THE NETWORK INFLUENCES OF INNOVATION AND LIFETIME CAREER SUCCESS IN JAZZ MUSICIANS BETWEEN 1945 AND 1958

A Dissertation

by

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Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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May 2015

Major Subject: Sociology

ABSTRACT

In this project I explore how career success and historical importance is an outcome of social network characteristics. Specifically, I look at jazz collaboration networks at the height of small-group jazz popularity (1945-1958) to determine if one's structural location within the larger network influences career success. Using a network dataset collected from the Tom Lord Discography I use social network analysis techniques and longitudinal logistic regression to examine a statistical relationship between network characteristics and success. I test several existing hypotheses in network literature, e.g., centrality, brokerage, and closure, as well as newer assertions that are gaining widespread use.

Because jazz is based on improvisation there are incentives to creating a well-functioning closed group that remains cohesive so that musicians can become familiar with and attuned to one another's musical styles. However, while this logic is sound the results of this project do not follow the closure tradition and are instead consistent with the sparse networks or brokerage hypotheses. Empirically, individuals within jazz networks who form a closed group are less likely to have a successful career. More broadly, significant conclusions of this project suggest that individuals within a rapidly changing network of innovators should maintain open networks with connections to diverse areas of the larger network.

For Sierra and Macie. With much love.

ACKNOWLEDGEMENTS

I would like to thank my committee chairs, Dr. Hiroshi Ono and Dr. Alex McIntosh, and my committee members, Dr. Joseph Jewell, and Dr. Jane Sell, for their guidance and support throughout the course of this research. Particularly, thanks to Dr. McIntosh for casually mentioning, in my first semester of graduate school, how a project on jazz networks might be very interesting. And thanks to Dr. Ono who pushed me in the right directions when needed and gave continual support on this project, even when at times it seemed doomed to failure. I am forever grateful for the support for, and promotion of, intellectual creativity and freedom from my committee. Their support has meant the world to me.

Several professors and colleagues were instrumental in the beginning stages of this project. I also thank all of them, wherever they may be. I also thank the musicians and musicians' families in this study who dedicated their lives to the creation of such a pure art form.

Thanks to my mom for all the proofreading and support over the years. And finally, to my wife for her patience, love, and understanding of the late nights collecting data, and working on the countless projects and assignments over the past six years. It goes without saying that without her this would not have been possible.

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

CHAPTER I

INTRODUCTION

Interest in social network analysis has grown considerably in recent years. The attention has reached each discipline in the social sciences as well as fields such as computer science, physics, biology, and epidemiology. While there is growing consensus that networks and network location matters, network concepts in these fields are applied a variety of ways. Furthermore, as networks are often significantly heterogeneous it is erroneous to apply the same concepts in similar fashions. For example, epidemiologists study the presence of network holes to understand the spread and flow of diseases while management scholars use them to gain advantage over other actors in the network. As a result, there is ambiguity surrounding the empirical implementation of network theories and the benefits that emerge from varying network structures. Specifically, the generally accepted theoretical logic that underlies measures in network theory, namely brokerage or sparsely connected networks and closure or densely connected networks, has been erroneously accepted to offer a similar benefit in dissimilar networks. Since networks differ qualitatively, network measures will have differing outcomes based on network qualities. Furthermore, despite evidence contrary to the benefits of structural holes and closure, they maintain a status of wide spread benefit within the discipline. There is tension, however, in the theoretical logic of these two popular measures. This tension must be resolved or clarified depending on the quality of network.

I examine a particular kind of social network to see how the concepts of network theory apply to the collaboration network of jazz musicians. The jazz network is theoretically interesting for a number of reasons, all of which are described in more detail below. First, jazz is nearly always recorded in a group setting, yet the individual has been the primary interest to critics and historians. Throughout the course of jazz there have been very few cohesive jazz groups that resemble a modern-day concept of a band. Second, since there were few bands, the network structure is very fluid. It was common for groups to record only a couple of records together before searching for a new outlet. Third, jazz is an improvisational art form. Improvisation, or the spontaneous creation of music, is central to small group jazz. The spontaneity of the music theoretically creates an incentive to identify a group of musicians who fit well together and remain as a cohesive group. Yet, this was uncommon. Finally, the rapidly changing structure in the jazz network is comparable to other fluid networks making the findings generalizable to other industries and networks.

In this project I apply existing theoretical measures, i.e., brokerage, closure, intercohesion, and centrality, from economic sociology and network theory to a longitudinal network of jazz musicians. For numerous reasons, the jazz network offers a unique perspective in understanding these competing measures. First, jazz was recorded in a live group setting, meaning all parts were recorded simultaneously. Group cohesion, then, takes on an important role in facilitating the creation of jazz music. This empirical fact speaks to the importance of closure in the network. Second, there have been very few closed groups or bands over the history of jazz. The nature of the jazz

market has been very fluid and transient, historically. In numerous cases, musicians recorded one album together and moved on, never to record together again. Therefore, brokerage is also of significant importance to the individual musician as they were concerned with their strategic approach to recording jazz. Additionally, the individual has been given importance over the group yet the music was predominantly recorded simultaneously[1] in a group setting. Finally, the network, although culturally important is also a labor market. The individuals involved were musicians by profession. By examining a unique sample of jazz innovators I expand the applicability of existing network measures and hypotheses as well as offer an additional example of examining cultural labor markets.

In the social sciences, brokerage and closure, explained in greater detail below, suggest that an actor that occupies a specific location within a network can expect to gain some benefit from its exposure to a larger network (Burt 1992, Coleman 1990). Both concepts rest on an interpretation of social capital which suggests that the structure of the relationship matters and that productive benefits are embedded in the relationship between two social actors. These benefits are contingent on the presence of the relationship, meaning that if the relationship were severed the actors could no longer expect to have the same access to the benefit.

[1] By simultaneously, I mean that all parts were recorded at the same time. This is not common in current music recording where each part (guitar, bass, drums, vocals, etc…) are often recorded individually and later mixed together by a recording engineer or sound technician.

According to one network theory, densely connected networks with many connections between ego's alters creates a closed network based on strong relationships, trust, and wide bandwidth for flows of information (Coleman 1988a). The alternate view, however, suggests that structural benefits originate in loosely connected networks. Actors that build relationships with otherwise disconnected alters may use their locational advantage to control information flows and obtain advantage over others (Burt 1992). These differences have dissimilar, even contradictory, normative implications and yet are presented by offering similar benefits to network actors (Walker et al. 1997).

Recently, network theorists have sought to merge the two theories mentioned above. They suggest that neither brokerage, as defined by the structural hole literature, nor closure is the optimal structure (Vedres and Stark 2010). Instead, actors who connect two or more closed groups experience the empirical benefits of both theoretical approaches. This network location, known as intercohesion, allows the bridging actor the opportunity to gain advantage through information controls while maintaining strong ties based on trust and security. Finally, several of these mentioned measures use and refer to more classical network measures as starting points. Centrality, or how central an actor is in the network, has long been considered as a prominent influence in securing benefits from a network although recently has been given a lesser role in identifying benefits to network actors. Clarifying the implications of these network theories and structures is important to our understanding of how one's network influences the likelihood of innovation.

I use a case study of innovative hard bop musicians to identify the importance and trajectory of network characteristics and measures. Music forms evolved dramatically over the course of the 1900s. In the early 1900s classical music was the prominent and popular form of music in society. However, jazz, primarily swing and dance bands, became a central musical by the 1920s. After World War II swing and dance band jazz music evolved into a form known as bebop. The evolution from big swing bands to the smaller bebop bands had important influences on modern day jazz. Although bebop is considerably important to jazz history and modern jazz music, it was not well received among the general public which decreased its longevity in the mainstream jazz scene. By the late 1940s a slower and more melodic form of jazz emerged which became known simply as *cool.* In the mid-1950s jazz musicians began experimenting with a mix of slower tempos and less constrained rhythms and melodies, particularly in the bass, piano and drums, and yet incorporated aspects of the bebop style. As a result, a synthesis of styles, which later became known as hard bop, emerged and became a popular form of small group jazz for years to come (Rosenthal 1988).

According to innovation research, innovation occurs over time and rarely, if ever, are innovations genuinely new. More likely, an innovation is a newer version of an existing product or idea, or a recombination of existing ideas (Schumpeter 1934). Under this assumption, hard bop musicians were likely participants (either actively or passively) during the bebop years (1945-1949). However these musicians were likely located in structural positions within the network that provided them with the freedom to take innovative risks. I analyze fourteen years of jazz network data (1949-1958) to

analyze the importance of structural network characteristics on innovative and historically important hard bop musicians. I use network analysis software to analyze several network measures in order to determine if the network structure is an influencing factor in their success and historical importance. There are multiple existing hypotheses of innovation, described below, that I apply to this unique network with hopes of adding to the empirical evidence of network theory.

The structure of this dissertation is as follows. Beginning in chapter II, I outline the historical setting and environment in which the networks were embedded. Next, I describe the theoretical origins and foundations of the network concepts used. In chapter IV I describe the mathematical basis and computation of the network measures used to analyze the network theory and hypotheses. I then interpret the results of the statistical analysis and I end with some additional remarks on the interpretation and my future plans in this area of research.

CHAPTER II

THE SOCIAL NATURE AND HISTORY OF JAZZ

> "Almost from the start, jazz players embraced a different mandate, accepting their role as entertainers and pursuing experimentation with an ardent zeal. This created a paradoxical foundation for jazz, one that remains to this day: for the jazz musician soon proved to be a restless soul, at one moment fostering the tradition, at another shattering it, mindless of the pieces" (Gioia 1997: 200).

The history of jazz music is complicated, ambiguous, and made up of as much legend as fact. There are several reasons for this, all of which merit extended discussions that are outside of the purposes of this dissertation. It is sufficient to say that jazz is a unique style of music created in the United States in the late 1800's (Ward and Burns 2000). While there have always been white jazz musicians and while several musical styles contributed to the initial characteristics of jazz, its primary influence is undoubtedly African (Schuller 1968, Shipton 2001). Jazz is thought to be created by slaves that worked on the plantations in Florida but became popularized and organized in Congo Square, New Orleans. Because of its African American origins, the question of race has been bound up in it from the start.

Jazz has only been truly popular for brief moments in its history. From its inception it has always been associated with the unpleasant and unsightly realities of society. As Shipton (2001: 1) suggests,

> "…when the word [jazz] came to be applied to define the "Roaring Twenties" as the "Jazz Age" it stood for decadence, late nights, illegal booze, licentious dancing, and a host of dubious pleasures indulged in by societies the world over who were recovering from the trauma of the Great War."

Additionally, consider introduction to the poem *Howl* by Allen Ginsberg,

> "I saw the best minds of my generation destroyed by madness, starving hysterical naked, dragging themselves through the negro streets at dawn looking for an angry fix, angelheaded hipsters burning for the ancient heavenly connection to the starry dynamo in the machinery of night, who poverty and tatters and hollow-eyed and high sat up smoking in the supernatural darkness of cold-water flats floating across the tops of cities contemplating jazz."

Jazz never completely shed its disreputable image. Drug addiction plagued jazz musicians for the better part of the 1900's. During the bebop era the number of musicians that used some narcotic or marijuana far outnumbered those that didn't (Winick 1959). During the late 1940's it was a major news story when a prominent jazz musician announced they were no longer taking drugs (Tolson and Cuyjet 2007). After Billie Holiday first tried heroin she said that finally she felt part of "the group" (Ward

and Burns 2000). Charlie Parker, whose masterful playing completely changed the course of jazz, died at age 34 and the coroner mistakenly estimated his age at 60. His heroin addiction was legendary, as explained below. Red Rodney called heroin use a badge of distinction, "It was the thing that made us different from the rest of the world" (Schneider 2008: 24). Unfortunately, the number of jazz musicians who died young due to complications from drug or alcohol abuse is abnormally high (Tolson and Cuyjet 2007).

Jazz is did not evolve in a linear fashion. One may ask, "how did swing lead to bebop?" or "how did cool jazz lead to hard bop?" only to find that there may be no satisfactory answer to these types of questions. Jazz is a progressive music that never settled into a predictable form. At the point when musicians felt the music forming an artistic rut they would create a new style to keep the music fresh. Notable jazz artists were experimentalists, innovators, and had a distaste for conformity (Gioia 1997). These individuals propelled jazz from one style to another throughout the 1900's.

Jazz increased in popularity between 1910 and 1915. Its first mention in print came in the San Francisco *Bulletin* in 1913 where it was described as a dance music full of pep and vigor. Swing bands, or big bands, garnered much notoriety and popularity during the 1920's and 1930's as several notable artists, i.e., Duke Ellington, Cab Callaway, Glenn Miller, Benny Goodman, etc…, and their bands toured across the US. By the 1960's, however, jazz popularity had decreased dramatically and continuously and there is little indication of change in the future.

Why Jazz?

If jazz is not currently a popular art form, why is it important to analyze its historical network? This point is valid and merits some discussion. The primary reasons to analyze the jazz network is because of its fluid[2] nature, and the importance and focus given to the individual within the group. Unlike the current structure of groups in popular music, there were very few rigidly defined groups in the jazz scene in the mid-1900s. To illustrate the contrary, at the peak of their career Robert Plant (singer in Led Zeppelin) asked Peter Grant (Led Zeppelin's manager) if he would support Plant on a solo album. The exchange is as follows (as recounted inWelch 2003).

> "Would you support me if I wanted to do a solo album?"
> "Of course. Who would you imagine would play guitar?"
> "Ummm," answered Plant, "I suppose I'd have to have Jimmy (Page)."
> "What about bass?"
> "Well, again," answered Plant, "It would have to be Jonesy (Led Zeppelin's John Paul Jones)."
> "And drums?"
> "Gotta be Bonzo (Led Zeppelin drummer John Bonham), I guess."
> "Why do you want to do a solo album Robert?"

The conversation suggests that when Plant became interested in recording a solo album there was no question who would play on the record. Similarly, when Bonham died in 1980, the remaining members saw no value in continuing with another drummer. Led Zeppelin without John Bonham was not Led Zeppelin. It can also easily be argued that The Beatles without Lennon or McCartney would not have been The Beatles.

[2] See Figure 1 in Appendix A

This structural rigidity was extremely uncommon if not non-existent in the Jazz scene. Musicians were continuously playing and recording with new musicians. There seemed to be a continual revolving door between the numerous small groups that were recording at the time. The work for the jazz musician was, and largely continues to be, not connected to a formal employer, thus it was necessary for musicians to make as many connections as possible (Dowd and Pinheiro 2013). The numerous connections increased one's likelihood of being called to play a gig or record and create some form of career stability. Indeed, there are very few moments in jazz history that the modern-day conception of a band existed.

The fluid network created a successful foundation in small group jazz because it is an improvisational art (Berliner 1994). Often musicians who had never played together could create great music because they were able to mutually improvise, or spontaneously create music. The spontaneous creation of music requires some group connection element although newness of the groups or a fresh lineup also promoted innovative improvisation. "You have to listen to other people very closely. If you're not doing that, you're not playing jazz" (Berliner 1994: 7).

There have been several metaphors describing the interaction that goes on between jazz musicians, primarily referring to small groups. Perhaps the most descriptive is that jazz is a musical language, improvisation is a conversation, and good improvisation is talking, or "saying something" (Monson 1996). The impulsiveness of the music required the members of the group to be musically attuned and in sync with one another, but in a way that was deeper than the beats, chords, and melodies. In a real

sense, improvisation requires musicians to communicate with each other through the notes they play, essentially having a musical conversation (Berliner 1994). Over time, the musicians develop a shared focus and become emotionally entrained (Collins 2005) with other individuals in the group so to facilitate the spontaneous musical exchange and increase group solidarity (Lee 2009).

Yet there is a discrepancy with the cohesion of small jazz groups and sociological group processes. As with any social interaction there may be a deeper connection between certain groups or pairs actors over other groups or pairs. People may commit to another person or group because they get an "emotional buzz" or "uplift" from the interaction or transaction (Lawler, Thye and Yoon 2009). The emotional connection creates a cohesiveness among the individuals in the groups, or between the individual and the organization, particularly if the success of the task cannot be easily separated from the individuals within the group. Thus the individual feels an attachment to the lasting group cohesiveness.

