints/FeatureServer and https://services1.arcgis.com/ ZIL9uO234SBBPGL7/arcgis/rest/services/PunkVenues/ /FeatureServer, respectively. For this research, bands were defined as groups of musicians who recorded at least one album and played live music regularly. The criteria for choosing and including a band was the year in which it was formed or that it was one of the first 100 bands selected. Once a band was selected and confirmed in at least two online sources, a single pair of latitude and longitude coordinates was selected to represent the city from which they hail from.

Table 2 The spatial and tabular data used in this study.

Names	Sources	Formats	Contents	Date of Compilation
PunkBandPoints	Self-authored dataset created through Internet research (published on ArcGIS Online).	Vector and tabular (shapefiles and an Excel csv file)	Subgenre, band name, year formed, city where the band was formed, and coordinates for the city	Nov 2016
PunkVenues	Self-authored dataset created through Internet research (published on ArcGIS Online).	Vector and tabular (shapefiles and an Excel csv file)	Name of historic genre-related venues, music genre, city where venue is located, coordinates for the venue's address	Apr 2020
NewYorkTracts	IPUMS[1]	Vector (shapefile)	State of New York census tracts	1970
AgeDataNY	IPUMS[1]	Tabular (Excel csv file)	New York City age data	1970
GenderDataNY	IPUMS[1]	Tabular (Excel csv file)	New York City gender data	1970
MedianIncomeNY	IPUMS[1]	Tabular (Excel csv file)	New York City household income data	1970
RaceDataNY	IPUMS[1]	Tabular (Excel csv file)	New York City race data	1970
CaliforniaTracts	IPUMS[1]	Vector (shapefile)	State of California census tracts	1970
RaceDataLA	IPUMS[1]	Tabular (Excel csv file)	Los Angeles County race data	1970
AgeDataLA	IPUMS[1]	Tabular (Excel csv file)	Los Angeles County age data	1970
GenderDataLA	IPUMS[1]	Tabular (Excel csv file)	Los Angeles County gender data	1970
MedianIncomeLA	IPUMS[1]	Tabular (Excel csv file)	Los Angeles County household income data	1970

[1] https://www.ipums.org/

These coordinates were gathered using the Latitude and Longitude Finder (https://www.latlong.net/) and then converted to decimal degrees for spatial analysis and display in ArcGIS Pro.

The census data for New York City and Los Angeles County in 1970 were downloaded from the National Historical Geographic Information System (NHGIS) on the University of Minnesota sponsored IPUMS website (https://www.ipums.org/). The age and race tables were organized by gender, which allowed for the aggregation and creation of an individual gender table. Education and household income were organized by years accomplished and household type and income amount, respectively. The shapefile containing census tract boundaries from 1970 was also downloaded from NHGIS.

3.2. Research Design/Methods

The GIS work was performed on a Dell Precision 7740 laptop with a Netgear N150 wireless router to support internet connectivity. The data was stored in Microsoft Excel and converted to comma-separated value (.csv) files before being imported into ArcGIS Pro 3.0.0. The steps shown in Figure 3 describe the methodology and cadence that was deployed for this study.

The next four paragraphs describe the data preparation tasks in a little more detail and Section 3.3 describes the spatial analysis in considerably more detail. Once the historic education, income, sex by age, sex by race census data was downloaded from IPUMS NHGIS website (https://data2.nhgis.org/main), the following preparation was required to facilitate meaningful analysis and representation.

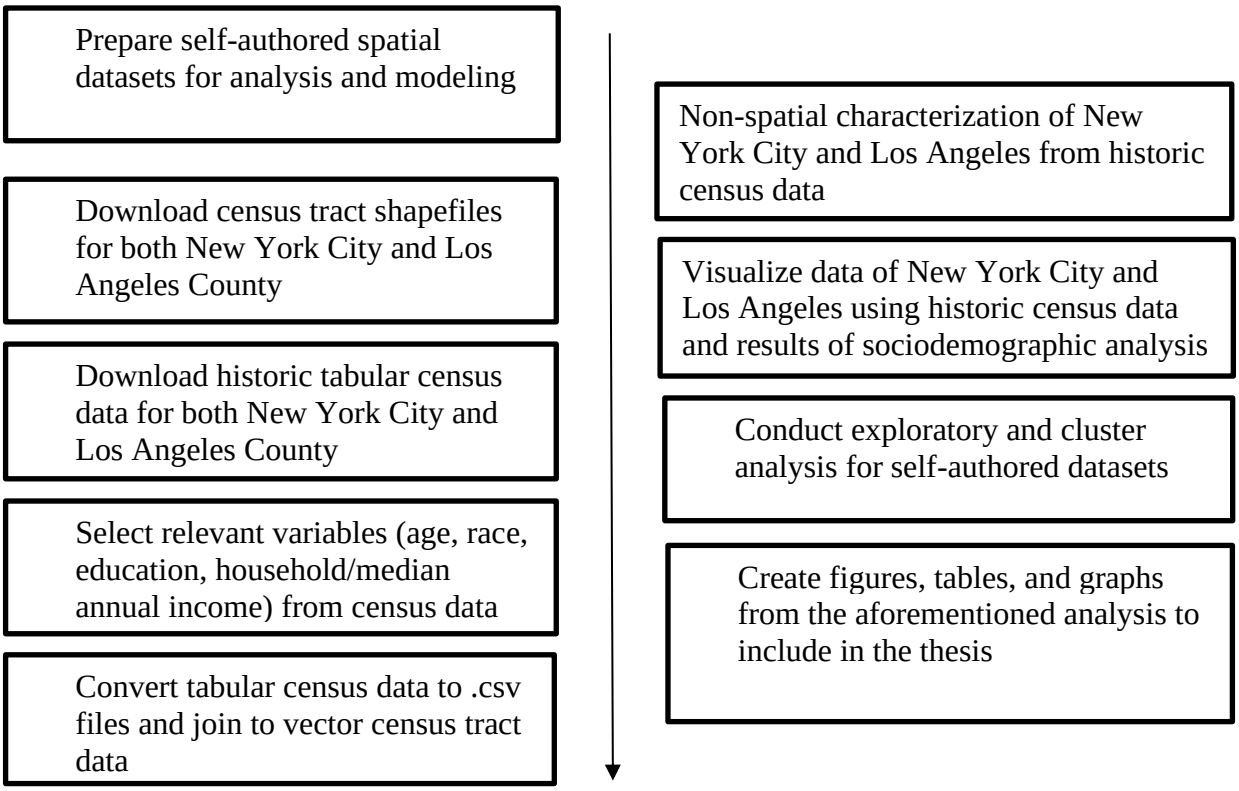

Figure 3 Data collection/preparation (left) and analysis/thesis preparation steps (right).

The 1970 education, income, sex by age, and sex by race census data were reformulated and used in the subsequent steps in the following ways. Three attributes were used to characterize the low, median, and high education levels in New York City and Los Angeles County in 1970: (1) no school years completed; (2) high school: 4 years; (3) and college: 5 years or more. After the tables were downloaded as csv files, they were imported into an ArcGIS geodatabase. The 1970 census tract shapefile was then joined with the education table to create three separate feature classes showing the range of education in New York City and Los Angeles County.

The 1970 household income data was broken down into: (1) married head-of-household; (2) primary head-of-household; (3) and other head-of-household. For each of these classifications, there was three classes – less than $2,000; $2,000 to $24,999; and $25,000 or

more for each study area. All rows were aggregated by household type for each income bin. Using the statistics option within the ArcGIS Pro attribute table allowed for quantiles to be created for the data. These values guided the criteria for low, median, and high-income households. As with the education table, the income table was then imported into the project geodatabase so it could be joined to the 1970 census tract shapefile. Individual feature classes were then created to display the three relevant levels of income.

Gender data for 1970 consisted of a very large table with many columns representing population counts by age for both males and females from 0 to 100 years old. To make the table useful for analysis, ages were combined in five groups: (1) years 0-11 children, (2) years 12-17 teenagers, (3) years 18-39 adults, (4) years 40-59 middle-aged adults, and (5) 60 years and older adults. The table columns were then aggregated by age group and gender. The table was then imported into the project geodatabase and joined with the 1970 census tract polygons. Feature classes were created for each age group, with a separate feature class showing ages 18-39 years to represent those within the population that are most likely to attend a punk show. This age group was picked based on the assumption that more young adults would attend a live punk show, rather than children or people aged 40 years or more.

The 1970 sex by race table was limited in the sense that few ethnicities were represented overall. For each ethnicity, both male and female population counts were reported in separate columns. Asian ethnicities were aggregated to form a single column, while Pacific Islanders and mixed ethnicities (other) were combined for ease of analysis. The male and female data for each race were then combined and (as with the other 1970 census tables), the sex by race data was included in the project geodatabase and joined with the census tract layer. Each ethnic group (Black, White, Asian, Pacific Islander/Other) was visualized by creating a separate feature class

in the project database.

With all of the data now in one place, the geoprocessing and analysis tasks described in the next section completes the workflow summarized in Figure 3.

3.3. Geoprocessing/Analysis

The analysis conducted for the thesis research began with exploratory examination of the point datasets containing the locations associated with punk music (Figure 4). This allowed for an initial empirical understanding of when subgenres originated, when (and where) they were most popular, as well as when (and where) bands and venues were most prominent. Cluster analysis was then used to confirm locations that identify groupings of instances as epicenters of the genre. This involved using the PunkBandPoints and PunkVenues feature classes, the Spatial Autocorrelation (Global Moran's I) tool, and the Find Point Clusters geoprocessing tool in ArcGIS Pro. Having the ability to determine spatiotemporal clusters within the data gave quantifiable evidence of subgenre epicenters and the origin of punk in terms of the initial band clusters.

The final analysis method employed required the characterization of each study area in terms of age, gender, race, education level, and annual household income – essentially the description of each census tract related to punk music through the lens of sociodemographic variables. The results of this analysis allowed for the reader to understand what kind of neighborhoods punk music popped up in NY City and the LA area in the 1970s.

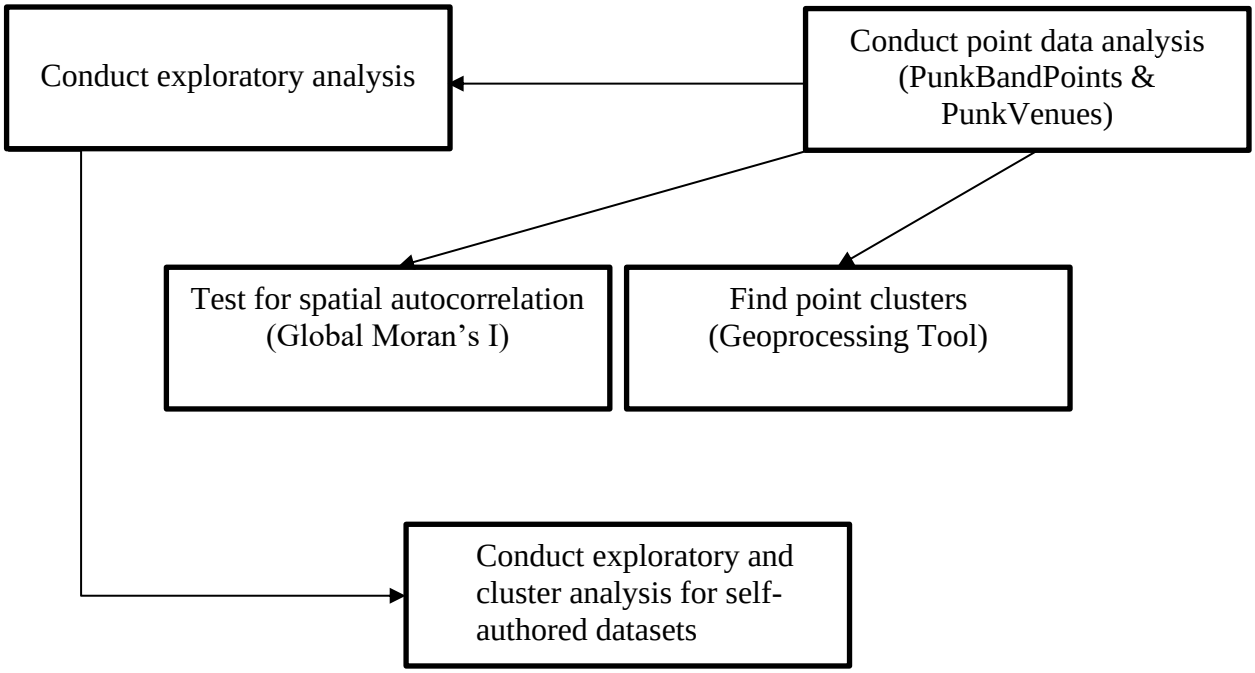

Figure 4 Workflow to conduct exploratory and cluster analysis of point vector data.

3.3.1 Exploratory Analysis

Exploratory analysis of the point datasets gave preliminary insight as to the distribution of early punk entities over space and time. Using the PunkBandPoints, the change in counts for bands by subgenre were compared to the years in which they were formed (Figure 5). The subsequent line chart shows peaks in subgenre popularity – essentially dating the pinnacle of each and illustrating when the subgenre began. Visualizing where bands formed (by counts and subgenres) served as a predecessor to cluster analysis (Figure 6). While the list of locations is lengthy, obvious groupings of bands in individual locations confirms the locations or places chosen to characterize the beginning of punk music. Initial analysis also showed trends in the distribution of subgenres, which appears to require further attention due to the rise of similar subgenres in several locations.

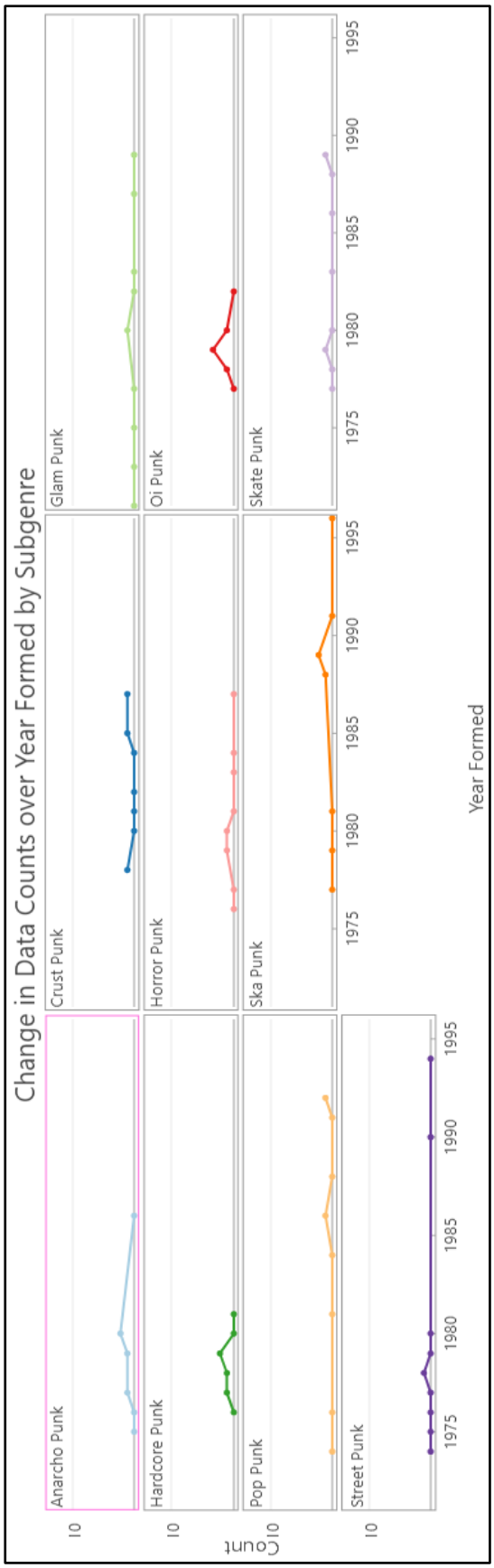

Figure 5 Number of bands (by subgenre) per year.