The jazz industry, however, was made up of very few organized groups that remained cohesive for any lengthy period of time as might be expected. As mentioned above, the jazz network was very fluid. It is as if the structure of the small group network mirrored the uncertain and improvisational nature of the music. One explanation to this phenomenon is that jazz musicians were rarely formally trained. Their lack of formal education meant the training and acquisition of skills came mainly from experience or on-the-job training (Mincer 1962). It is likely that musicians' human capital, or skills, increased with their social capital.

About the collaboration among jazz musicians, famous small-group jazz bassist Milt Hinton said, "I was pretty young when I realized that music involved more than playing an instrument; it's really about cohesiveness and sharing" (Hinton and Berger 1991). Throughout jazz history, though, the individual has been given importance over the group even though the two were fundamentally connected. Indeed, the progression of jazz is suggested to be highlighted by following a select number of musicians, i.e., Charlie Parker, Miles Davis, John Coltrane, Art Blakey, to name a few. Additionally, when a group was categorized to be innovative, it was commonly a result of them following an innovative leader. For example, the Dizzy Gillespie Big Band attempted to create bebop, a small group musical style, in a big band setting. And while the members could each be considered as innovative in their efforts, Dizzy was considered the innovator as the leader of the bebop big band. The other members simply followed the directions of the sole innovator.

Although jazz requires a group, the individual within the group is considered to be the innovative or inspirational component and is thus the primary focus. Almost perfectly consistent, historians have attributed innovation and creative characteristics to the individual over the group. Thus the individuals were the seminal figures that made revolutionary and permanent changes to the art form (Sales 1992). Therefore, the jazz community offers unique insight to a constantly changing network where the individual within a group is of primary focus, yet the group is essential to the artistic creation.

The jazz history literature is full of adjectives such as inventive, innovative, fresh, new, brilliant, etc… Yet it is currently uncommon to refer to arts as innovative.

Currently, when innovation is discussed it is often in reference to some technological breakthrough, a significant upgrade to an already existing device, or medicines for infectious diseases. While innovation and technology are often used synonymously, innovation and innovators exist across all genres, disciplines, and professions but rarely are non-technological advances considered as innovation to the lay public (Powell and Grodal 2005). Rogers (2003: 12) suggests that "an innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption." This suggests that it is not uncommon that innovation exists outside of the technological realm even though it may not be recognized as such.

There are three eras that have been of primary importance to the evolution of and innovation in small group jazz: bebop, cool, and hard bop. Jazz historians have bracketed the years that each style was most popular. However, it is erroneous to suggest that bebop was only played between 1945 and 1949, cool jazz between 1950 and 1953, and hard bop between 1954 and 1958. Indeed, all three genres are likely being played every Friday and Saturday night in jazz clubs across the US. Since the stylistic differences between each pair of genres are noticeable, there are three unique epochs of study. Additionally, as outlined below, the differences in the jazz environment during each style are significant.

One of the great challenges in writing on music is capturing and representing the emotion and experience of the musician in a way that those who have never done so can understand (Berliner 1994, Monson 1996). Charles Seeger (1977) referred to this as the linguocentric predicament; which suggests that no matter how eloquent the author, there

is something fundamentally untranslatable about the musical experience. Essentially, the author must explain the musical process without relying on the music to do so. To illustrate, in order to identify good jazz a musician may say the group is playing in the "groove" (Berliner 1994, Monson 1996). *Groove* may mean nothing to the non-musician and describing what the groove without simply stating, "the groove is… the groove" is quite challenging. A similar experience may arise when describing any of the emotion sensations felt by the musician while playing.

The spontaneity of jazz creation suggests that the music not only reflect the individual's personality and skill, but also is a response to their environment. Indeed, as explained below, musicians often incorporated the shared social factors of drug abuse, racism, rejection or rebellion into the ever changing repertoire of music and their performances (Tolson and Cuyjet 2007). Thus in order to describe the sociological characteristic of bebop, cool jazz, and hard bop I use Warren Waren's FAMIL[3] typology (Fans, Artists, Music, Industry, and Literature). The industry-specific FAMIL typology fits within Griswold's (1987)[4] methodology for understanding the sociology of culture. However, as this project is not a historical project, per se, I focus primarily on fans, artists, music, and only portions of industry.

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[3] Currently, Dr. Waren's typology is unpublished. However, it offers a unique and sociologically centered method to examine the jazz scene historically.

[4] In her article, Griswold (1987: 1) suggests that in order for cultural studies to be complete and persuasive they must adhere to four main components: "(1) the *intentions* of creative agents, (2) the *reception* of cultural objects over time and space, (3) the *comprehension* of cultural objects in terms of intrinsic and heuristic genres, and (4) the *explanation* of the characteristics of objects with reference to the social and cultural experiences of social groups and categories" (italics added).

Bebop: 1945-1949

From its earliest days, jazz was a forward-looking and progressive art form; "continually incorporating new techniques, more expansive harmonies, more complex rhythms, more intricate melodies" (Gioia 1997: 199). There were several groundbreaking and innovative musical techniques that emerged and evolved in the bebop era (approximately 1945-1949). For example, the tempo of swing music was primarily oriented around the dancers in the crowd. Bebop, however, is characterized by very fast tempos that demanded precise musical technique not characteristic of swing music. The smaller group structure coupled with the speed of bebop tempos required musicians to be some of the most musically and technically talented individuals up to that point as well as be willing to take improvisational risks in the new art form (Ward and Burns 2000).

Bebop has had a lasting influence on jazz music. As swing music was sweeping the nation, swing musicians rebelled against the popular musical constraints they had created for themselves. As mentioned below, the musicians were creatively and artistically limited by the routineness of swing. Thus, bebop began in the backrooms and backstages of dance band concerts as a means for the musicians to express themselves in a way that was not accepted in the dance band scene.

One of the most prominent and clear differences between the swing and bebop genres was the size of the group. Swing bands were typically comprised of up to 35 people. Musicians were part of a section in which 4 or more individuals played the same instrument. The bebop group, however, is comprised of between five and seven players.

The small-group nature of the structure carries some important social implications, namely section size, interaction, and venue.

A musician in the small group was often the only person playing their instrument[5] thus the instrument sections (i.e., trumpet, trombone and saxophone) in big bands were irrelevant. The aloneness of each instrumentalist increased the risk experienced in the small groups as there was nowhere to hide (musically) if they made a mistake.

The amount and quality of the group interaction also increased. As improvisation became the norm in the small group it became vital that the members interact musically. Naturally, interaction in big bands existed which musicians would interact with each other and with the crowd. For example, Dizzy Gillespie was well known for interacting with the crowd while he played in the Cab Callaway big band (Ward and Burns 2000). However, the interaction within the smaller group was much more intimate and essential than in the large group. A growing number of young modernist jazz musicians felt that swing was in a rut with an abundance of clichéd riffs and predictable solos (Bogdanov, Woodstra and Erlewine 2002). As a response to the monotony of swing music, the central role of improvisation in the small group made it rare that soloists would play the same solo twice.

[5] There were occasions when two trumpet players (for example) would play on the same record in a competitive manner. The competition, or battles, contributed to individuals striving to become better players. Although, these occurrences happened often in live setting like a jazz club and not on records. It was rather rare to have two musicians that played the same instrument at the same time on a record.

Bebop struggled to gain commercial acceptance and although its importance to jazz as an art form is unquestionable, the downfall of popular jazz began with the rise of bebop. From its inception, bebop musicians sought to create music that was exclusionary to musicians that weren't talented enough to play. The fast tempos and new forms of improvisation, largely a product of Charlie Parker's musical innovations, practically required virtuoso musicians. Due to the fast tempos, swing dancers could not dance to bebop and dancing was actually discouraged at bebop concerts (Bogdanov, Woodstra and Erlewine 2002). Dancers eventually migrated to vocal jazz as their chosen medium and instrumental jazz was pushed further into the background. As a result, and possibly contributing to the lack of dancing, the jazz venue changed from a large hall to the small club scene. This change had significant impact on the erosion of the image of jazz to the public. Respected beboppers wanted to "free jazz" from what they considered to be the "tyranny of popular taste," but the common jazz listeners described the music as frantic, nervous and chaotic (Burns 2004) and difficult to listen to.

It was not simply the tempo, required musical technique, and decline in poplar instrumental jazz that differentiated bebop from swing and isolated its musicians from the crowds. Narcotics, particularly heroin, plagued the jazz environment and became associated primarily with the bebop scene and its musicians. "Even the word *bebop* became an embarrassment, linked as it was to social eccentricity and drug abuse and the planned obsolescence of fashion" (DeVeaux 1997: 167). Charlie Parker, the center of the bebop movement, first used heroin as a teenager and he continued to use it until his

death in 1955, with brief moment of sobriety. Even though his addiction caused him to miss gigs and concerts, lose work, sell or trade his saxophone for heroin, Parker successfully changed the direction of jazz. Miles Davis once said "you can tell the history of jazz in four words: Louis Armstrong, Charlie Parker" (Washington and Griffin 2008: 237). Parker was so influential in the bebop movement that younger musicians not only tried to emulate his playing, but also sought to emulate his addiction. They thought that if they shared his addiction, they could somehow share his genius too (Burns 2004, Schneider 2008) or that there was some correlation between success in jazz and drug abuse (Tolson and Cuyjet 2007, Winick 1959).

Eventually, several young bebop musicians realized that the addict lifestyle was unsustainable and sought to distance themselves from Parker (Gioia 1997, Ward and Burns 2000). Even Dizzy Gillespie, who once said Parker was the other half of his heartbeat, left California after a series of concerts without him due to his erratic behavior. John Lewis, pianist in The Modern Jazz Quartet, loved Parker's music, but loathed the environment he and bebop created. A subculture between Times Square and the jazz clubs on West 52nd street in Manhattan mixed bebop with hustlers, drug dealers, prostitutes, bohemians, and fans that all valorized heroin as part of their rejection of square America (Schneider 2008). The social and geographic environment that surrounded bebop and the social capital or group in-ness that came from heroin use made the drug very appealing to musicians, primarily younger ones. Additionally, several musicians claimed that the electrifying effect of heroin assisted with the fast creativity bebop required. Indeed, some stated that bebop can't be understood, written,

created or played unless high on heroin (Schneider 2008). The bebop cult following saw Parker as the apostle of hipness and fellow musicians understood that in order to distance themselves from his stigma they would have to distanced themselves from bebop as well. In 1949, *Vanity Fair* ran an article titled "Bop is a Flop – Commercially" and in 1950 the Dizzy Gillespie bebop big band quit touring and disbanded. The bebop era had ended.

Cool: 1950-1953

As with the relationship between bebop and swing, there are a number of similarities and differences between cool jazz (hereafter cool) and bebop. The venues of performances remained predominantly unchanged as cool followed with the small group structure. Bebop is typically described by adjectives like hot, fast, frantic, complicated, complex, wild, reckless, on the front of the beat, driving, etc… Cool, on the other hand, is described as practically the opposite: laid back, relaxed, on the back of the beat, romantic, light, lyrical, etc… Jazz historian Ted Gioia suggested that all artistry tends to be cool or hot (Gioia 2000), bebop and cool epitomize these artistic temperatures as cool was the antithesis of bebop (Shipton 2001).

The roots of cool are not as unique and novel as its predecessor, bebop. The softer and smoother tones were traced back to Bix Beiderbecke, Lester Young, Lennie Tristano, and Frankie Trumbauer of the New Orleans jazz and the swing era (Gioia 1997) and the role of the melody in cool songs stemmed from classical music composers as much as early jazz composers (Shipton 2001). Improvisation maintained a central

role in cool, but the improvisation was driven by the melody and not the chord as it was in bebop. Additionally, the transition between the composed and the improvised is much less identifiable (Shipton 2001). The result was that cool was much easier to listen to and understand, which streamlined its introduction to a much broader population. As Miles Davis said "Bird (Parker) and Diz (Gillespie) were great, but if you weren't a fast listener you couldn't catch the humor or feeling of their music. Their music wasn't sweet and it didn't have harmonic lines that you could easily hum with your girlfriend trying to get over with a kiss" (Ward and Burns 2000: 372).

Arguably, Miles Davis was to cool what Parker was to bebop. After Miles Davis left Charlie Parker's quintet in 1948 he began experimenting with softer and more melody driven tunes in the middle range of the trumpet. He began working with Canadian pianist and arranger Gil Evans on arrangements for an unconventional nine piece group. These, and other Miles' recordings would capture the essence of cool jazz. The arrangements and performances, eventually released as *The Birth of the Cool*, acted as a model to be replicated throughout the cool years (Gioia 2000).

Post-bebop lead musicians, mainly trumpeters and saxophonists, were confronted with two choices of the style they could play. They could either replicate what Parker and Gillespie had done previously, essentially becoming a copycat with varying degrees of effectiveness, or they could create new lines, melodies, and style all together. Two of the more famous cool alto saxophonists, Lee Konitz and Paul Desmond, avoided Parker's music entirely so to not fall into the trap of repeating what he had already done. Instead of playing as many notes as articulately as possible, Desmond played very few

notes, but made sure they were the right notes. “Paul was picking these notes with great combination of intellect and concern for the purity of his sound and he wasn’t out to dazzle anyone” (Shipton 2001: 702). Similarly, Konitz sought to create a completely smooth tone free of vibrato that was easy to listen to and understand. These two styles proved very successful, particularly among college age listeners. Desmond’s work with the Dave Brubeck quartet highlights the essence of cool and *Time Out* was the first jazz album to sell over a million records.

The racial makeup of the cool jazz era reintroduced racial conflict within the jazz group (Singer and Mirhej 2006). *The All Music Guide to Jazz (2002)* suggests that 82% of significant cool musicians were white while only 20% of significant bebop musicians were white. Of the topic, Lee Konitz stated “It’s a pain in the neck. I’ve been apologizing in some way for not being black all my life. Like am I bluesy enough to be authentic” (Zwerin 1998). Miles Davis also received significant amounts of criticism from black musicians within his nonet when he hired white musicians to play on *The Birth of the Cool* (Davis 1989). Up to this point, jazz musicians shared a similar connection to each other and the environment through the music. Indeed, since the 1920’s the importance of race in jazz had been declining, particularly among musicians in small groups. With the emergence and prominence of white musicians in the cool era, however, race resurfaced as an important point of conflict within the musical environment. Some historians suggest that cool is the departure point of “white jazz” and “black jazz”.

Perhaps one of Art Pepper's experiences best characterizes the tension between white and black musicians during this time period. As recounted in Pepper's autobiography (Pepper and Pepper 1999), some of Pepper's friends overheard two black musicians who played in Pepper's band making fun of him. When Pepper confronted one of the musicians, he was told, "Oh fuck you! You know what I think of you, you white motherfucker?" He then spat in the dirt, stepped in it and said, "You can't play. None of you white punks can play!" (Pepper and Pepper 1999: 114). It is possible that black musicians saw the popularity of white jazz artists as an overtaking of the space where blacks could avoid the stereotypical racism of the 1950s (Winick 1959).

The drug abuse in the cool era differs qualitatively from the bebop era as well. As mentioned above, heroin and bebop went hand in hand in the sense that musicians believed they played better because of it. Several prominent cool musicians turned to drugs as a means to cope with their complicated personal issues, unemployment as well as dealing with the jazz environment. For example, as jazz popularity increased musicians began travelling for "one nighter" shows. The group would travel long hours and be expected to go out on stage immediately on arrival. Audiences began noticing that the musicians always looked warn out, tired, and unkempt. One responded in Winick's (1959: 246) study of jazz drug use stated, "…We'd get up on the bandstand looking awful. The audience would say 'Why don't they smile? They look like they can't smile.' I found I could pep myself up more quickly with heroin…" Many black musicians began using as a means to cope in a racist environment. After a trip to France and Japan in 1949 Miles Davis, who uncharacteristically avoided heroin in the bebop era

despite being closely associated with Parker, began using heroin as a means to cope with depression. Overseas Miles was treated like a human being, like someone important (Davis 1989), back in the US he experienced a very different reality. While drug abuse was still common in the cool era, it was used as an escape instead of a means to play bebop.