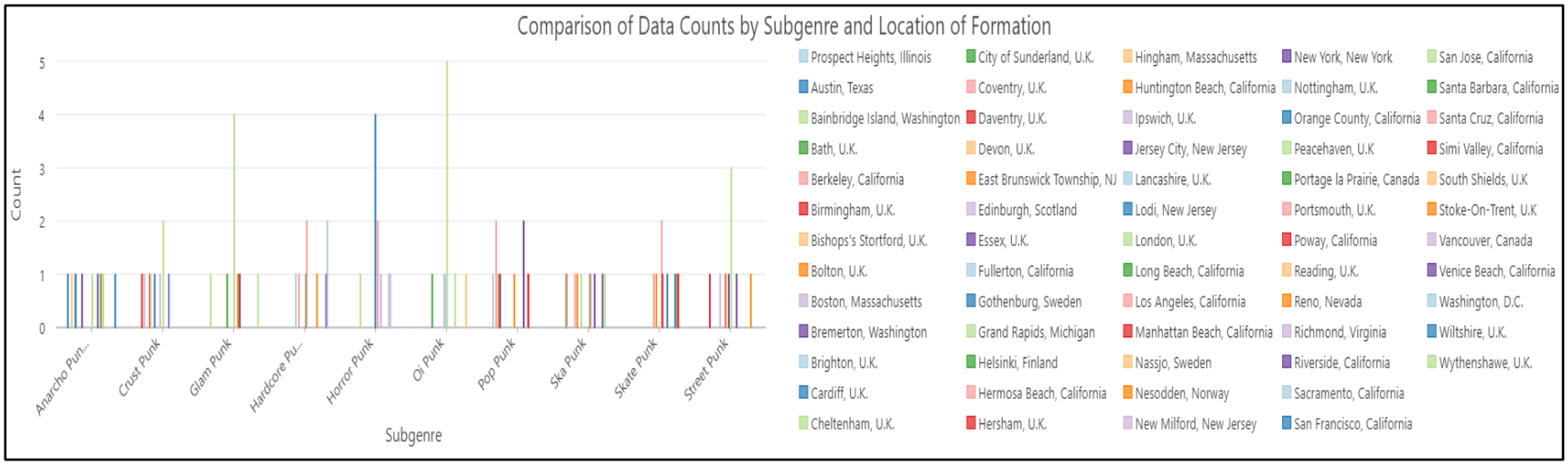

Figure 6 Number of bands (by subgenre) by location.

3.3.2 Spatial Autocorrelation (Global Moran's I)

The Moran's I statistic for spatial autocorrelation is given as (ESRI 2022):

$$I = \frac{n}{S_0} \frac{n \sum_{i=1}^{n} \quad \sum_{j=1}^{n} w_{i,j} z_i z_j}{S_0 \ \sum_{i=1}^{n} z_i^2} \tag{1}$$

where z_i is the deviation of an attribute for feature i from its mean ($x_i - X$), w_{ij} is the spatial weight between feature i and j, n is equal to the total number of features, and S_0 is the aggregate of all the spatial weights:

$$S_0 = \sum_{i=1}^{n} \quad \sum_{j=1}^{n} w_{i,j} \tag{2}$$

The z_I-score for the statistic is computed as:

$$z_I = \frac{\mathrm{I} - \mathrm{E}[I]}{\sqrt{V[I]}} \tag{3}$$

where

$$E[I] = -1/(n-1) \tag{4}$$

$$V[I] = E[I^2] - E[I]^2 \tag{5}$$

To determine the spatial nature of punk music's formation, the Spatial Autocorrelation (Global Moran's I) tool in ArcGIS Pro was used to characterize the spatial distribution of punk bands by subgenre. The aforementioned ArcGIS Pro tool sets a default null hypothesis that assumes the creation dates of early punk bands and venues were randomly distributed. Equations (1-5) show the workflow, with Equation (3) showing how the z score for the statistic was calculated. The spatiotemporal distribution of the PunkBandPoints and PunkVenues datasets was tested for the years the bands were formed, the years in which a venue was established, as well as for the geographic locations associated with a band's subgenre. In order to use an individual band's subgenre as an input parameter (and meet the tool's numerical input requirement), a numerical identifier (SubgenreID) was created to represent it throughout the analysis.

Inputting additional parameters for the Spatial Autocorrelation (Global Moran's I) tool in ArcGIS Pro was required for the tool to work properly. To determine the relationship between the location of a punk band forming and the time at which it formed, the PunkBandPoints dataset was used as the input feature class, with the year the band was formed chosen as the input field. Rerunning the tool to examine the relationship between the location of a punk band forming and differing subgenres, the PunkBandPoints dataset was used once more as the input feature class, with the abovementioned SubgenreID used as the input field. Determining the relationship between the opening of an early punk venue and the time at which it opened, the PunkVenues dataset was used as the input feature class, with the year the venue opened as the input field.

3.3.3 Determining Clusters

The PunkBandPoints feature class contained 100 of the earliest punk bands separated by subgenre and was used with the Find Point Clusters tool in ArcGIS Pro to find clusters of bands based on geographic location and observed frequency. Using the tool's DBSCAN (or defined distance) algorithm, Find Point Clusters identified the number of features within a defined distance chosen by the user. Once the number of features were counted, the tool determined whether or not they were clustered based on a minimum feature count value also selected by the user. If the number of features counted was equal to or greater than the minimum feature count within the defined distance, then the tool identified such as group of features as a cluster (and all else as noise).

Time clusters showed whether subgenre creation was driven by proximity to similar bands in a specific period, or if the categorization was arbitrarily assigned (regardless of geographic location or year the band came to be). Using the Find Point Clusters tool, a cluster would be defined as a group of at least 3 punk bands existing within 1 mile of each other. The

same analysis was given to the feature class containing music venues, with a cluster of early punk venues defined as 5 or more locations within 15 miles of each other. Establishing these distance and count parameters set a reasonable area and frequency threshold that could identify grouping within the data. The results of this analysis allowed for the reader to determine whether or not the source neighborhoods of punk bands and punk music venues were one and the same for both New York City and Los Angeles, CA.

3.3.4 Census Data Analysis

The 1970 census data was used to characterize the residents in study locations over time (Figure 7). The census tracts which intersected the band formation sites and venues were selected and used to depict life in those locations. To denote whether or not an instance of early punk coincided with a particular census tract, a binary (numerical) field was created to represent whether or not a band or venue existed within it. A 0 was assigned to tracts without an early punk instance, and a 1 was assigned for those that had at least one band or venue located within its boundary. This allowed for ease of analysis and querying out census tracts that did not intersect with an instance of either a band forming or venue opening. Census tracts adjacent to those that intersected instances of early punk were not analyzed due to the subjectivity involved with determining adequate boundaries which may have introduced statistical bias.

The census data was then compiled for New York City and Los Angeles County to determine the age, gender, race, education level, and annual household income of those living within areas where punk music began in the 1970s. Census tracts associated with early punk bands and venues were separated from the larger dataset containing all census tracts for ease of quantitative analysis and statistical findings. These separate census tracts were then compared to each other, both within their individual locations and to those that existed across the country

from each other. This allowed for conjecture regarding the similarity of tracts found mutually within one location, and those that were separated by thousands of miles.

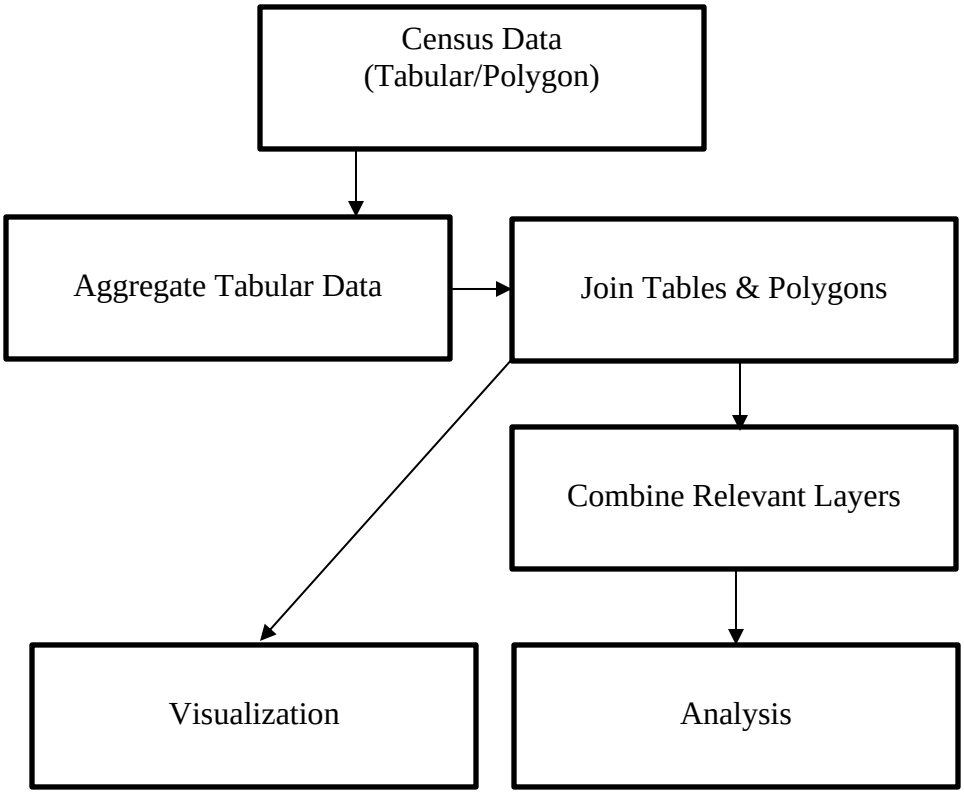

Figure 7 Workflow for census data analysis.

Chapter 4 Results

This chapter details the results of the work described in the previous chapter in three parts: (1) exploratory analysis; (2) cluster analysis; and (3) census data analysis. The exploratory and cluster analysis answers the research questions which ask when and where punk bands and venues originated, while the census data analysis answers the research questions dealing with sociodemographic profiles for locations associated with early punk music.

4.1. Exploratory Analysis

The exploratory analysis of the early punk bands (PunkBandPoints) data showed three locations where punk music was most prevalent during the 1970s and 1980s (Figure 8).

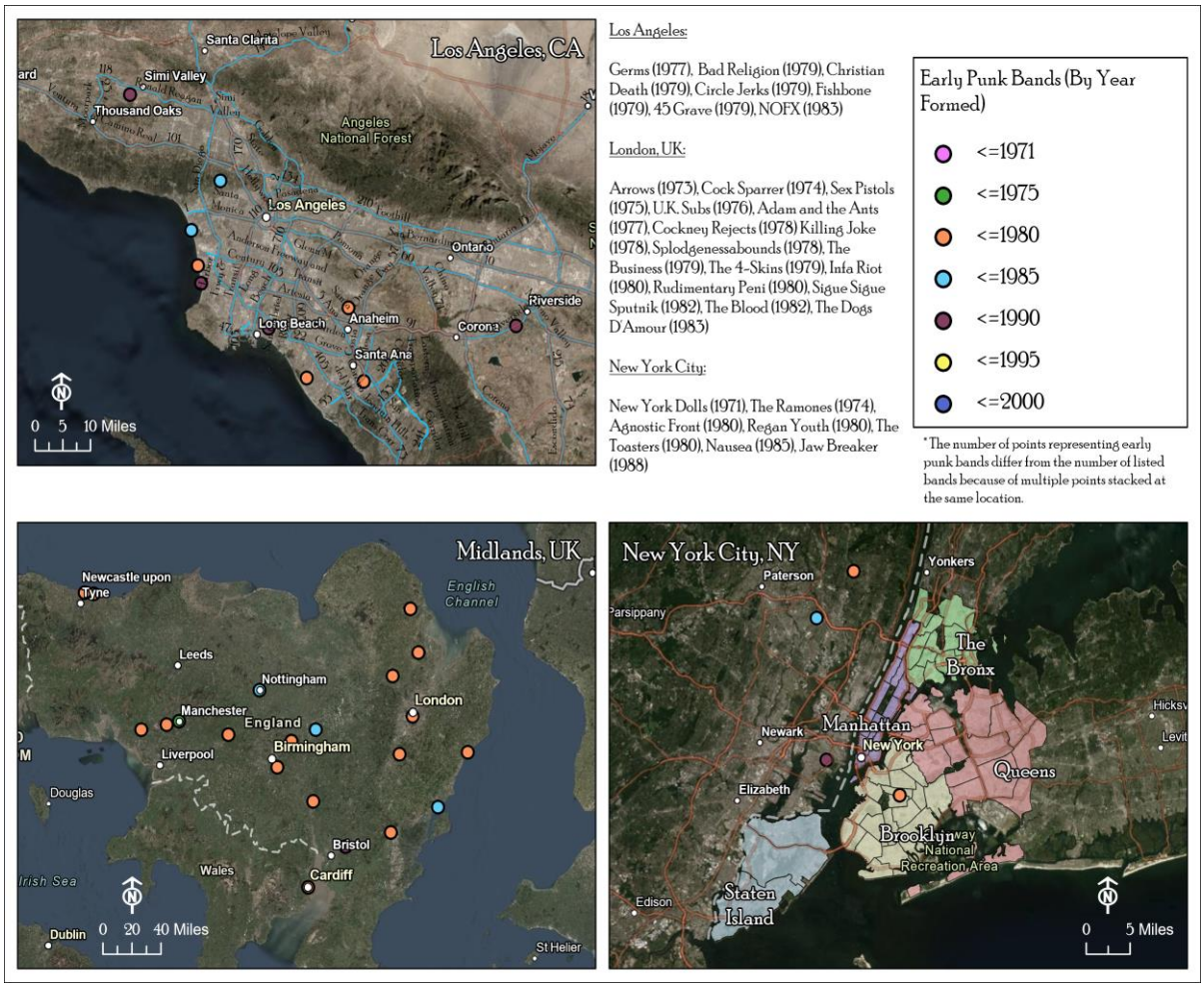

Figure 8 Geographic locations associated with early punk bands forming in the

Table 3 shows the locations, counts, and date ranges for three locations where punk music was formed.

Table 3 Areas of highest frequency from 1971 – 1988 (*denotes earliest instance).

Location	No. of Bands	Date Range Observed
London, UK	15	1973 - 1983
New York, NY	7	1971* - 1988
Los Angeles, CA	7	1977 - 1983

Locationally, the data is definitely tri-modal in nature, with more than twice as many instances occurring in London, UK than in New York City and Los Angeles. Because the earliest instance of punk music was observed in the conterminous US (and the census data in the UK was not collected at the same level of granularity as in the US during this period), the next part of the thesis focused on New York, NY, and Los Angeles, CA. The timeline of early punk bands in New York shows a larger temporal range compared to Los Angeles, where the punk bands popped up over 6 years at the end of the 1970s and the early 1980s.

While each subgenre was represented equally in the data collection process (ten bands per subgenre), Table 4 shows the date ranges and locations of the earliest instance recorded for each subgenre observed in the study.

Table 4 Date ranges and locations for the earliest observances of punk subgenres recorded.

Subgenre	Date Range Observed	Location of Earliest Observance
Anarcho	1975-1986	London, UK
Crust	1978-1987	Devon, UK
Glam	1971-1989	New York, NY
Hardcore	1976-1981	Los Angeles, CA
Horror	1976-1987	Sacramento, CA
Oi	1977-1982	South Shields, UK
Pop	1974-1992	New York, NY
Ska	1977-1996	Coventry, UK
Skate	1977-1989	Manhattan Beach, CA
Street	1974-1994	London, UK

Five of the first ten subgenres observed can be attributed to locations within the UK. Three are located in California and the final pair to New York. Certain subgenres appear to have larger date ranges, with groupings of fewer instances observed over a longer period (i.e., glam, horror, pop, ska, skate, and street punk), while anarcho, crust, hardcore, and oi punk appear to have surges of formation observed within shorter periods. Subgenres associated with high frequency over shorter periods are located almost entirely within the UK, with hardcore punk being the only American exception. Subgenres that tend to have longer temporal influence can be mainly attributed to locations within the US.