Cool never declined to the extent that bebop did. Many of the great cool albums were recorded into the late 1950's and 1960's. Yet by the mid 1950's another new style was emerging that efficiently synthesized bebop and cool. Hard bop, as it was later termed has possibly had the most lasting influence in modern jazz.

Hard Bop: 1954-1958

Hard bop emerged as a subgenre of bebop yet maintained many characteristics of the cool scene (Shipton 2001). For example, the tempos of hard bop were often very fast (influenced from bebop), but they maintained a melody-driven orientation (influenced from cool) which was based more on R&B and bluesy tonalities (Bogdanov, Woodstra and Erlewine 2002). The return to the blues made hard bop rhythmically complex, but melodically simple (Seymour 2000, Shipton 2001). Particularly unique to hard bop was that the rhythm section (piano, bass and drums) become much more involved musically than in previous genres. Whereas prior to hard bop, the drums kept time, the bass outlined the chord progression and the piano was a comping instrument, hard bop allowed for more individual experimentation within the music. Thus, hard bop maintained the improvisation-based structure that allowed for artistic creativity, but

incorporated an importance of melodic simplicity. The result was a jazz style that was easy to listen to which made them more accessible to the pop audiences (Seymour 2000). Rosenthal (1992) suggests that hard bop reconnected jazz to its African roots thus it became extremely popular in predominantly black communities, while many of the white jazz listeners turned to vocal jazz. There are a number of important hard bop musicians who contributed to the evolution and popularity of the style but perhaps the most important are pianist Horace Silver, drummer Art Blakey, and trumpeter Clifford Brown.

Silver's contribution to hard bop is primarily musical. Simply, he introduced a new style to the pianists' left hand pattern. Silver's left hand "[grumbled] along playing repeated notes, alternating notes, or repeated chords. It [was] a slightly muddy but entirely original approach to how a pianist might accompany right hand bebop improvisations" (Shipton 2001: 670). Silver's "left-hand thing" allowed the pianist increased freedom to experiment with soloing or rhythmic accompaniment. Additionally, although Silver never saw himself as such, other musicians thought of him and his playing as very funky and sought to emulate it.

Art Blakey's contribution as a musician and drummer is unquestionable. However, his contribution to hard bop and jazz as a whole is much more noteworthy. In the late 1940's Blakey organized a rehearsal band called the Seventeen Messengers. Later, he shortened the name to the Jazz Messengers. The Jazz Messengers, of which Silver was an original member, maintained a revolving door for its musicians. Over the next four decades Blakey taught and worked with countless up and coming musicians.

"He had been the sacrificial hero who played and played, night after night, while those little fledglings stumbled over themselves until they began to swing with enough confidence to take off and begin their own bands" (Ward and Burns 2000: 424). The Jazz Messengers was, perhaps, hard bop's greatest proving ground; a graduate school and training academy for hard boppers (Seymour 2000). Blakey actively trained, educated, and recruited[6] musicians for the Jazz Messengers. Thus, his influence to the hard bop genre, and jazz in general, is incalculable.

Hard bop was also important to the prevalence of drug abuse in jazz as prominent and central figures publicly abstained from drug use and inspired other musicians to do the same. Arguably, hard bop musicians were the first to openly and consistently acknowledge the overwhelmingly detrimental effects drugs were taking on their musical success. Leading this new movement of narcotic-free jazz was trumpeter Clifford Brown. By the time Brown emerged onto the jazz scene he was already considered a virtuoso who's "fat sound and flawless execution were unsurpassed" (Gioia 1997: 313). Brown stood out from the typical jazz crowd as he refused to use drugs. He offered up and coming musicians a worthwhile role model both on and off the stage. Not only did Brown refuse to use drugs, he also actively inspired others to quit their debilitating habits. Brown's example practically contradicted that which Charlie Parker left behind just a few years earlier.

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[6] In the later years, the group became a popular and well-known springboard to musical success that Blakey held large auditions to fill the openings in the group.

Brown died in a car accident in 1956. He was 25 years old. His tenure as a jazz musician was short. Sonny Rollins said "He was like a shooting star. He's there, and he's gone" (Schudel 2006). Yet his inspiration as a musician and person remain considerably important in jazz history. His legacy as a clean jazz musician started a movement that encouraged others to refrain from drug abuse, particularly narcotics. It was through Brown's example that other musicians began to see drug abuse as debilitating instead of a catalyst to great playing.

The jazz industry also was organized in a way that propelled hard bop. Alfred Lion and Francis Wolff[7] started Blue Note Records in 1939 and both had an uncompromising love for hard bop (Gioia 1997, Rosenthal 1992, Seymour 2000). They actively sought out the "baddest" hard boppers in New York. Lion and Wolff required musicians to rehearse for a minimum of two days prior to recording in order to create a musical bond between individuals in the group and to allow engineer Rudy van Gelder to accurately capture the nuances of the group. Blue Note records stood out among other labels as producing the best hard bop records.

However, and possibly more important than the quality of music is how Lion, Wolff and Gelder treated the musicians. They gave young artists an avenue to pursue hard bop interests, but also treated them with respect; as if they were part of a musical family. The required two days rehearsal prior to recording was rare among labels at the time. Even more rare was that the musicians were paid for those rehearsals and Lions

[7] Wolff, born in Berlin, was a photographer and many of the photographs in the record (and later cd) booklets were taken by him during rehearsals.

and Wolff provided food for the musicians (Shipton 2001). Lion and Wolff attended the rehearsals in order to get to know the players and establish a rapport with them. One musician stated "Alfred and Frank were more like musicians than record producers. They loved to hang out and have a good time" (Rosenthal 1992: 102). About Wollf's interaction with musicians saxophonist Hank Mobley recounted:

> "We'd be making a tape and sometimes my horn would squeak, and Frank Wolff would say, "Hank Mobley! You sqveeked! You sqveeked! – and the whole band would crack up. We couldn't get back to the tune. And old Alfred Lion would be walking around (taking photographs) [snap] "Mmmmm!" [snap] – "Ooh" – [snap] – "Now vait a minute, it don't sving, it don't sving!" So we'd stop and laugh, then come back and slow it down just a bit. Then he'd say [snap, snap] – "Fine, fine dot really svings, ja!"

Saxophonist Jackie McLean equated working for other record labels (Prestige specifically) to working under the Nazi regime; but Blue Note was different and the quality of the records reflected it. Eventually, other labels began to emulate Blue Note's method for recording jazz.

Hard bop has shown considerable staying power and many people have returned to the style even after the era "ended" (Rosenthal 1988). Similar to cool, some of the greatest hard bop records were recorded after the "hard bop era" had ended.

CHAPTER III

SOCIAL NETWORK THEORY AND NETWORK STUCTURES OF INNOVATION AND SUCCESS

Networks are present in virtually any empirical situation. As such, social scientists have analyzed a multitude of different network structures in varying social environments. It is generally accepted that one's personal network matters in that it influences behavior and carries potential to affect individual outcomes. Yet it is far too crude to simply suggest that networks matter without highlighting the ways in which a network differs greatly from one social situation to another. Within one environment being in the "right place" may increase one's likelihood of being promoted (see Burt 1992), while in another environment the same actor occupying a similar structural location may be at an increased risk of becoming infected with a sexually transmitted disease (see Bearman, Moody and Stovel 2004).

Social network analysts have long maintained that one's location within the larger network is important to the extent to which an actor may benefit from their network or augment social capital (Brass 1984). The extent to which an actor is central to the overall network impacts the ease at which they may access resources from other members of the network for personal benefit. Structural location, however, has been misinterpreted to carry similar benefits in dissimilar networks (Mizruchi and Potts 1998). Such conclusions are erroneous as the content of the overall network determines the potential outcomes from individual network characteristics.

To illustrate, consider two networks, one of which is a network of business people and another is a network through which a virus is spreading. The central actor in the business network may be very important and powerful. They may have successfully been promoted to a managerial position in which they monitor several employees in varying divisions. Due to their structural position as a broker, explained in greater detail below, they have access to new information, can control flows of information, and may use their location for further promotion. Overall, their centralized location within the structure is more positive than negative.

In the virus spreading or contagion network the results of one's location within the larger network may differ drastically. An actor in a similar location as the example above may be one of the first to contract an illness spreading through the network (see Bearman, Moody and Stovel 2004). Their centralized location suggest that they are in direct or indirect contact with a large number of individuals from different walks of life. Thus the centralized actor is at a higher risk of being exposed to an illness. Additionally, the centralized actor, when infected, may facilitate and accelerate the spread of some illness through their many connections. Though the two networks act similarly, the empirical content may differ drastically. Therefore it is erroneous to suggest that all structural networks, regarding location within the network, carry a similar outcome independent of the empirical nature of the network.

Innovation scholars have used such examples to suggest that individuals who occupy these and other similar location act as gatekeepers to the diffusion of innovation. Additionally, characteristics of the network, e.g. network density, influence the rate at

which diffusion occurs (Rogers 2003). Analyses of network structure and its effect on innovators has not reached mainstream as of yet for a number of reasons. Yet, network characteristics surely influence innovators and innovation albeit in potentially different ways.

Network analysis carries a rich tradition of theoretical perspectives (Erikson 2013). To illustrate briefly, there are several studies that focus on the location of the individual within the broader network (Brass 1984, Burt 1992), the effects of densely connected networks (Coleman 1988b), the effects of sparse or weakly connected networks (Granovetter 1973), the incorporation of personal characteristics (Mehra, Kilduff and Brass 2001), and the effect of cultural influences on the network (Emirbayer and Goodwin 1994). Current theoretical agendas in network research focus on two well-known theories and the empirical premises on which they rest, namely brokerage and closure. In this section I review several structural network concepts and their theoretical implications in an innovation network.

Throughout this project I use the measures as theoretically suggested to influence innovators and career success as suggested in the existing literature. Therefore, some of the hypotheses will be contradictory given the theoretical logic outlined below. For example, brokerage and closure rest on similar theoretical logics, augmenting social capital, however, the structural premises of the networks are vastly different for each measure. The hypotheses mentioned below will reflect the direction presented in the literature.

Centrality

Degree Centrality

Degree centrality, or degree, is the most basic of all centrality measures. It is simply the sum of ego's ties. In Figure 1 the degree of certain actors is identified by the number adjacent to the node. Degree is used either as a control variable or a predictor in countless papers and projects and has been correlated with a variety of outcomes. While it does tend to correlate highly with varying outcomes, it also gives important information about the focal actor; namely, the size of their egonet.

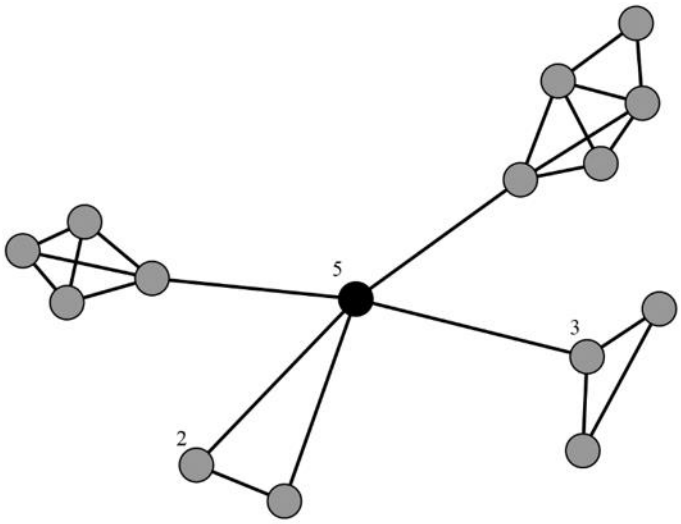


Figure 1. Degree Centrality

In addition to degree being calculated as directional, in-degree and out-degree, it can also capture the strength of the tie. For example, if we were analyzing an email

network between coworkers we could ask the respondents how many times in a day actor *i* sent an email to actor *j*. If *i* sent *j* 5 emails the degree may be represented as a 5. This value could then be used to determine if the actors exchange a high or low number of emails compared to other coworkers. However, the email communication could also be represented dichotomously, as a 1 or 0, which simply shows whether or not the actors exchange emails. The valued degree shows the strength of the tie while the non-valued degree shows only the presence of a tie. For this project I use both the dichotomized and the valued ties, although not simultaneously. Some measures, such as constraint, rely on the strength of the tie while other measures, such as density, are most easily interpreted as binary values.

Degree is a very basic and crude measure of one's connectedness to the network. The argument can be made, and frequently is, that if an actor has a high degree centrality, they are better connected to the network. Also, the actor with high degree is in direct contact with many other network actors. These actor are recognized in the network as channels for information and are a "crucial cog in the network" (Wasserman and Faust 1994: 179). In contrast, actors with low degree should occupy a peripheral location and occupy a relatively unimportant location to the overall network structure.

Degree centrality is important within collaborative networks in jazz as those musicians with high degree have recorded with a large number of musicians. The benefits of this can range from simply being well-known/connected to being in touch with disparate parts of the network that are disconnected. Following Schumpeter (1934),

an innovative record could be a recombination of the variety of artistic styles the musician becomes aware of through their extensive contacts.

Hypothesis 1: There is a positive relationship between a network actor's degree centrality and the likelihood of being considered a hard bop innovator and having an overall successful career.

Within the context of the jazz network, an actor with high degree suggests that the actor had recorded with a large number of other musicians. One benefit to degree centrality is that it is interpretable in any network situation. It is, however, a very coarse measure of centrality (Borgatti, Everett and Johnson 2013) and in certain networks, the actor with high degree centrality may not be central, but in a densely connected peripheral subgroup. Additionally, two actors that are connected to five other actors have equal measures of degree regardless of the connectivity of the five other actors. Thus there are limitations to the generalizability of the interpretation of degree. Because of these limitations network scholars created other measures to capture and measure levels of centrality.

Eigenvector Centrality

Eigenvector centrality has been described from multiple perspectives (Bonacich 1972). Essentially, eigenvector centrality is an extension of the actors' degree centrality "in which we count the number of nodes adjacent to a given node (just like degree centrality), but weight each adjacent node by its centrality" (Borgatti, Everett and Johnson 2013: 168). In effect, eigenvector centrality addresses the idea that a network actor is only as connected as their alters' connections. An actor may have a high degree

centrality, but if the actor's alters are poorly connected, or disconnected, the high degree centrality is be misleading to the overall connectedness of the actor. Thus network actors can have equal degree centrality scores but be connected to the network in very different ways. Eigenvector centrality gives a high value to actors who are connected to other well-connected actors. It is, then, a more accurate measure of who is more connected to the overall network instead of just the immediate network.

Eigenvector centrality is potentially a better measure of connectedness within the jazz network simply because the number of musicians in a big band, for example, will regularly give the musician a high degree centrality. However, it may be more important that the musician records with well-connected and established musicians instead of simply a large number of musicians. Thus the sheer number of musicians to whom the actor is connected may not be as important as who the contacts are and who they are connected to.

Hypothesis 2: There is a positive relationship between eigenvector centrality and the likelihood of being considered a hard bop innovator and having an overall successful career.

Since the eigenvalue that constitutes a high or low eigenvector centrality is purely a network phenomenon the measure is not influenced by individual identity. Thus a jazz musician who has recorded with other well connected musicians within the network has a higher eigenvector centrality. For ease of interpretation and without loss of generality, it is common to change the eigenvector from a continuous to a

dichotomized variable. Preliminary tests indicate that the latter generate outcomes which are robust to its original specification in this sample.