Much like the PunkBandPoints data, initial exploratory analysis of the early punk venue dataset (PunkVenues) shows the locations and highest frequency of where early punk music was played in live music settings (Figure 9). This plot and the counts and date ranges summarized in Table 5 shows the opening of historic punk music venues collected in this thesis research project.

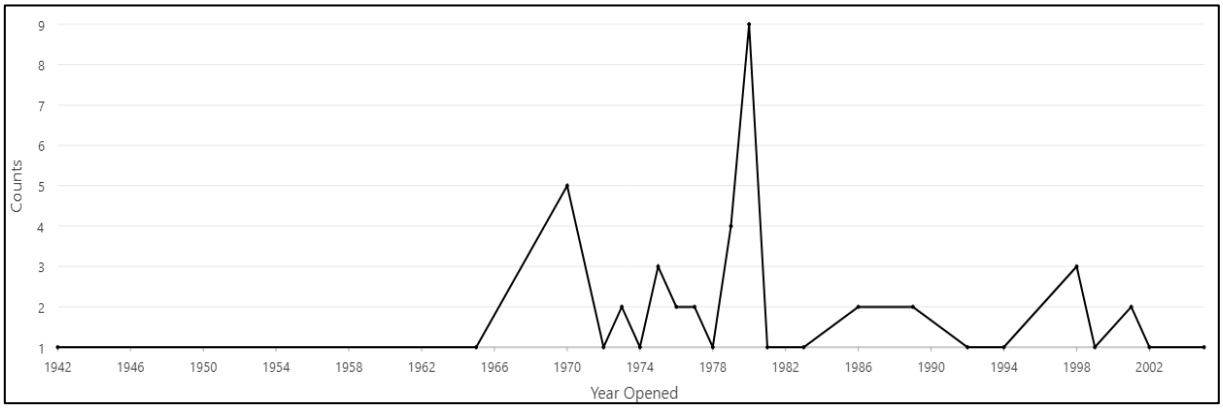

Figure 9 Frequency of early punk music venues observed over

Table 5 Areas of highest frequency observed for early punk music venue openings.

Location	No. of Venues	Date Range Observed
New York, NY	8	1965-1981
Los Angeles, CA	7	1973-2001
San Francisco, CA	4	1970-1980
Boston, MA	3	1970-1980

Highly populated coastal regions within the US hosted the highest frequency of early punk music venues observed (Figure 10). While instances of venues opening in London, UK were recorded, acknowledgement of the study area (New York and Los Angeles) biased the data collection for this particular dataset.

It appears that venues that already existed transitioned into locations where early punk music was played for certain New York, San Francisco, and Boston venues, while locations that were opened in Los Angeles after the first instance of punk music was observed. Los Angeles also has the largest date range associated with historic music venues, revealing a greater level of influence over a longer period of time. New York is second to Los Angeles in this regard, with San Francisco and Boston showing similar values (i.e., ~10 years) that appear to create spatiotemporal boundaries that accurately depict the popularity of punk music observed in the PunkBandPoints data. The venue dataset also allows for popularity to be evaluated in terms of time itself, which shows a steady decline (or fewer venues being opened) beyond 1990 (Table 6).

4.2. Cluster Analysis

The results of using the Spatial Autocorrelation (Global Moran's I) and Find Point Clusters tools to describe the distribution of punk music across the US are described in the next two subsections.

4.2.1 Spatial Autocorrelation (Global Moran's I)

The Spatial Autocorrelation (Global Moran's I) tool in ArcGIS Pro was utilized to better understand the spatiotemporal distribution of both the early punk band and early punk venue vector datasets. Given the nature of the data (and the tool's requirement of a numeric input field), the distribution of punk bands by subgenre, punk bands by year formed, and punk venues by year opened were analyzed in this manner.

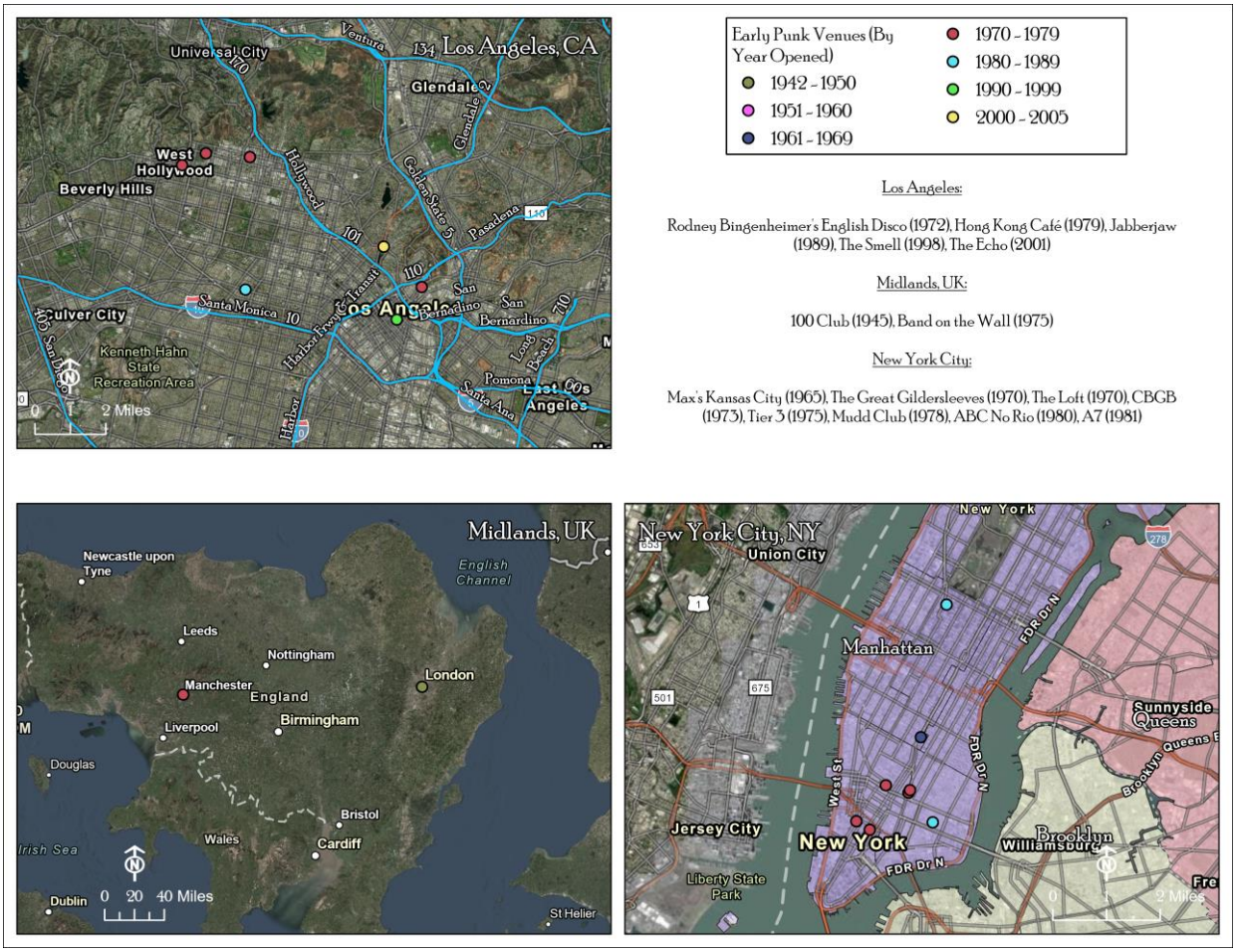

Figure 10 Geographic locations associated with early punk venues opening in the 1970s.