Betweenness Centrality

Betweenness centrality (Freeman 1979) is a measure of how often a node falls on a geodesic, or shortest path, between two other nodes. Actors with high betweenness values are also known as gatekeepers, go-betweeners, or intermediaries. Thus the actor who is high in betweenness centrality may have increased power over whatever may be flowing or moving through the network as well as they may hear of important information before others. As shown in Figure 2, actor B has a high level of betweenness because he or she falls on the geodesic between all actors on the left and all actors on the right the logical, and in this instance, only option is to go through actor B. This position gives actor B increased power over what he or she plans to do with the acquired information.

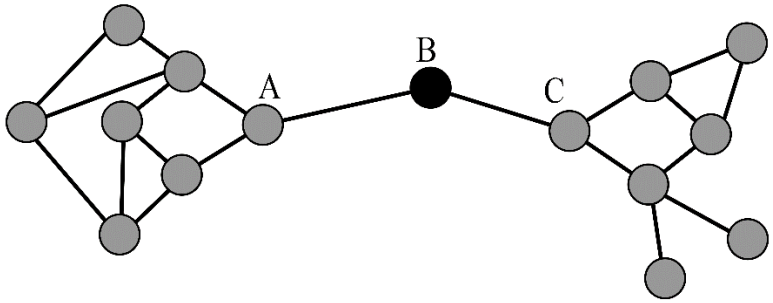


Figure 2. Betweenness

It is unlikely that network actors are actually aware of some of these measure as they are purely a network phenomenon. Thus, while the musician who ranks high in the betweenness measure may not have purposely positioned themselves in such a rational position, they likely benefitted from being an intermediary between other groups of musicians. Similar to degree centrality, the musician who is between other musicians has a higher likelihood of being made aware of distinct styles and can thus recombine them in an innovative way.

Hypothesis 3: There is a positive relationship between an actor's betweenness and the likelihood of being considered a hard bop innovator and having an overall successful career.

The musician with a high betweenness value acts as a gatekeeper between other musicians. This suggests that the individual may become aware of valuable information faster and is generally well connected to the overall network through the individuals with whom they have recorded.

Closeness Centrality

Closeness centrality measures how far each actor is from all other actors in the network. The distance is measured in steps, or geodesics to every other actor (Wasserman and Faust 1994). Over-all, a low closeness score means that the actor can reach a large portion of the network directly or through contacts. This likely augments social capital as the actor is close to resources embedded within the network. Closeness also represents a degree of independence. The actor that is very close to other actors

does not need to rely on intermediaries for access to information, power, influence or other resources (Prell 2012).

The advantage to being close to other musicians is that other musicians are likely more aware of the close musician's availability and skills. For example, if a pianist is needed on a record and the bassist knows of a very skilled player that is only two network steps away, it may be easier to connect and record with said pianist. Similarly, the close musician is also more likely to be made aware of pending projects or benefits embedded within the network because they are few steps away from other actors.

Hypothesis 4: There is a negative relationship between closeness centrality and the likelihood of being considered a hard bop innovator and having an overall successful career.

Since closeness is an inverse measure the jazz musician with the lowest closeness score is essentially closer to the other musicians within the network.

Closure

The concept of closure has long been a principle within social network and social exchange theories. Social exchange theorists suggest that the continuation of a social exchange is dependent on trust and reciprocity (Blau 1968), both of which are characteristics of closed network groups or cliques (Coleman 1988b). Generally, closure is defined by a group of individuals that are densely or maximally connected (see Figure 3). The closed group is typically comprised of strong or embedded ties. This suggests that the members of the group are not only structurally densely connected, but the

characteristics of their agreement or relationship surpass the superficial or those of acquaintance. Strong ties, then, characterize close friends instead of casual acquaintances, or their equivalents depending on the environment, as they are assigned value or worth to the depth and importance of the tie (Uzzi 1996).

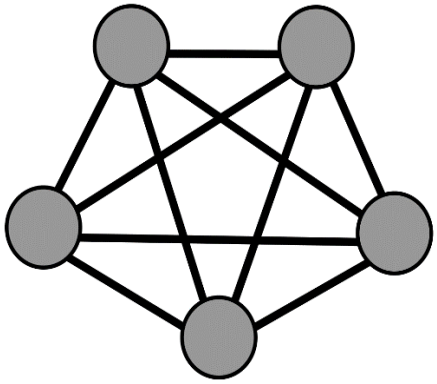


Figure 3. A Maximally Connected or Closed Clique

Closure increases network bandwidth. Bandwidth is the extent to which everyone in the network is aware of the details of important information as well as each other's behavior (Burt 2005). Previously identified as network "pipes" (Podolny 2001) and the "embedded logic" (Uzzi 1996) the bandwidth hypothesis suggests that "strong, redundant connections ensure a reliable flow of data so that everyone in the network is informed about behavior that enhances or erodes reputation" (Burt 2005). The closed network allows for information or other scarce resources to move freely between actors within the network. Avenues for flow enlarge over time, assuming no ill-willed

behavior of either party narrows such paths of travel as the bandwidth hypothesis is dependent on the individual's reputation.

Early research on the benefits of a closed network group suggests that closure assists in augmenting one's social capital (Coleman 1988b). Social capital, while widely defined, is known as a benefit to an individual through their relationship with another individual. This suggests that relationships carry productive benefits to the individuals involved. An individual who gains access to resources through relationships with friends and family is increasing or augmenting their social capital. Social capital is dependent on the maintenance of such relationships (Coleman 1990) and if the relationship is severed, access to the resource is lost and social capital decreases.

As network actors become committed to a group collective they are more likely to participate in a productive exchange (Lawler, Thye and Yoon 2000). Productive exchange suggests that each member will benefit in some way from the group's collective efforts. The interdependence among group members is high. It is the most group-oriented form of exchange as it requires the individuals to work together for a collective reward. The individuals give to the group and receive benefits in return thus creating a person-to-group transactional relationship (Lawler, Thye and Yoon 2009). Characteristics of closed groups create and secure the normative environment that foster cooperation.

Closed group relationships function because of a number of important features. Each of which carry an individual consequence or repercussion to the group as a whole. Some of the basic attributes of the closed groups are trust, mutual monitoring,

reciprocity, and elimination of the free rider problem. As such, densely or maximally connected groups can foster the development of shared norms and share knowledge in an effort to maximize benefits from collaboration (Ahuja 2000, Uzzi 1997).

Trust and Mutual Monitoring

Trust is a concern within network structures. Trust in networks is defined as commitment to a relationship prior to knowing how the other persons will behave (Burt 2005). Distrust, on the other hand, is present when guarantees regarding the individual's behavior is requested prior to the commitment to the relationship. Closed groups create and facilitate trustworthy relationships. Essentially, a closed relationship is one that is embedded or comprised of strong ties. For example, Lazerson (1988) finds that small Italian auto manufacturer firms prefer to hire family members or people referred to by a family member. Not only does this reduce the transaction cost of hiring the new employee, but the new hire enters into a relatively familiar place based on relationships of kin. Additionally, in his analysis of firms in Japan, Ono (2007) finds that cultural implications influence trust, commitment and goodwill which reduce the level of martketness and the need to specify terms, conditions, and contingencies in the employment relationship. Trust, therefore, helps to reduce transaction costs due to uncertainty and creates opportunities for exchanges, economic or otherwise, that are difficult to price or enforce with contract (Uzzi 1996). The development of an innovative practice or idea is likely to occur within a closed group due to the trust created (Obstfeld 2005).

Additionally, trust within the closed network allows for participants to make important decisions and progress toward organizational goals without involving costly contracts or other formal agreements (Ben-Porath 1980). Trust creates an environment in which sensitive or innovative ideas can be shared without being preoccupied that another member of the group will steal the idea and pass it off as their own. This social structure facilitates an exchange of "thick" and proprietary know-how among the actors (Helper 1990). In an analysis of international joint ventures Wong and Ellis (2002) find that investors in Hong Kong identify future business partners based on *guanxi,* or interpersonal relationships. Consider the quote:

> "It is hard to say whether you can trust anybody unless you have had the experience of working with him… I think the trust is based on the fact that we are come [sic] from the same village. But more important is that I had known him for over two years before we established the joint venture. After two years of observation, I felt comfortable that I had a good understanding of him" (Wong and Ellis 2002: 284).

Identities and histories matter in that repeated exchange creates trust and strong ties (Geertz 1978). Identity is important as it assigns value to the relationship or transaction which results in increased or decreased social capital (Portes and Sensenbrenner 1993). Likewise, from past relationships or exchanges members of the group become more certain of additional members behaviors (Burt 2005). Repetition,

then, creates trust. As Blau (1968) suggests, interactions begin at as a slow process where little trust is required as little risk is present. As actors prove their trustworthiness they are more likely to be involved high group behavior where significant risk is involved.

Trust within the closed group also acts as a mutual monitoring or governance mechanism. As interviews with clothing company managers suggest, "Trust means he's not going to find a way to take advantage of me. You are not selfish for your own self. The company and partnership (between firms) comes first" (Uzzi 1996: 678). Similarly, trust within the closed group offers mutual monitoring opportunities to ensure that all contribute.

As stated above, closure augments social capital. One way in which this occurs is due to cooperation based on the constraints on members of the closed group. The organizational and normative constraints allow groups to operate in relationships that would otherwise be hindered by the threat of opportunism (Walker, Kogut and Shan 1997). Thus, lower level of group constraint allow for the rational actor to engage in opportunism or other inappropriate group behavior.

When the risk of opportunism is low the actor will "overbuild" or give additional importance or credence to the social structure or closed group (Uzzi 1997: 53). This is not suggesting that one actor will take on the role of the zealot, or the opposite of the free rider (see Coleman 1988a), although this is possible. Instead, the absence of the opportunist actor creates a shared emotional or affective process that will increase the likelihood of commitment to produce within the group (Lawler, Thye and Yoon 2000).

Often times, the shared emotional commitment is absent when the purely rational actor or opportunist is present.

Reciprocity and Free Riders

Closed subgroups within networks assist in correcting problems with reciprocity and free riders. As Coleman (1990) suggests, reciprocity is the mechanism that turns relationships into social capital. Indeed, there is little motivation to maintain a relationship with a non-reciprocal actor or "free rider". A free rider is one who benefits from the group effort while contributing little or nothing to the overall goal (Coleman 1988a). The shared norms that evolve within closed groups discourage the free rider problem by encouraging reciprocation among members.

The free rider was introduced primarily in studies of public goods (see Grossman and Hart 1980, Groves and Ledyard 1977). As defined above, a free rider problem exists when an actor benefits from a collective good or resource without contributing to the cost of the good. The rational actor will seek to maximize benefits and, if possible, eliminate costs or provide suboptimal costs while maintaining the benefit of the good or resource. Therefore creating an unbalanced ration of input to output. This occurs because as the public good is dispersed to the whole, the actor will only accrue a fraction of the benefits. If the actor is motivated purely by the benefits accruing to them from their own action, they will be unmoved and unmotivated to continue exerting the energies to produce to benefits and hence become a free rider on others' action (Coleman 1988a).

Reciprocation within social exchange theory generally involves at least two actors who are exchanging some good or service. The exchange requires no explicit contract but there are implicit expectations. To illustrate, couples with young children may exchange babysitting favors. It would be a social taboo for one couple to write up a contract outlining the details of the exchange, however reciprocity is generally expected. To illustrate, Uzzi (1996: 678) posits that a "significant outcome of trust is that it facilitates the extension of benefits to transacting partners and invites the receiving partner to reciprocate when a new situation arises."

Reciprocity and joint activity within closed groups produce a common focus, a sense of group affiliation, and is emotionally uplifting to those involved (Collins 2005) as norms arise that seek to the limit negative external effects or highlight the positive (Coleman 1988b). Furthermore, reciprocity within such a group is expected as it serves as a social reminder to the obligations of the group (Blau 1968). Within the closed group that or oriented toward a goal, such as a work or research team, reciprocity may be more accurately described as contribution. Although possible, actors may not exchange with other individuals, but contributing to the group goals. Thus, the group takes on a persona with which members must reciprocate so that progress toward a goal is made.

The closed group helps to eliminate the free rider problem in that all group members are visible and organized. This, of course, is dependent on the size of the group. It may be very difficult of one member to free ride when they make up 25% of the group, but as the group increases in size the free rider may see opportunities to become relaxed or lazy in their efforts.

In the closed group the actors are aware that their contributions will result in a benefit. Therefore there is an incentive to contribute particularly when such contribution cannot be claimed by another partner. For example, in a musical group the drummer cannot take credit for the guitarists work. This is applicable to each member. There is an incentive, therefore, to contribute to the mutual benefit of the group as the individual's success may be dependent on such a performance. Essentially, smaller closed groups may eliminate the free rider problem as there is nowhere to hide. In network analysis, closure is measured by egonet density, outlined below. Essentially, high egonet density suggests that the clique or group is more closed.

Closed cliques in modern pop and rock are quite common. It is unlikely that a small group of musicians would be as fluid as the jazz groups of the 40s and 50s. The jazz environment, as outlined above, was very volatile, risky, and fluid. A closed group that rehearsed regularly and recorded often would offer career stability that was fleeting during this time. It would offer the musicians a place to develop as a cohesive group as well as individually.

Hypothesis 5: A positive relationship exists between an individual's measure of density and the likelihood of being considered a hard bop innovator and having an overall successful career.

As stated above, closure within the jazz community was very rare. Essentially, a closed jazz group means that the individuals record primarily with each other instead of

moving from group to group. To the author's recollection, there is only one group[8] in jazz history that remained as a cohesive group for more than a year or two.

Problems with Closure and "Overembeddedness"

Above I have explained how trust and reciprocity create an environment for productive exchange and assist in the elimination of the free rider problem and opportunist behavior from the purely rational actor. One may presume, then, that closed network groups are an obviously beneficial option when creating interpersonal or inter-firm networks. However, researchers suggest that the network actor can become increasing closed in their network thus effectively isolating themselves from potentially resourceful contacts. Essentially, an actor may become overembedded in their network or over-reliant on the individuals within their network.

The concept of embeddedness has a long and fruitful history in economic sociology. Polanyi (1944 [2001]) used the concept to explain the social structure of contemporary markets and the individual's motivations to the market. Additionally, Polanyi asserts that market institutions are historically specific and fluctuate according to historical variation. Specifically, Polanyi suggests that the economy is not autonomous and independent as stated in economic theory, but subordinated to political, religious, social, and other network or relational influences. More recently, Mark Granovetter (1985) used the embeddedness concept to illustrate the social nature and influence of

[8] The Modern Jazz Quartet (MJQ) comprise of John Lewis, Milt Jackson, Percy Heath, and Connie Kay. Though each of the members recorded with other musicians during their time as a group, MJQ was a successful group for over 40 years.

individual economic behavior. His perspective contrasts the classical and neoclassical economic traditions which assume the economic actor is atomized, self-interested, and undersocialized, and instead suggests that economic behavior is embedded in networks of interpersonal relations. Following Polanyi and Granovetter, market behavior and economic behavior is a product of social, economic, and historical influences on the firm and individual.

As stated above, an optimum or threshold exists in which the embedded actors become overembedded in their network. The overembedded effect is detrimental to the individual or actor as they become over-reliant on too few actors within their network and are unlikely to be made aware of opportunities beyond their network. The closed and embedded group reduces or limits the flow of new or novel information from other actors (Uzzi 1997). This occurs because there are too few links to outside members and the closed group is characterized by redundant ties to the same network partners (Burt 2005). This type of network becomes solidified and over-routinized which lead it to be out of line with its environment and may ultimately lead to its decline (Uzzi 1996).

The redundant and repeated information can create an "echo effect" of converting selectively disclosed information into data and fact (Burt 2005). The echo effect is a result of sharing portions of the larger story that will resonate with the audience or crowd. Within closed groups the actors may become mutually attuned to one another's emotional predispositions and omit other important information in presentation to colleagues. "The resulting echo hypothesis says that closed groups do

not enhance information flow so much as they reinforce predisposition" (Burt 2005: 168).

Sparseness, Brokerage, and Structural Holes

In contrast with the closed and embedded tradition outlined above, some scholars suggest that closed groups are detrimental to one's individual success and instead individuals should seek to create sparsely connected networks. The logic behind this idea addresses the problems of information flows within closed groups. Instead of risking passing on redundant or not-novel information the actor who connects with individuals from all walks of life will more likely be made aware of a variety of information. The increased ability to access different sections of one's network increases the likelihood becoming aware of a good idea or innovation (Burt 2004). To highlight the details of the sparseness argument, I describe two well-known applications: the strength of weak ties and structural holes.

The Strength of Weak Ties

The sparseness hypotheses gained momentum after Granovetter's (1973) work on the Strength of Weak ties. The presence of a weak tie, or bridge, is characterized by the absence between two actors who have in common at least one network actor. Consider Figure 4 for example. The weak tie argument functions on the assumption of a homophilous relationship. If actors A and B have similar qualities or share some interest and actors A and C have similar qualities then actors B and C are likely to have similar qualities. The absence of tie between actors B and C represents a weak tie. Similarly,

the commonalities between all three actors suggests that actors B and C have a higher probability of having at least a weak tie (Borgatti and Halgin 2011). The strength of weak tie thesis suggests that weak ties "tend to form bridges that link individuals to other social circles for information not likely to be available in their own circles" (Lin 1999: 469).

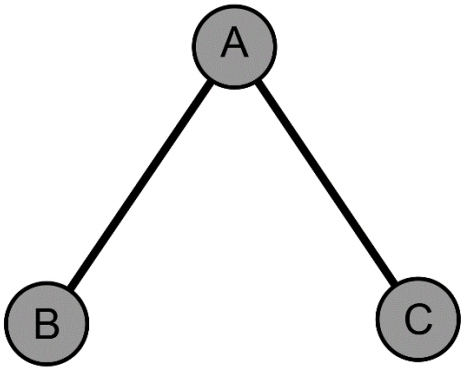


Figure 4. The Weak Tie Triad

The underlying causes of these relationships are based on transitive characteristics (Granovetter 1973). This type of transitivity suggests that people tend to be characteristically homophilous, meaning they tend to have strong ties with people who are similar to themselves. The two unconnected (B and C) actors with a mutual connection will likely have commonalities as well. Additionally, Granovetter reasons the importance of weak ties is partially due to the fact that strong ties are unlikely to be bridging ties. This is because if two actors have a strong tie they are likely to know

many of the same people. The numerous redundant ties implies that their connection will not be a bridge to other portions of the network. Therefore, it is only weak ties that create bridges.

Granovetter (1973) suggested that bridging connections, or weak ties, are unique and valuable sources for hearing new information that is not already circulating among their close friends or strong ties. In this sense, the theory explains individual social capital. Granovetter illustrated the importance of weak ties by examining how managers found better job opportunities through weak ties instead of strong ties. The weak tie creates a bridge to other parts of a network and opens potential avenues for additional resources and increases individual social capital.

Structural Holes

The concept of structural holes, developed by Ron Burt, is a mechanism used within networks for the benefit of a broker. The concept draws on several lines of research and theorizing developed primarily by sociologists in the 1970's. Central to the concept are the works of Granovetter (1973) on the strength of weak ties, Freeman (1977) on the structural concepts of betweenness centrality, Cook and Emerson (1978) on exclusivity of exchange partners and Burt (1980) on structural autonomy created by network complexity. The central premise of the theory is brokers increase their social capital and gain competitive advantage by spanning structural holes or connecting otherwise disconnected portions of the network.

As defined by Burt (1992) a structural hole is a chasm that separates nonredundant contacts. The nonredundant contacts are groups of individuals who may

be aware of one another, but are focused on their own activities and do not immediately interact with those of the other group (Burt 2004). The space, whether physical or other, between the groups creates a hole in the network as depicted in Figure 5. By bridging the hole an individual gains access to novel information and increased opportunity to control projects from both sides of the hole.

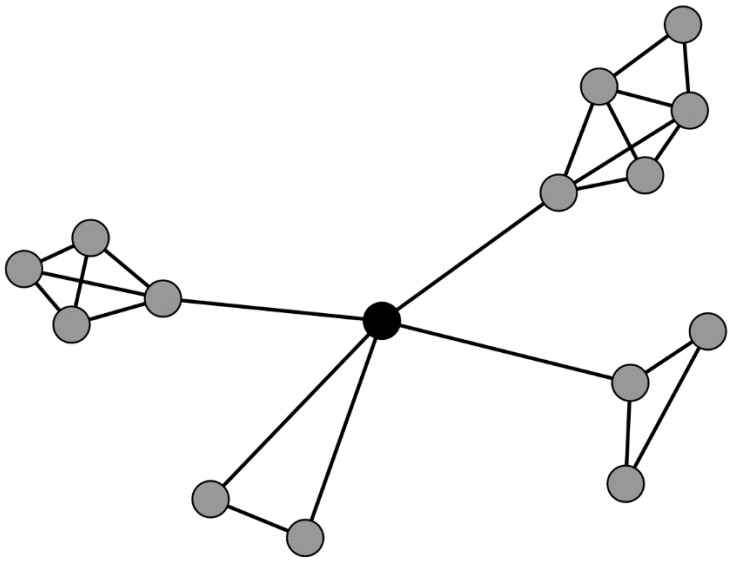


Figure 5. The Structural Hole Model

There are three primary benefits to the individual spanning the chasm or broker: autonomy, control, and flow of information. Brokers experience increased autonomy due to the fact that the strength of the ties to the parties on either side of the chasm are weak. To place the structural hole concept within Granovetter's language, all brokers

create a bridge and all bridges are weak ties (Borgatti and Halgin 2011). Since they connect weakly with the other parties their behavior and activity is not under direct supervision from either group which allows for a degree of independence from the individuals to whom the broker is connected. The broker also experiences opportunities for increased control over each party. To illustrate, if both parties are competing with one another the broker has the ability to use information from one party to play off of the other. This allows the broker to maintain a degree of control over either party. Finally, the broker can use the position to filter or control the flow of information from one party to the other. Synonymously with control, the broker is able to sugar-coat, alter, withhold, or completely change the details of information flowing from one side of the chasm to the other in a way that places him or herself in the most positive light. This situation becomes ethically and legally complicated when a broker is privy to sensitive or insider information and chooses to divulge the information for some individual benefit.

The brokerage position offers a unique vision advantage across the network (Reagans and McEvily 2008). Closed groups facilitate the flows of information, but the information within groups is more redundant or homogeneous than between groups (Burt 2004). Network actors who connect with a variety of other actors form different walks of life which give them increased opportunity to familiarize themselves with alternative forms of thought. The broker can then synthesize several independent ideas into a genuinely novel approach or innovation. Brokering structural holes, then, may be essential to the creation of novel ideas and innovation (Burt 2004).

Structural hole research focuses specifically on the broker, or individual spanning the chasm or hole. Bridging a structural hole is important to actors for the reasons listed above as all may contribute to the augmentation of one's social capital. There has been much research done on social capital and an in-depth discussion is not warranted in this paper. However, simply defined, social capital is a benefit that emerges from a relationship within a social structure that makes possible "the achievement of certain ends than in its absence would not be possible" (Coleman 1988b). Imperfect markets are ripe with disconnections of individuals or holes in networks that allow some people to access information before others.

The timely access of optimal information is an asset in itself (Geertz 1978) and one's position in a structure influences the likelihood of timely access to novel information. Therefore, a benefit of social capital as defined within a structural hole argument is the timely access to flows of information and opportunities for information between otherwise disconnected network actors. Or as Burt (1998: 8) suggests "the structural hole is an opportunity to broker the flow of information between people, and control the form of projects that bring together people from opposite sides of the hole."

Bridging structural holes has been applied to communities, groups, teams, divisions, corporations, and individuals. There is a long tradition of research that suggest that the bridging of a hole is beneficial to the actor or entity doing so. Some more recent studies suggest that individuals who locate themselves near a structural hole are "at a higher risk of having good ideas" (Burt 2004: 349). Choi and Rhee (2010) state that there is widespread confirmation of the benefits and productivity of bridging

structural holes in Western Economies yet cultural implications of other societies suggest other network measures, such as closure, are more beneficial. Mehra et al. (2001) suggest that individuals who connect otherwise disconnected individuals in a firm perform a useful service to the firm and are more likely to gain higher performance ratings from supervisors. Shiplov and Li (2008) find that firms that bridge structural holes will experience increased market performance, superior access to information, and increased status through higher-status partners. Finally, Susskind et al. (1998) suggest that the presence of structural holes offers important dynamic information about the cohesiveness of a firm in periods of structural change such as downsizing.

While on the surface Burt's and Granovetter's theories seem tautological as they both refer to the benefits of sparsely connected networks, they in fact explain a similar phenomenon in two very distinct networks. Burt uses the theory to explain how managers strategically manipulate their ego networks in order to receive a promotion while Granovetter is theorizing about a serendipitous world in which people make ties that incidentally become resourceful. Burt's view, then, is much more strategically oriented. Furthermore, as I outline at length below, Burt extends the sparseness theory into a network method. Indeed, Burt's flagship book on the topic *Structural Holes* (1992) is theoretical and methodological in which he creates quantitative measures to analyze the theoretical dispositions.

There are two common measure used to outline structural holes, effective size and constraint – both outlined below. Effective size essentially measure the redundancy

in one's direct network while constraint measure the extent to which ego's alters are also connected to each other. Constraint limits the potential for creating structural holes.

The sparseness argument is somewhat counterintuitive in jazz, and possibly other forms of music for that matter. The brokered network suggests that the musicians with whom the actor recorded are not connected to each other. How is this possible, though, since it is incorrect to suggest not all musicians who recorded an album together did not play together? Essentially, musicians whose networks are rich with structural holes recorded with one grouping of individuals at one point in time and with a completely, or mostly, new group later. Thus the broker becomes the only musician connecting the groups.

Hypothesis 6: There is a positive relationship between effective size and the likelihood of being considered a hard bop innovator and having an overall successful career.

Hypothesis 7: There is a negative relationship between constraint and the likelihood of being considered a hard bop innovator and having an overall successful career.

Similar to some of the centrality measures. The actor who is sparsely connected to the overall network may become aware of unique styles and will have an increased ability to come up with an innovative product. However, as Obstfeld (2005) suggests, while it is easier for the sparsely connected actor to think up an innovative style it is harder for that musician to find the right people to carry out the idea. Thus, the musician

experiences an action problem as they experience difficulties turning the idea into a product.

Brokerage and Closure Trade-Off

As illustrated in the previous sections, it appears that the closure and brokerage hypotheses make the same assertions (an increase in social capital) but rely on opposing and even contradictory logics. The closure argument suggests that densely connected networks provide the best network benefit while the brokerage hypothesis suggests that sparse networks provide the most benefit. While the two theories may be based on contradictory premises, they are not as mutually exclusive as the underlying logic may dictate. To illustrate, occupying a brokerage position may be necessary in order to create an innovative idea, but the closed group will facilitate the development of the idea or method within a closed group (Reagans and McEvily 2008). There are situations in which brokerage and closure are complementary, despite their contradictory logic.

The "either-or" logic has permeated the networks literature, but recently a combination of the two logics has become popular. This idea is based on several older works (primarily from Brian Uzzi) that highlight the disadvantages of a purely brokered or closed network. Uzzi suggests that if a continuum exists with purely embedded and purely brokered at the left and right ends, the optimal location is somewhere in the middle. Cultural factors and historical transformations, however, may dictate if being left of center or right of center is more beneficial (Helper 1990, Lazerson 1988).

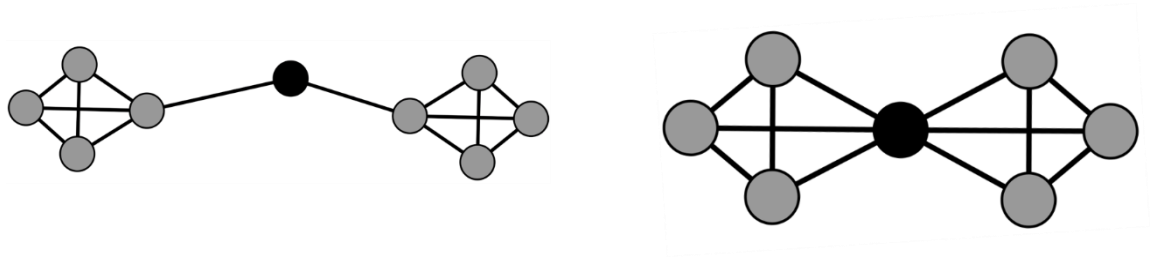
As mentioned above the social actor that creates primarily strong ties is in risk of becoming overembedded in their network. Overembeddedness suggests that the focal actor becomes over-reliant on too few contacts. In Uzzi's (1996) analysis of clothing firms, he finds organizations that have a high degree of embedded or disconnected networks are more likely to fail than organizations that maintain a balance of embedded and sparse contacts. These organizations maintain a small number of embedded ties with whom they work closely to produce competitive advantage. However, embedded ties possess their own pitfalls or negative attributes. Specifically, the focal actor's capacity to compete is substantially determined by a web of ties, many of which are beyond their direct control. Thus the extent to which a firm is structurally embedded in its network can constrain its success. The focal actor must also seek to maintain relationships with a higher number of "arms-length" ties (Uzzi 1996). The arms-length ties offer a security contingency of more channels of information in the occasion that the embedded tie fails to perform.

Uzzi and Spiro (2005) further demonstrate that Broadway musicals' critical reception of hit, flop, or fail correlates to the amount of small world and global connections. In this instance global does not refer to around the earth, but to connections to other small worlds or pockets of dense cliques on other area of a larger network. In other words, an innovative musical (a "hit") is a function of enough cluster cohesion (the continuity of one musical "team" from one show to the next) and connectivity (diversity in team composition from one show to the next).

Structural Folds

A unique and novel concept has emerged in the literature that elaborates a strategy to capture the benefits from both closure and brokerage. Vedres and Stark (2010) posit that innovative ideas are not "free-floating" outside the group or "out there" in the global network waiting to be picked up by the nearest broker and developed within their closed group. Instead, a truly innovative idea comes from the productive friction that disrupts "business as usual" and encourages redefinition, redeployment, and recombination of resources (Stark 2009). Furthermore, innovation is generated and discovered through a process of cognitive curiosity and recognizing what has not yet been formulated into a category.

Instead of structural holes, they suggest that structural folds offer the best opportunities for the focal actor to benefit from their network. The structural fold depicts a "different understanding of the innovation process and the structural basis for it, intercohesion, as mutual participation in multiple cohesive groups, provides the requisite familiarity and diversity for access and for action through a distinctive network topography that is not a summation of brokerage and closure" as depicted in Figure 6 (Vedres and Stark 2010: 1151).



Structural Hole Structural Fold

Figure 6. The Structural Fold in Contrast to the Structural Hole and Closure

The logic of the concept is founded on the weaknesses of brokerage and closure. Namely that brokerage offers numerous avenues that provide access to information but fails to provide means for implementation. Conversely, closure provides the means for coordination but lacks the diversity for newness discovery. This phenomenon is also suggested to be an action problem and an idea problem (Obstfeld 2005). Where brokered ties experience the difficulty of executing action from their good ideas, closed ties experience a problem generating sufficiently diverse ideas. Vedres and Stark (2010), however, suggest that the idea problem in itself is an action problem as innovation must be generated within a group and consists of much more than the importation and implementation of new ideas. Instead, as mentioned above, innovation and entrepreneurship is a recombination of the necessary means of production from a previously existing combination and employing them in a different way (Schumpeter 1934). The recombination of already existing resources and schemas suggests that rarely, if ever, is an innovation genuinely new. Instead, following Schumpeter and

Vedres and Stark, the innovation is a result of productive friction that encourages newness.

Vedres and Stark's (2010) concept of intercohesion refers to mutually interpenetrating, cohesive structures. The structural fold is a combination, in a sense, of closure and brokerage. An intercohesive actor must be connected to at least two cliques. Actors are multiple insiders that participate in dense cliques and have familiarity across groups as they are members of multiple overlapping cliques. Theoretically, then, the focal actor maximizes the benefits of brokerage and closure by brokering two closed cliques.