Table 6 No. of early punk venue openings by decade.

Decade	No. of Venue Openings Observed
1970-1979	22
1980-1989	15
1990-1999	6
2000-2010	4

The Spatial Autocorrelation (Global Moran's I) tool in ArcGIS Pro started with a default null hypothesis that assumes that early punk bands by subgenre are randomly distributed. The tool generates a report that lists the Moran's Index, the variance, the z-score, and p value, among others, and using these metrics, the null hypothesis was accepted, which means the spatial distribution of punk bands by subgenre was random. The p value of 0.71 implies that location is not a determining factor within the scope of subgenre creation.

The same tool was used to check whether the geographic distribution of the start dates of early punk bands was randomly distributed. The report generated using the tool and the PunkBandPoints dataset included a p value of 0.040 and suggest that the spatial distribution of punk bands by year formed was clustered. This result suggests that location and time, considered together, did influence where and when punk bands were formed.

The Spatial Autocorrelation (Global Moran's I) tool in ArcGIS Pro was also used to examine the distribution of punk venues using a null hypothesis that assumes that the locations of the opening dates of early punk venues were randomly distributed. The resulting z-score (2.39) and p value (0.018) show that the spatial distribution of punk venues by year opened was Clustered as well. This suggests that location and time, considered together, did influence where and when punk music venues opened.

4.2.2 Determining Clusters

The Find Point Clusters tool in ArcGIS Pro was used to identify regions where early punk musicians gathered. Using the tool, a cluster would be identified if at least 3 punk bands were formed within 1 mile of each other. The following locations contained clusters of early punk bands based on this criterion: (1) London, UK (15 bands); (2) Los Angeles, CA (7 bands); (3) New York, NY (7 bands); (4) Lodi, NJ (4 bands); and Berkeley, CA (3 bands).

The Find Point Clusters tool in ArcGis Pro was used next to identify locations where early punk bands played live music regularly. Using the tool, a cluster would be identified if at least 5 venues were found within 10 miles of each other. The following locations contained clusters of early punk venues based on this criterion: (1) New York, NY (8 venues); (2) Southern California – Los Angeles, Hollywood, and West Hollywood, CA (7 venues); (3) Northern California – Berkeley, Oakland, and San Francisco, CA (5 venues).

4.3. Census Data Analysis

The historic census data from 1970 was used in ArcGIS Pro to describe the places where punk music originated. Thirty-one census tracts intersected the PunkBandPoints and PunkVenue vector data, and were used to characterize the population living within them. The variables in Table 7 were analyzed to determine the relationships between age, race, education, and income level, and the presence of a punk band or punk venue. While the variables observed in census tracts specifically located within either location (New York City or Los Angeles County) were more similar than dissimilar, variance was observed in median annual income and education level.

In 31 census tracts representing areas where punk music began in New York City and Los Angeles County, the majority of the people living within them were Caucasian (Table 8). African Americans and Asians were similar in count to each other, but had decidedly fewer people living within census tracts that were associated with early punk music. Pacific Islanders and mixed races made up a negligible portion of these populations. These findings were evident in both locations, with little variance observed in accordance to race and population for both New York City and Los Angeles County.

In terms of annual income, areas associated with middle to slightly upper middle class annual income values align with instances of either a punk band forming or a venue opening (Table 9). That being said, there is a proportionately larger subset of the population that are lower-middle to lower class depicted in the analysis. Punk music is definitely not associated with areas of extremely high median annual income, but with areas that are slightly above median annual income.

Table 7 Variables used in census data analysis.

Variable	Sociodemographic
Caucasian	Race
African American	Race
Asian	Race
Pacific Islander	Race
Other	Race
< $2000	Annual Income
$2,000-$2,999	Annual Income
$3,000-$4,999	Annual Income
$5,000-$6,999	Annual Income
$7,000-$9,999	Annual Income
$10,000-$14,999	Annual Income
$15,000-$24,999	Annual Income
> $25,000	Annual Income
Children	Age
Teenagers	Age
Adults	Age
Middle Aged Adults	Age
Older Adults	Age
No School years	Education
Elementary 1-4 years	Education
Elementary 5-6 years	Education
Elementary 7 years	Education
Elementary 8 years	Education
High School 1-3 years	Education
High School 4 years	Education
College 1-3 years	Education
College 4 years	Education
College 5 > years	Education

Table 8 Percentage of population by race in census tracts with punk music bands or venues.

Race	Percent of Total Population
Caucasian	83.6
African American	8.3
Asian	7.3
Pacific Islander	0.06
Other	0.82

While the majority of the population living within census tracts associated with early punk music made between $7,000-9,000, this was not equally evident for both locations. Populations in Los Angeles County were more likely to make between $2,000-6,999, while those that lived in New York City were more likely to make between $5,000-14,999. In terms of relative affluence, populations living in census tracts associated with early punk music in New York City generally made more money than populations living in census tracts associated with early punk in Los Angeles County.

Table 9 Percentage of population by income in census tracts with punk music bands or venues.

Annual Income	**Percent of Total Population**
< $2000	14.3
$2,000-$2,999	8.7
$3,000-$4,999	13.8
$5,000-$6,999	13.3
$7,000-$9,999	17.1
$10,000-$14,999	15.8
$15,000-$24,999	11.1
> $25,000	6.3

Ages associated with punk music creation sites tend to show a relatively young population living within the census tract boundaries. Over 60% of the total population is between the ages of 0-39, with the majority of individuals being ages 18-39. The number of children living in these areas represent more than double their teenage counterparts. While there are a fair number of middle-aged adults living within these regions, they represent less than a quarter of the overall population. In terms of young vs. old, children and teenagers outnumber those who are 60 years and older by nearly 3%. To summarize, it appears that census tracts that intersect with punk music generally have a large number of young adults who tend to have a relatively

large number of offspring – an observation that is evident for both New York City and Los Angeles County.

Table 10 Percentage of population by age group within punk music creation sites.

Age Groups	**Percent of Total Population**
Children (0-11 years)	14.4
Teenagers (12-17 years)	6.1
Adults (18-39)	39.7
Middle Aged Adults (40-59 years)	22.4
Older Adults (60+ years)	17.7

Approximately 56% of the populations associated with early punk music have an education level between one year of high school and three years of college. The majority of people living within these census tracts maintain at least a high school level education, with the second highest frequency of education level associated with an Associate level degree, or possibly an unfinished Bachelor's degree. Roughly 10% of the population is highly educated, which is triple the size of the population that have no education whatsoever. At least 62% of the population is high school educated or higher, with 38% never graduating from high school.

While the percentage of education levels in census tracts associated with early punk appear to increase for both locations for 1-3 high school years and begins to decrease at 1-3 college years, populations living within Los Angeles County were observed to be slightly more educated than populations living within New York City. Populations living within Los Angeles County were observed to have a higher frequency of individuals that have completed 1-3 college years, while those that lived within New York City were observed to have a higher frequency of individuals that have completed 1-3 high school years (but never graduating).

Table 11 Percentage of population by education level in census tracts with punk music bands or venues.

Education Level	Percent of Total Population
No School years	3.3
Elementary 1-4 years	3.8
Elementary 5-6 years	6.0
Elementary 7 years	2.7
Elementary 8 years	8.1
High School 1-3 years	14.1
High School 4 years	25.8
College 1-3 years	16.0
College 4 years	9.9
College 5 > years	10.3

Chapter 5 Conclusion

Based on the findings of this study, it remains unclear whether punk music can be described as a phenomenon directly related to local geography and sociodemographics. However, this raises questions about the geographic specificity of music genres more generally. Music is understood as being rooted in place; however, its spatial diffusion patterns are less well-realized. Using a similar approach to analyze other music genres could provide a comparison as to the relationship between punk rock and its geographic context. Similar conditions for differing music would bolster the counterargument. These findings show that the beginning of punk music was associated with clusters of youthful individuals living in lower to middle-class neighborhoods in coastal metropolitan areas. This may or may not be the same for other music genres. As punk music is a definitive outlier in terms of mainstream popularity, it is reasonable to assume that it more than likely sets itself apart from other music based on the variables examined within this thesis.

5.1. Summary and Discussion

The clustering of early punk music shows a relatively narrow time frame during which punk was new and popular, after which it declined in popularity and frequency. While there are several instances of punk music being played in the early 1970s across the country, it was and is played more prevalently near creation sites on the east and west coasts of the United States. Of course, New York City and Los Angeles County are entertainment and music industry epicenters, so it makes sense that these were the areas in which these musical genres emerged. That said, this analysis did not show that punk music mapped perfectly onto regions that simply incubate music more generally. For example, the cities of Boston and San Francisco are not traditionally known to be entertainment hubs, and yet were strongly connected with the

emergence and spread of punk music. Another anomaly that was uncovered by the cluster analysis was how subgenres were seemingly randomly distributed across the country and over time.

With respect to subgenres, the null hypothesis before analysis was the assumption bands that sounded alike would originate from the same locations. This is largely true of oi punk, with multiple bands coming from London, UK between the late 1970s and early 1980s. This was not true for the other subgenres included in the study. Oi punk was observed to be (initially) a distinctly British phenomenon – essentially a reaction of the working-class youth to economic and living conditions experienced in London. In comparison to other subgenres, oi is interesting because of the brief time frame in which it was most popular, and for the fact that it remained centralized in one location. Figure 11 shows members of the oi punk scene outside of a popular venue in London – note the similar ways in which the participants dress. This particular aesthetic originated with the oi punk scene, but its influence can be observed in other locations discussed throughout the study.

The subgenre of horror punk can be attributed to influential band members (specifically Glenn Danzig), who generated a cluster in Lodi, NJ, with very few instances observed elsewhere. It is important to remember this while considering how music was shared and grew in popularity during the research timeline, not within the context of how easily and quickly music can be shared presently. An analysis of current punk subgenres would have to include the advent of the internet and music streaming services available today, which would dramatically change the results coming from the type of clustering methods used in this research. Thus, this study can only explain subgenres as varying punk music categories that are either directly related to

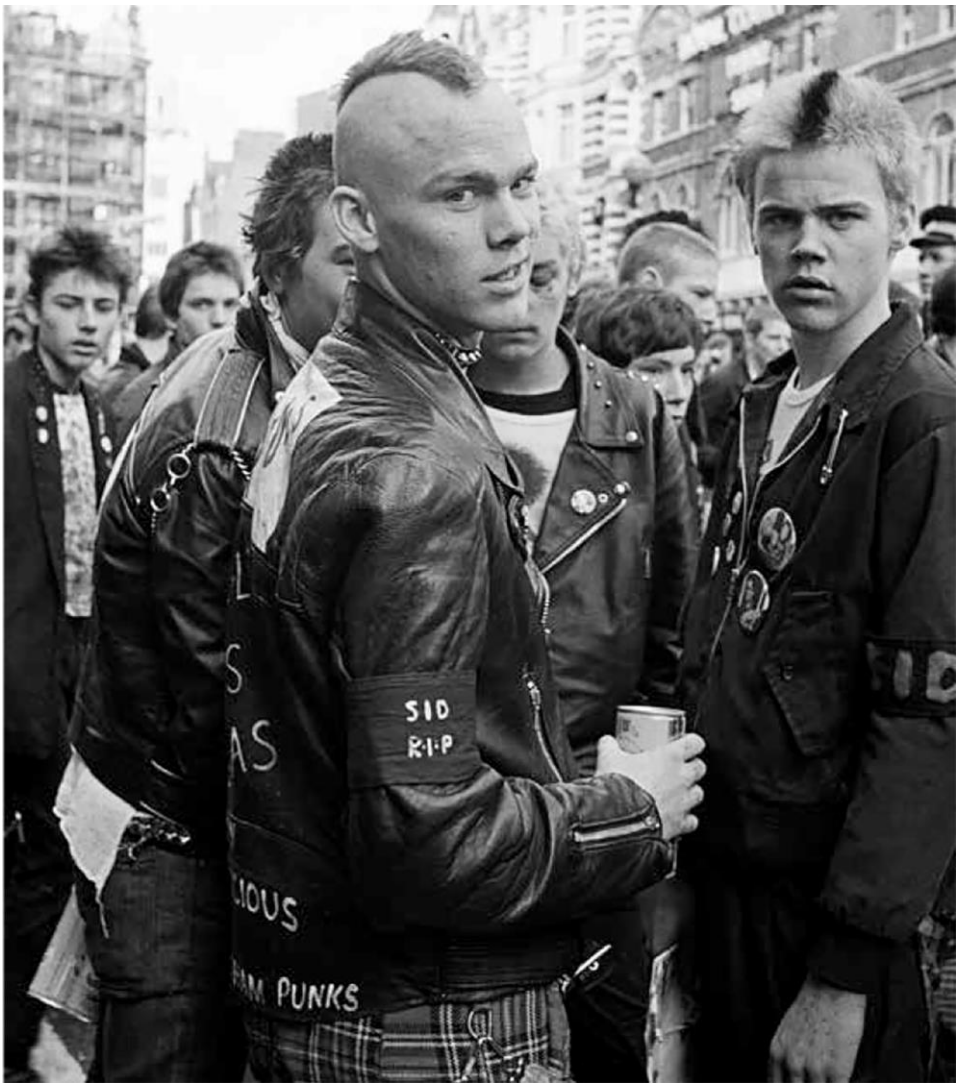

Figure 11 Oi punk scene in London, UK (1979).
source: https://www.documentjournal.com/2019/07/before-boris-there-was-thatcher-youth-revolt-in-70s-london/

influential band members or local music scenes in which the particular subgenre thrives in popularity.

This study suggests that early live music venues associated with punk music were largely reactionary in their openings, meaning that the venues opened specifically to meet the demand of punk music. There were only a few instances of established venues becoming known for punk music after the first instance of a band forming was observed. The analysis created groupings

within New York City and Los Angeles County, but it also showed clusters in other highly populated coastal cities around the country. These observations seem to similarly be reactionary in nature, or exemplify how large, populated areas provide live-music venues within their city (or downtown area). While acknowledging that large cities offer more opportunities for live-music settings, there is evidence of punk specific venues being located in and around punk music creation epicenters in both New York and Los Angeles. The only difference is that those located in New York and Los Angeles have conflicting sociodemographic variables attributed to creation sites, namely with Los Angeles having lower income. That being said, there were definitive ties to geographic location, time, and punk music observed throughout the study – specifically in New York, Los Angeles, and London in the early 1970s.

When examining the census data, it became apparent that young, Caucasian, moderately educated, lower-middle class populations have a strong association to the epicenters of punk music. Considering the observed sociodemographics, punk musicians would hardly have a leg to stand on if pressed to justify the level of angst and aggression expressed through their music and aesthetics. While living in and around 1970 New York City and Los Angeles County may come with its own set of difficulties, the fact remains that the overwhelming majority of the people who listened to and played punk music were not poverty-stricken, or part of an oppressed group of underrepresented individuals. This speaks to the inauthenticity of many punk ideologies, but it also sheds light on the fact that punk music draws in youthful participants, who (for their own individual reasons) seek to be part of something loud, aggressive, and rebellious.

5.2. Limitations

The following subsections outline the limitations observed throughout the research and analysis portions of this thesis.

5.2.1 Data Limitations

A major limitation of the PunkBandPoints dataset was the lack of attributes dedicated to band members. Had fields such as SINGER, GUITAR_LEAD, GUITAR_RYTHM, BASS, and DRUMS been included, the nature of subgenres could have been further explored to acknowledge individuals who were members of different bands. Musicians who played in multiple bands across multiple subgenres (Figure 12) could possibly create a common lineage between dissimilar types of punk music. Identifying this common lineage could further connect subgenres with specific locations, with core members serving as the impetus. Given the current dataset, cluster analysis can only characterize the distribution of subgenres as a random phenomenon, with only a few that were explained in the context of both time and space.