Uzzi and Spiro's (2005) explanation of the small world resembles the structural fold logic. They suggest "the more a network exhibits characteristics of a small word, the more connected actors are to each other and connected by persons who know each other well through past collaboration or through having had past collaborations with third parties" (Uzzi and Spiro 2005: 449). However the structural fold gives additional focus to the brokerage of cliques and outline the importance of outlining a specific structural feature that can predict successful performances or individuals, namely intercohesion.

It is important to note that the structural fold process relies on network analysis software to identify the clique, see methods section for more detail. Other research which highlights the complementary nature of brokerage and closure identifies the cliques a priori. For example, Uzzi and Spiro (2005) identify the group as a team of musicians or actors participating in a musical. Reagans and McEvily (2008) differ

slightly in that they do not outline the groups, but their analysis is of a research and development firm that specializes in six areas of expertise. It can be argued, then, that the six areas act as a natural funnel into groups of individuals who have similar areas of interest. Instead, the structural fold approach suggests that actors can be members of the same pre-defined group without being mutually and maximally connected to other members. Therefore it is more accurate to allow the algorithm to identify cliques instead of identifying them a priori and making the assumption that all fit equally into the group.

The jazz musician that spans a structural fold will experience an increased stability and safety in their career. Assuming that the broker is indeed connected to two closed groups and those groups are at least moderately successful the brokering musician would be in an ideal location for a successful career. Since the brokering musician is connected to more than one group, if a group fails there is a still potential for the other to succeed. Thus the loss to the musician may not be as catastrophic.

Hypothesis 8: There is a positive relationship between the number of structural folds and the likelihood of being considered a hard bop innovator and having an overall successful career.

The musician that spans a structural fold is connected to two or more closed groups. In popular music, this phenomenon is quite rare as it would be the equivalent to one musician recording in both the Beatles and the Rolling Stones. While it may be more common in jazz because groups are more fluid the fact that cohesive groups were uncommon makes the structural fold concept unlikely in this sample.

The Core Periphery Structure

Among Schumpeter's (1942) more compelling arguments is his hypothesis that capitalist structures are characterized by innovative actors and corporations who become established incumbents, only to be challenged and replaced by a new set of innovative actors. Innovation is "pursued by market entrants to the detriment of incumbent firms that presently hold market power yet lack competence in this innovation" (Phillips and Owens 2004: 281). This line of thinking has permeated neo-institutional theory on organizational change.

Neo-institutional theory holds that organizations imitate or mimic each other in order to increase competitive advantage and conform to a socially constructed environment (DiMaggio and Powell 1983). The mimetic, coercive, and normative pressures of change secure an organizational environment that perpetuates existing regimes and constrains regimes of change (Greenwood and Hinings 1996). The existing environmental constraint holds that real change will only occur if the status quo is overturned and the dominant organizations are broken down (Greenwood and Suddaby 2006).

By reintroducing the individual into institutional theory, DiMaggio (1988) explains that individual actors can influence institutional change despite pressures for stasis. Institutional entrepreneurship suggests that new institutions arise when motivated actors with sufficient resources see an opportunity to realize their interests. Thus in the midst of an institutional environment, certain individuals maintain the ability to exert their influence on organizational change and innovation (Battilana, Leca and

Boxenbaum 2009). This research tradition has influenced the logics of theories on the diffusion of innovation.

As mentioned above, institutional theory maintains that dominant organizations are constrained by and maintain the status quo. Additionally, there is little incentive for incumbent organizations to revolutionize an industry if they maintain a significant portion of some equivalent to a market share. Therefore, institutional change is likely, though not always, to emerge from institutionally peripheral actors (Kraatz and Moore 2002, Pozner, Stimler and Hirsch 2010). New institutional practices and innovations, then, begin in the periphery and disseminate through network until widespread acceptance and adoption or the innovative practice fails and is eliminated from the network (Rogers 2003).

This line of research can be applied to innovative individuals as well as firms. Although well-defined, the core-periphery transition exhibits methodological and empirical limitations (see methods section for methodological issues). Empirically, the work has been oriented toward understanding the dissemination of successfully adopted innovations. Thus, the research produces a pro-innovation bias and fails to incorporate innovations that did not reach widespread adoption (Rogers 2003). Through the successful dissemination the research assumes that all innovations are beneficial. Finally, the literature has been criticized for a lack of concern for variation in the implementation or customization process and has given an over-attention to symbolic adoption with individual adaptations instead of actual and complete adoption (Fiss and Zajac 2006, Westphal, Gulati and Shortell 1997).

The core periphery hypotheses represent the movement between structural locations throughout the musician's career. The peripheral musician was likely young and emerging in their career while the core musicians would represent more established artists. For example, since popular bebop musicians were likely at the core during the bebop era their innovative freedom was constrained by bebop as an art form. Innovative musicians, in this sense cool or hard boppers, were involved in jazz but not at the center of the movement. However as the styles that they played because more common they moved from the periphery to the core.

Hypothesis 9: There is a negative relationship between the core periphery measures and the likelihood of being considered a hard bop innovator during the bebop era and having an overall successful career.

Hypothesis 10: There is a positive relationship between the core periphery measures and the likelihood of being considered a hard bop innovator during the hard bop era and having an overall successful career.

CHAPTER IV

DATA AND METHODS

I use social network analysis and logistic regression to determine if a musician's location within the larger structural network influences artistic innovation and career success. The social network analysis method is used to assign a value for the structural measures outlined below. These measures come strictly from the locations within the network. There are no qualitative characteristics incorporated into the measure outlined below. I then create a panel dataset with the output from the network analysis results (or output) which I use in the logistic regression analysis to predict three dependent variables: the likelihood of being considered as a hard bop innovator, whether or not the individual has won a Grammy Lifetime Achievement Award, and as of 2012 whether or not the individual has been inducted into the DownBeat[9] Hall of Fame. Since the dependent variable is not continuous using ordinary least squares (OLS) regression is inappropriate. I use logistic regression which is designed for dealing with binary outcomes (Treiman 2009).

Following diffusion of innovation theory, I suggest that being considered a cultural innovator is influenced by contemporaneous and longitudinal effects (Rogers 2003). Or, that network location prior to the emergence of a cultural innovation is

[9] DownBeat Magazine has been in print since 1934 and is one of the most popular and well-read jazz publications. It created the DownBeat Hall of Fame in the 1950's. Musicians can be inducted in three ways: a reader's poll, critic's poll, and veteran's committee poll. The veterans committee inducts deserving, deceased musicians of past eras. I do not give preference to how the musician was inducted, but whether or not they are inducted.

relevant. The era of focus, 1945-1958, is when small group jazz began to be the norm (Ward and Burns 2000), and, arguably, are the most important years to modern jazz styles. The avant-Gard, modal, and free jazz styles began the rise to popularity in 1959 thus in this project I use 1958 as the end of data collection of the hard bop era. I use Ucinet (Borgatti, Everett and Freeman 2002) as the network analysis software and Netdraw, a sub-program of Ucinet, to create the visualizations.

Social network analysis (hereafter SNA or network analysis) is currently a popular and efficient method of measuring the overall structure of relationships between network actors. Over the past 30 years, research on or using SNA has increased exponentially. Visual representations of the analyses are typically portrayed in a map or graph, used interchangeably, where network actors are represented by nodes (or dots) and the relationship represented by a line, commonly referred to as a tie, connecting two nodes.

Nodes and ties can represent a variety of empirical relations. The nodes in this project are musicians and the tie represents that the two individuals recorded together in a session. The ties are undirected which means there is no direction to the connection between the individuals. To illustrate this point, consider the friendship network in Figure 7. In this hypothetical network, these four actors were asked to name who their friends are. The undirected pair is represented by the tie between actors, or nodes, A and C. The tie is undirected as both stated that the other actor was a friend. The directed friendship pairings are represented by two nodes with a unidirectional arrowhead. To illustrate, C stated that G was a fried, but G did not state that C was a friend. There is,

therefore, a direction given to the friendship. The same applies to the other actors whose relationships are characterized by a unidirectional arrow.

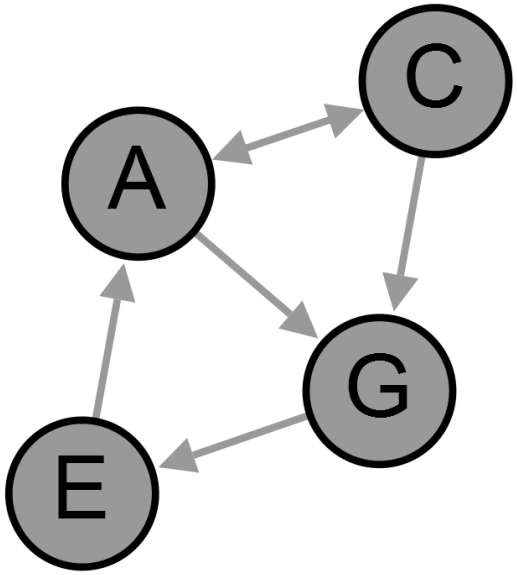


Figure 7. An Undirected and Directed Friendship Network Graph

Another way to elaborate the bidirectional tie is identifying how face-to-face communication between actors occurs. When two people are communicating they are making some type of information exchange. Even if one party is not talking they are still communicating through body language, facial expressions, lack of paying attention, etc. (Wasserman and Faust 1994). The jazz network in this project is comprised of solely undirected, or bidirectional, ties. This is because I collected collaboration data, explained in more detail below, of the musicians who recorded on an album together.

The data then represent that the bassist, pianist, drummer, etc… played together on the album. The undirected relation does not show that the drummer recorded with the pianist but the pianist did not record with the drummer. This type of relationship would be impossible given the network.

In this section I highlight the empirical specifications of the measures used to test the theories outlined in the previous chapter. As each measure from SNA is relatively independent I outline the mathematical properties behind each measure. These measures make the theoretical constructs empirically testable. In the statistical analysis, the outcomes of the network measures are treated as independent variables.

Centrality

Centrality is one of the most basic concepts and most important tools in SNA. Nearly all empirical studies use a measure of centrality to try to identify the important nodes within the network (Everett and Borgatti 2005). Essentially, all measures of centrality analyze the extent to which a network actor is central within the overall network as well as their personal network. However, centrality is an umbrella concept with multiple independent measures that each analyze different aspects of being central. Therefore, a high value of a single measure does not signify a high level of overall centrality, if one even exists. As each measure is based off of different logics, each measure must be interpreted independently.

Since the 1950's there have been three basic categories of centrality: degree, betweenness and closeness. Bonacich (1972) added eigenvector centrality to the three

classic measures. Although other measures exist, these four dominate the empirical measure of centrality (Everett and Borgatti 2005). Therefore, I only examine the effect of these four measures.

Degree Centrality

As stated above, degree centrality is simply the sum of ego's ties. Therefore it is defined as:

(4.1)

$$\mathrm{d_i} = \sum_j x_{ij}$$

where *i* represents the actor and x_{ij} is the (*i*, *j*) entry in the adjacency matrix, or the value of the tie between *i* and *j*. Thus, the jazz musician with high degree centrality recorded with a large number of musicians.

Eigenvector Centrality

As defined above, eigenvector centrality examines the extent to which one's alters are well connected. Eigenvector centrality is mathematically defined as:

(4.2)

$$e_i = \lambda \sum_j x_{ij} e_j$$

where *e* is the eigenvector centrality score and λ (lambda) is a constant called the eigenvalue which value is typically 1. Equation *4.2* suggests that each actor's centrality is proportional to the sum of centralities of the adjacent actors. Jazz musicians with high eigenvector centrality recorded with other musicians that were well connected to the overall recording community.

Betweenness Centrality

Betweenness centrality measures the proportion of geodesics on which the focal actor lies. The final measure is then summed between every pair in the network. The formula for betweenness of node *j* is:

(4.3)

$$b_j = \sum_{i<k} \frac{g_{ijk}}{g_{ik}}$$

where g_{ijk} is the number (count) of geodesics connecting nodes *i* and *k* through *j*, and g_{ik} is the total number of geodesics paths connecting *i* and *k.* It is possible that a node can have a betweenness score of zero, if the node never falls on the shortest path between two other nodes or if it is an isolate (not connected to any other nodes). Jazz musicians with high betweenness will frequently be the actor that connects different components of the network or other musicians.

Closeness Centrality

Closeness is an inverse measure of centrality, thus the actor with the minimum distance is the most central as it take the fewest steps to reach all other actors in the network. The formula to calculate closeness centrality is:

(4.4)

$$C_c(i) = \sum_{j=1}^{n} d_{ij}$$

where d_{ij} is the distance to connect actors *i* and *j*. As mentioned above, closeness is an inverse measure of centrality, thus equation *4.4* calculates the *farness* score for each actor.

Closeness is commonly, although not always, presented in a normalized from. The normalization (Freeman 1979) expresses the measure as a per cent and corrects the inversion of values. The percent interpretation suggests that an actor who has a betweenness score of .29 is only 29 per cent connected to their network as they could be. The formula for the normalization is:

(4.5)

$$C`_c(i) = [C_c(i)]^{-1}(n-1)$$

A musician whose closeness score is low is closer to every other musician in the network, as closeness is an inverse measure of centrality. This suggests that the

musician may be well-known as they are located in a position that other musicians may be made aware of them more easily.

Closure

One of the most common measure use in SNA is density. Density can be used to measure the overall connectedness of a graph or the connectedness of ego's alters. Thus, each whole graph and each individual within the graph has a network density measure. Since I am calculating individual measures on innovation and success, I only use the individual's egocentric density measure, or egonet density.

Similar to other measures I will discuss, density is computed without ego. This means that although it is a measure of the ego, it actually measures the ego's alters. Therefore, ego does not change the value given. Density is defined as the proportion of ego's alters who are connected to each other (Borgatti, Everett and Johnson 2013). The concept can be presented in two ways: valued and dichotomous. For ease of interpretation I dichotomize the relationships so that a 1 represents a tie and a 0 represent no tie. Any tie value greater than 1 in the original data is converted to a 1. This facilitates interpretation because the result can be presented as a percentage whereas if density is computed with tie strength the interpretation is significantly more complicated.

Egonet density, where in ego is *i*, is calculated as follows:

(4.6)

$$D_i = \frac{L}{n(n-1)/2};$$

where *n* refers to the number of alters ego is connected to and *L* refers to the number of ties between alters (Prell 2012).

Density represents network closure. It ranges from 0 to 1 and a higher value (close to 1) represents a more closed network. For example, if an actor has an egonet density of .9, this suggests that 90 percent of ego's alters are also connected to each other. If all possible ties between actors are present, the graph or subgraph is considered to be complete (Wasserman and Faust 1994) or closed. Jazz musicians who play in primarily one group experience a closed network phenomenon.

Brokerage

As mentioned above, Burt's (1992) initial book on structural holes can be seen as a theoretical and methodological book in that he specifies formulas to measure the concepts he explains. These formulas have been incorporated into SNA software. There are four measures of structural holes in network analysis: effective size, efficiency, constraint, and hierarchy. However, because of redundancy two are used primarily in the literature, effective size and constraint, therefore, I only incorporate these two measures into the analysis.

Effective size

Effective size measures the extent to which an ego is connected to otherwise disconnected groups or individuals within the network. Effective size is the number of alters, minus the average number of ties that each alter has to other alters, omitting ties to the ego. For example, suppose that A has ties to 5 other actors and none of those actors has ties to any on the others. The effective size of ego's network is 5. Alternatively, suppose that the five alters are all connected to each other. The average degree would be 4 (omitting the tie to the ego) making A's effective size 1. Therefore, effective size is the actual size (or number of alters) reduced by its redundancy (or connections among alters).

Essentially, effect size measures the redundancy of ego's alters. Effective size is computed by subtracting ego's alter's average degree from the number of alters, omitting ties to ego. The lower effective size value suggests that the musicians alters are well connected and ego is more likely to receive redundant information. Conversely, musicians with higher levels of effect size are connected to many otherwise disconnected musicians and is in an ideal structural position to receive the theorized benefits of sparsely connected networks.