Figure 12 Ian MacKaye singing for hardcore band Minor Threat (left) in Washington, D.C. (1980) and post hardcore band Fugazi (right) in 1987 (Washington, D.C.)
source: https://www.rebelnoise.com/interviews/ian-mackaye-2009

Another limitation of the early punk band data was the manner in which the locational data was generalized during collection. There were no specific street addresses available for every instance of a punk band forming (unlike the punk venue data), and thus there were several duplicate longitude and latitude values associated with bands forming within the same city.

Providing more granular locational data would have given a more accurate depiction of the data's distribution, as well as refined the census tract characterization. While the dataset containing early punk venues did have a sample size of more than thirty separate sites associated with where punk music was first played, it would have been advantageous to include other locations (such as influential recording studios) to further refine geographic boundaries of punk influence. This would either expand or densify the data among common locations, creating a more well-rounded and accurate dataset. Like adding band members to the PunkBandPoints data, attributing this layer with FOUNDER, OWNER, and OPERATOR fields would tie individuals within heavily distributed punk areas (Figure 13) to bands playing various subgenres during specific timeframes.

Figure 13 Fat Mike – founder of Fat Wreck Chords and lead singer/bassist of NOFX (1990).

source: https://diffuser.fm/nofx-fat-mike-interview-2015/

The only real limitation attributed to the census data from 1970 was the way several races and ethnicities were grouped into broad categories. Even after aggregating the data for ease of manipulation and analysis, the categories represented very few ethnic groups (as opposed to the number of groups that are represented in modern census data). While the annual income data represented the distribution of wealth in both New York City and Los Angeles County, the cost of living during the 1970s was vastly less than it is today. When looking to income data as a strong explanatory variable, much was lost contextually due to how little annual income values from the past align with those from the present. A possible fix for this would be to include a table that equates economic classes proportionately to what is earned today.

5.2.2 Analysis Limitations

The only limitations observed from the spatial autocorrelation analysis of the point vector data were the limitations of the datasets themselves. Although the tool (by default) assumes a random distribution, the null hypothesis proposed throughout the study assumed that every aspect of the data would be clustered due to the nature of the phenomenon being observed. Punk subgenres were randomly distributed within the context of time and space, but if the dataset included band members, then this could have been analyzed to find clusters of duplicate values. As it currently stands, the analysis only states that geographic location does not play a large role in the type of punk music being played. Had members been a variable, then this could possibly have been an explanation for similar subgenres occurring at random locations (member relocation).

The geographic cluster analysis of the early punk band and venue data was likely limited due to how clusters were defined. Three punk bands forming within one mile of each other appeared to be the most conservative representation of a cluster, but reducing the number (or

increasing the distance value) may have created clusters not acknowledged in the first analysis. This was the nature of the cluster analysis conducted for this thesis, insofar as one must choose the parameters for each cluster, making them inherently subjective. While New York City, Los Angeles County, and London appeared as obvious clusters (even from rudimentary tabular examination), other locations could have been realized as possible subgenre epicenters or areas where punk was becoming popular depending on the dates observed.

5.3. Future Work

Moving forward, this research can be expanded by examining similar genres of music, defining the genealogy of punk music from its inception, and using predictive modeling to include punk music (and related census demographics) across the United States. Punk music is aggressive, with lyrical subject matter that is counter to mainstream social ideals, both aesthetically and ideologically. Finding other genres with similar qualities can lead to a better understanding of how genres are related, and to what degree they differ based on the region in which they form and develop. For example, metal and reggae music are tied to punk music through both band member lineage (i.e. Glenn Danzig in The Misfits vs Glenn Danzig in Samhain or Danzig [horror punk vs heavy metal]) and musical composition. A novel approach would be to include locational values as explanatory variables in regression analysis.

Including the genealogy of punk music in future work would create new data for analysis in GIS. Bands that come from or are directly influenced by specific bands of similar subgenres create a traceable directory of punk instances that can be visualized and examined geographically (Figure 14). While not addressed in this study, punk music does have circuitous ties to reggae music, including how comparable it sounds to ska punk, as well as its rebellious subject matter. Both punk and reggae bands play music as a form of social sedition. Thus, the analysis of the

people and environment must demonstrate similar circumstances, if not similar or proportionate sociodemographics. Metal music was also created from the same angst and aggression that drove the ideology of oi punk – essentially disgruntled lower-middle class workers who question the system through which they must negotiate to survive. The ties to both reggae and metal music could further the understanding of how music genres themselves form within the context of similar genres.

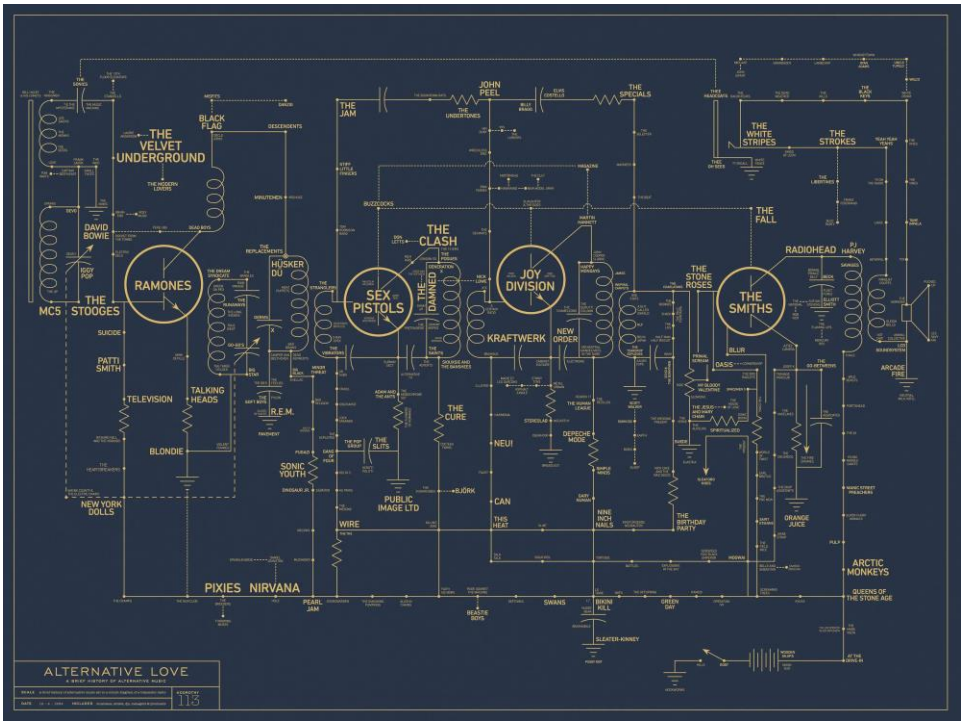

Figure 14 Example of punk music lineage analysis.
source: https://www.wired.com/2016/10/lets-obsess-intricate-map-alt-music-history/

Another way this work can be expanded upon would be to introduce predictive modeling and apply it to all census tracts within the US. If the spatial and sociodemographic analysis of punk music can serve as a piece of the puzzle that defines the nature of music formation overall, then employing predictive analysis to define punk-type locations outside of the study area would create training data that can be compared to other music genres, regardless of where they are

formed. Comparing the sociodemographic variables associated with specific music genres would then lead to a better understanding of how localized culture and economic conditions drive the type of music that can originate at a given location.

In conclusion, the beginning of punk music is geographically tied to New York City, New York, Los Angeles County, California, and London, UK. In terms of being a spatial phenomenon, both bands and locations where live music is played can be defined as clusters that exist in all three locations. Along with spatial clustering, temporal clustering can be observed across all subgenres that tie the beginning of punk music to the early-to-mid 1970s. The only real anomaly uncovered in this research is the fact that bands that played similar types of punk music did not create spatial *or* temporal clusters. The results from this study acknowledge that punk music is both a spatiotemporal and micro-cultural phenomenon, while also characterizing the genre for further musical research as a whole.

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