Constraint

Constraint is an inverse measure of structural holes. Essentially it is a measure of the extent to which ego is investing in alters that are also invested in egos other alters. Consider Figure 8 (Figure 2.1 from Burt 1992) for reference to the example.

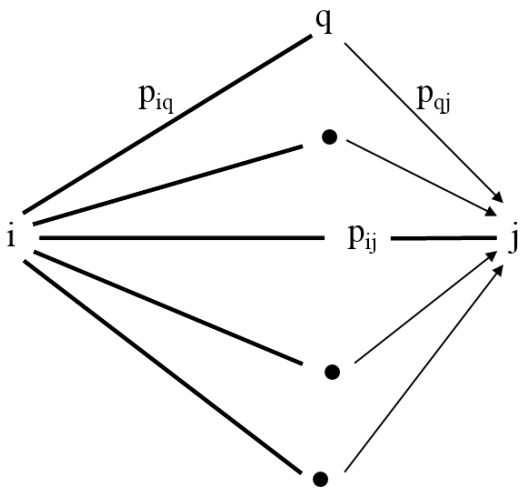


Figure 8. Constraint in Structural Holes

Actor *i* experiences network constraint with actor *j* because: (a) actor *j* has invested in another one of actor *i*'s contacts, *q*, and (b) actor *i* has invested in a relationship with actor *j*:

(4.7)

$$p_{iq}p_{qj}$$

where p_{iq} is the proportional strength of relations between actors *q* and *j*, and p_{qj} is the proportional strength of relationship between actors *i* and *j*. Constraint across all contacts in the network is measured as:

(4.8)

$$c_{ij} = (p_{ij} + \sum_{q} p_{iq}p_{qj})^2 \qquad q \neq i, j.$$

Burt (1992) theorized that the structural hole is beneficial for the entrepreneur. Therefore, actor *j* constrains entrepreneurial opportunities to the extent that (a) actor *i* spent a significant amount of time investing in the relationship with actor *j*, and (b) *j's* personal network is closed or approaching closure thus limiting the opportunities to create structural holes. As the equation measures the value of all ego networks in the larger network, both conditions are measured. When constraint for actor *i* is high, one interpretation is that there are few holes to negotiate while another suggests that all avenues return to the same actor. For example, even if *i* severed ties with *j*, actor *q* is still invested in *j* thus *i* is still connected to *j* indirectly. Thus *j* maintains influence in *i's* network.

To quote from Burt (1992: 55), "with constraint the product of investment multiplied by the lack of structural holes, the expression squared, defines the constraint on you from a lack of primary holes around contact *j*." Thus:

(4.9)

$$\left(p_{ij} + \sum_{q} p_{iq}p_{qj} \right)^2 \qquad q \neq i, j.$$

The sum of equation 4.9 across contacts measures the aggregate constraint on entrepreneurial or brokering opportunities. To summarize, the actor's network activities are constrained if (a) they have invested the bulk of time and energy in relationships that lead back to a single contact, and (b) if their potential brokering opportunities lead back to a single contact.

Hanneman and Riddle (2005) summarize constraint as a the extent to which ego's connections are to those who are connected to one another. They explain the measure using trading partners, i.e., if ego's trading partners all have each other as potential trading partners then ego is highly constrained. Alternatively, if ego's alters do not have each other as trading partners they cannot constrain the ego's behavior. Similarly a jazz musician who is highly invested in one other person may find it exceptionally difficult to create structural holes.

Structural Folds

Identifying the structural fold requires several steps. As Vedres and Stark (2010) suggest, identifying cliques a priori may create a clique bias. Furthermore, the pre-identified clique may not accurately identify a true grouping within the clique. Therefore, I use Ucinet (Borgatti, Everett and Freeman 2002) to identify cliques within the network. There is a discrepancy between how Vedres and Stark identify overlapping cliques and how cliques are identified in Ucinet. However, the output from Ucinet allows me to reach the same conclusions used in Vedres and Stark (2010).

The discrepancy is concerning the algorithm used to identify the cliques. Vedres and Stark use the Clique Percolation Method (CPM) which identifies k-cliques of a minimum number of nodes (i.e., k=3 suggests that the clique must have 3 maximally connected nodes). CPM then identifies adjacent cliques, or cliques with an overlapping member. Ucinet, however does not use the CPM and instead uses the Bron and Kerbosh (1973) algorithm.

The Bron and Kerbosh (1973) algorithm uses a technique to cut off ties that cannot lead to additional cliques. It is a recursive method used to (1) identify actors that belong in a clique, (2) identify sub cliques within the larger clique, and (3) exclude members of the larger clique into smaller cliques thus shrinking the larger clique into multiple smaller cliques. In other words, the method separates network actors into specific cliques that will not and cannot be contained within another clique. Ucinet then extends the application of the algorithm to identify those actors that belong to multiple cliques, or the clique overlap method. Furthermore, like CPM, in Ucinet I am able to identify the minimum number of members to a clique.

I use two values, median and mode, across all years of data as the minimum number of clique members. These values represent the median and mode number of musicians that recorded in separate albums or sessions across all years of data. I reject using the mean because in the 1940's there were several big bands with between 30 and 40 members in the group. This pulled the average number of musicians who recorded an album together upward, thus potentially skewing the results. Furthermore, there are empirical reasons to use median and mode over mean as the typical size of a recording

jazz group of the time was between 4 and 7 people. Thus the median and mode more accurately describe the empirical recording environment.

The actor that occupies a structural fold is identified in the following way:

Step1: Run a clique analysis in Ucinet

Step 2: In Netdraw, visualize the actor by clique adjacency matrix and delete all partially connected actors to the clique. The remaining ties are only the members who are maximally connected to a closed clique. I represent this graphically in Figure 9 where the red circles represent the musicians and the blue squares represent the maximally connected cliques.

Step 3: Run a degree centrality analysis on the new actor by clique matrix exported from Netdraw. This degree measure will give the number of times an individual is connected to a clique, or the number of cliques the actor is a member of.

Step 4: I then use equation 4.*10* to identify the maximum number of dyadic overlaps for each actor. In this case the dyads are cliques, or clique overlap.

(4.10)

$$SF = \frac{D_i(D_i - 1)}{2}$$

where D_i is the degree centrality or network size of actor *i*. Thus, in Figure 9 the four actors in the circle occupy one fold (2 cliques) as their degree is two. A musicians that bridges a structural fold would actively be recording with two or more closed cliques. As mentioned above, this may be quite rare in the network of study.

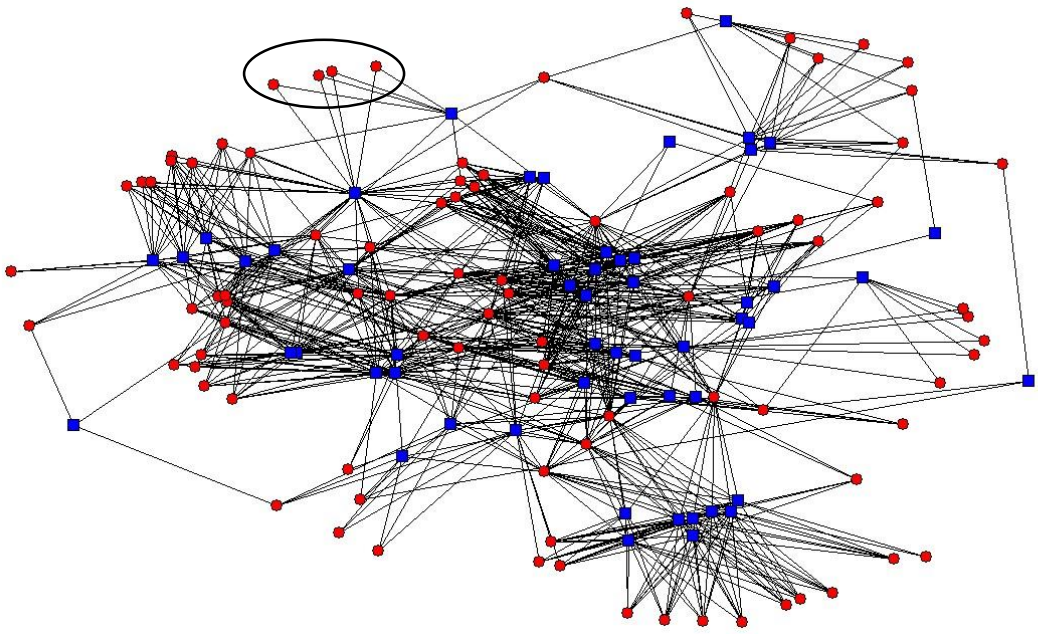


Figure 9. A Partial Clique Participation Network Graph

Core-Periphery

Although the concepts of core and periphery have been used in the literature for decades, prior to 1999 the concept was never accurately defined methodologically (Borgatti and Everett 1999) and the concepts of core and periphery were abstract ideas of network location. As such, Borgatti and Everett (1999) methodologically outline two measures of the core periphery structures: discrete and continuous.

Discrete

The discrete method relies on the notion of a two-class model in which it identifies classes as core and periphery. The core is identified as a densely connected cohesive subgraph while the periphery is identified as actors that are loosely connected to the core. The discrete method uses a blockmodel construct which is similar to the clique method outlined above with the difference being that the blockmodel identifies only one clique as a core. Thus the discrete method identifies the core and periphery where core=1 and periphery=0. The adjacency matrix of an ideal discrete model is depicted in Figure 10 (from Borgatti and Everett 1999), where actors 1-4 make up the core and actors 5-10 the periphery. The discrete method requires the data to be binary, thus I dichotomize the relations between ties.

	1	2	3	4	5	6	7	8	9	10
1		1	1	1	1	0	0	0	0	0
2	1		1	1	0	1	1	1	0	0
3	1	1		1	0	0	0	1	1	0
4	1	1	1		1	0	0	0	0	1
5	1	0	0	1		0	0	0	0	0
6	0	1	0	0	0		0	0	0	0
7	0	1	0	0	0	0		0	0	0
8	0	1	1	0	0	0	0		0	0
9	0	0	1	0	0	0	0	0		0
10	0	0	0	1	0	0	0	0	0	

Figure 10. An Ideal Discrete Core/Periphery Adjacency Matrix

The pattern observed in Figure 10 is rarely realized in empirical data. It is unlikely that most empirical organizations will have a perfectly dense or closed block with another block that contains few ties. Real structures and graphs will only approximately resemble such a structure (I elaborate on this more below). The two-part equation used to identify the discrete method is:

(4.10.1)

$$\rho = \sum_{i,j} a_{ij}\delta_{ij}$$

(4.10.2)

$$\delta_{ij} = \begin{Bmatrix} 1\ if\ c_i = CORE\ or\ c_j = CORE \\ 0\ otherwise \end{Bmatrix}$$

where a_{ij} indicates a presence or absence of a tie, c_i refers to the core or periphery category that actor i is assigned to, and δ_{ij} (also called the pattern matrix) indicates the presence or absence of a tie in an ideal structure.

Continuous

A limitation to the discrete method is the excessive simplicity of partitioning all nodes into two classes: core and periphery. One remedy to this limitation is to eliminate the classes of core and periphery and introduce a less structured and continuous measure approach. The *coreness* structure first identifies the centroid of a Euclidean point cloud,

or the center of some image, based on Pythagorean's theorem. It then recognizes the distance of the node from the centroid and identifies similar nodes in regard to distance from the centroid. The concept of coreness, then, measures the extent to which multiple actors fit or belong to a core. Thus:

(4.11)

$$\delta_{ij} = c_i c_j$$

where *c* is a vector of nonnegative values measuring the degree of coreness of each node. The level of coreness, or pattern matrix, (a) assigns large values to pairs of nodes that are both high in coreness, (b) assigns medium values when one node is high and the other low, thus creating a continuous version of a semi-periphery, and (c) assigns low values to pairs of nodes that are both peripheral (Borgatti, Everett and Johnson 2013). In this instance the mathematical program seeks to find a set of values c_i so that the pattern matrix, or δ_{ij}, is represented by the product of the two nodes' (c_i and c_j) coreness (Borgatti and Everett 1999).

The method uses the MINRES algorithm, also popular in factor analysis, to estimate the value of *c*. In this case the application of the factor analysis is to actors instead of variables. The object is to identify values of *c* so that the correlation between the data matrix and the pattern matrix is high. Essentially, the algorithm identifies commonalities between two nodes within the network. The product of the two nodes'

coreness allows Ucinet to identify groupings that make up a core, semi periphery, and periphery based on continuous values.

There are limitations to empirically testing a hypotheses based off the core/periphery structure. The primary limitation is that equation *4.10.1* and *4.10.2* are required to fit a core and periphery. However, the empirical data may not resemble a core periphery structure. In this instance the equation identifies a mathematical core when an empirical core does not exist. Additionally, adjacency networks that contain distinct and largely exclusive sub groups or cliques may violate the model altogether. The method requires that actors of high degree centrality been connected to each other to create the core and the cohesive subgroups interfere with the accuracy of the method. These limitations may be best illustrated through a series of figures.

Figure 11 is the adjacency network map of musicians in this project in 1948. For clarity, this map includes only the main network component; all disconnected components were omitted. It is clear that there is a distinct and largely exclusive clique in the right portion of the figure.

As stated above, the clique-like subgraph within the circle may affect the accuracy of identifying a core. As seen in Figure 11, this appears to be the case. The discrete method identified the red nodes as the core nodes as depicted in Figure 12. However, this grouping clearly does not occupy a core position within the graph.

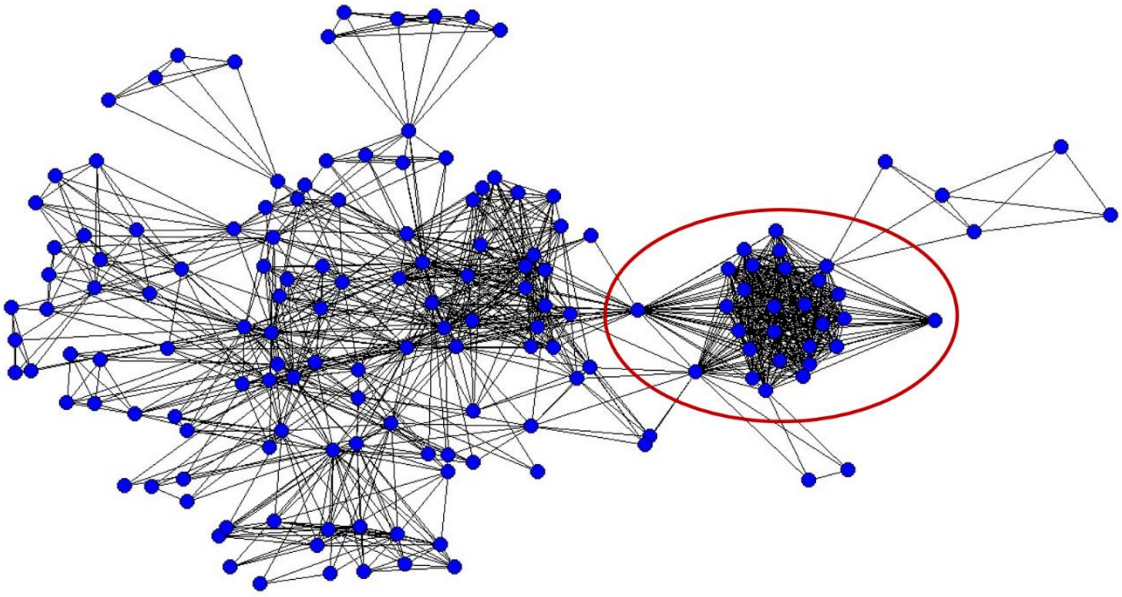


Figure 11. 1948 Main Component

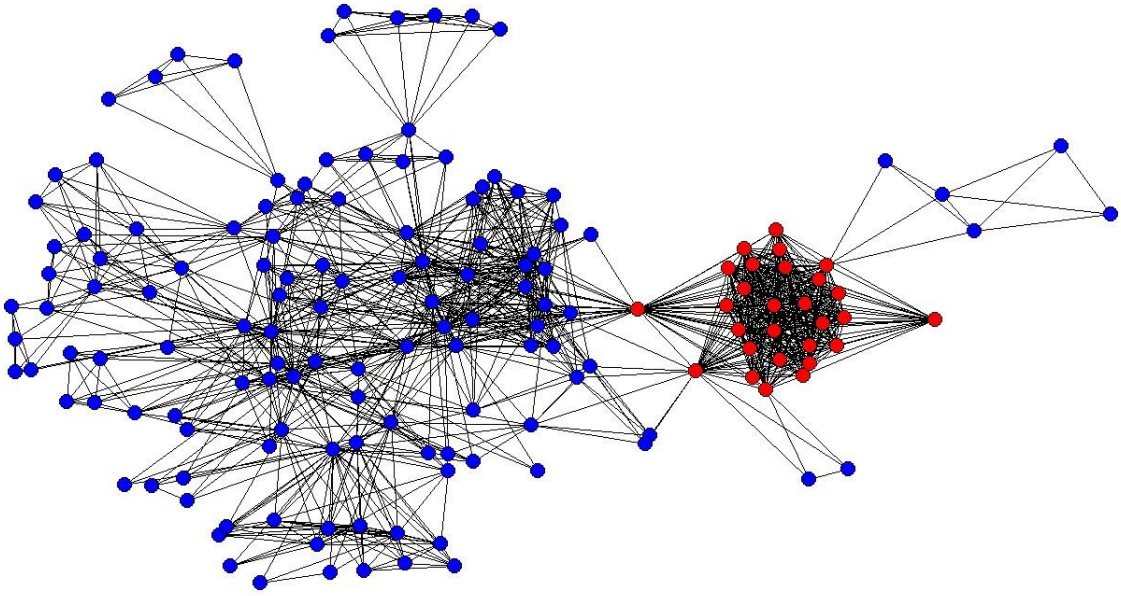


Figure 12. 1948 Discrete Core Periphery Analysis

Because the discrete method may be overly constraining in identifying two classes of groups it is possible that the continuous method may more accurately identify nodes that rank high in the coreness measure which then can be interpreted as the core. This also appears to be the case. As seen in Figure 13, where the red nodes are the core according to the discrete method and the larger nodes have a higher coreness according to the continuous measure.

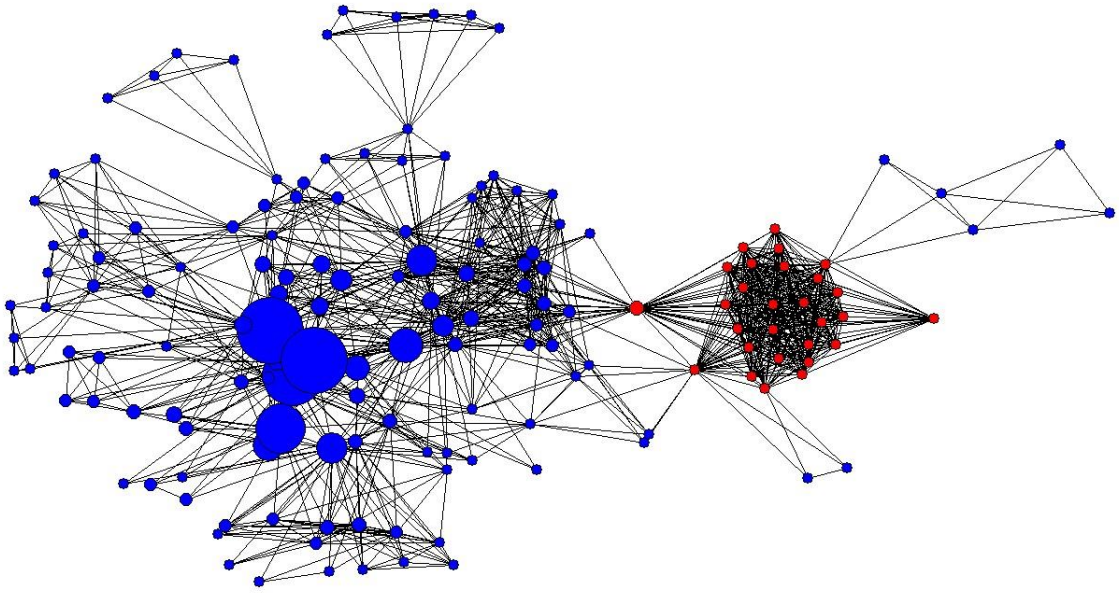


Figure 13. 1948 Core Periphery, Discrete and Continuous Methods

Based on the results highlighted in Figure 13, one may conclude that the continuous measure more accurately identifies the core and thus should be the primary measure of the core periphery method. However, such a conclusion is erroneous as I demonstrate in the following figures.

Similar as above, Figure 14 is the main component adjacency matrix graph used in this project from 1950. There appears also to be a clique toward the bottom, like that in Figure 12. Unlike Figure 12, however, in Figure 14 there appears to be a lack of ties where a centroid may be identified. Thus both continuous and discrete measures may be inaccurate.

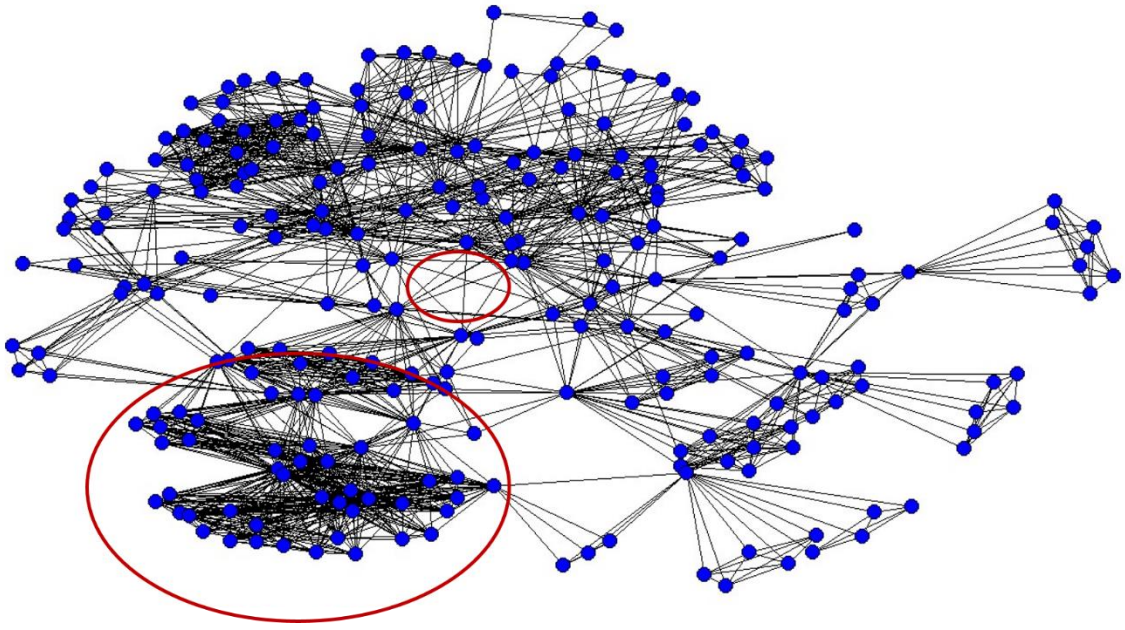


Figure 14. 1950 Main Component

As identified in Figure 15 the discrete method identified the clique-like subgroup as the core. Thus the core is represented by the red nodes and periphery by the blue nodes. Similar to Figure 13, it should be obvious that the red nodes are not at the core of the network and thus should not be identified as the core.

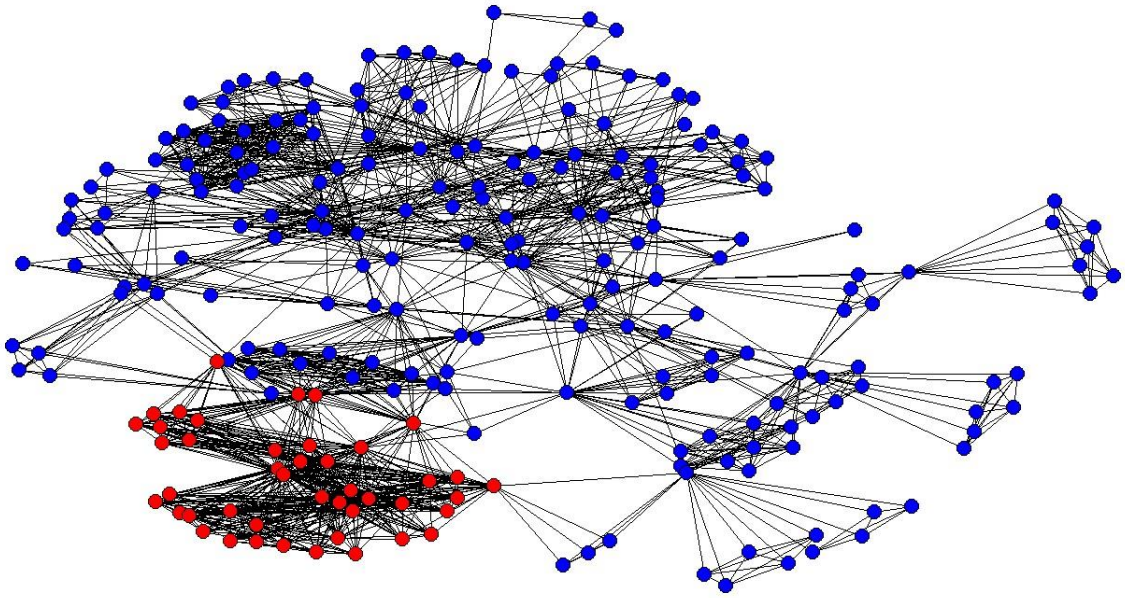


Figure 15. 1950 Core Periphery Analysis

Finally as depicted in Figure 16 the continuous method identifies the same nodes as the discrete method to be the core. The core is represented by the larger nodes and the red nodes. A reason for this phenomenon is that the sparseness in the center of the network impacts identifying the centroid of the Euclidean cloud point. Thus a_{ij} in the equation *(4.10.1)* fails to observe ties within the ideal core of the network.

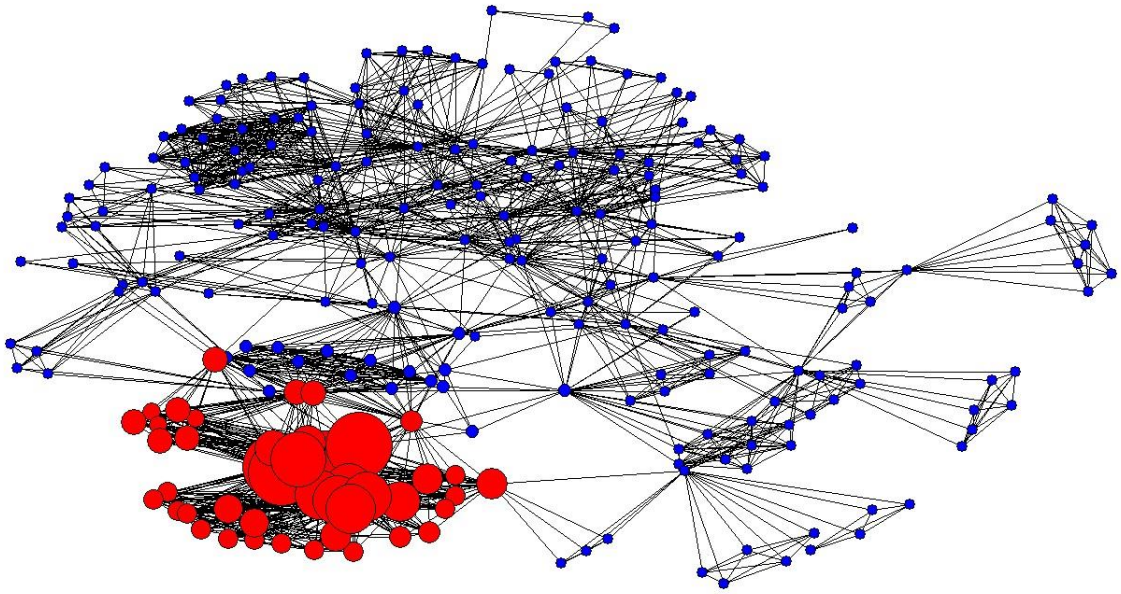


Figure 16. 1950 Core Periphery, Discrete and Continuous Methods

In some networks, then, the number, location, and strength of ties may decrease the accuracy and reliability of the core periphery analysis. As stated above, the method is required to identify a core mathematically. Problems may arise when the mathematical core is not represented empirically, thus rendering it arbitrary or of little value. While I still test the hypotheses on the core periphery structural influences, I raise caution to drawing definitive conclusions if results are statistically significant. Significance would warrant further investigation as to their reliability.

Data

To identify if network structures and characteristics influence artistic innovation and lifetime career success I collect the ego network data of twenty-eight musicians that

were actively recording between 1945 and 1958. This is the era in which small group jazz was most popular. Prior to 1945 and World War II big band or swing jazz was the popular jazz style, and bebop seems to be fully formed in 1945 (Bogdanov, Woodstra and Erlewine 2002). Additionally, there was a recording ban between 1942 and 1944 during which times the only records made were intended as morale boosting efforts for the soldiers fighting in WWII. After 1960 the popularity of jazz decreased significantly. I omitted the records released after 1959 because jazz historians suggest that the hard bop era ended in 1958 and was "worn out" and "overused" by 1960 (Rosenthal 1992). Furthermore, the style changes in 1959 led historians to suggest that 1959 was the beginning of the Modal era. The selected musicians have been identified by jazz historians as innovative and influential to the hard bop style. In order to create an unbiased sample I also selected twenty-nine non-innovators and collect the data of their ego-networks as a control group. This corrects for the sampling on the dependent variable bias.

Typically, sampling on the dependent variable is discouraged. However, when measuring specific and rare outcomes in a unique environment researchers may be forced to wait several years for the phenomenon to occur frequently enough to meet methodological assumptions. To avoid this, researchers sample on the dependent variable to capture the rare phenomenon under study. Forgues (2012) offers a strategy to effectively unbias the sample based on additional data collection. As historical network analysis is new, there are no set methods on how to do this specifically in SNA. When collecting ego network data based on a specific individual characteristic, the number of

individuals that do not match the characteristic will far outnumber the focal actor. For example, in my sample I collect ego network data of 28[10] innovative hard bop musicians. Yet the number of musicians in the sample is in the hundreds in each year. This occurs because for every innovator there are numerous non-innovators with whom the innovator recorded. In 1958, for example, there were 28 innovators and 258 non-innovators.

Yet bias may still occur because of the focus on the networks of innovators. A critique may be that measures will undoubtedly be biased as only the focal actor's ego network data are collected. To correct for this bias I randomly select 29[11] non-innovative musicians and collect their ego-networks as well. I match the characteristics of the innovators and non-innovators so to collect similar individuals at similar times, i.e. all are black males. I analyze all innovators and non-innovators ego networks in all years. This complies with the selection logics outlined on case-study sampling (Forgues 2012). After collecting the non-innovator ego network data the sample size increased substantially. In 1958, for example, there are 28 innovators and 593 non-innovators after collecting the random non-innovators.

---

[10] The hard bop innovators are: Art Blakey, Benny Golson, Blue Mitchell, Bud Powell, Julien Cannonball Adderley, Carl Perkins, Charles Mingus, Clifford Brown, Dexter Gordon, Donald Byrd, Hank Mobley, Horace Silver, J.J. Johnson, Jackie McLean, John Coltrane, Johnny Griffin, Kenny Dorham, Kenny Drew, Lee Morgan, Lou Donaldson, Max Roach, Miles Davis, Sonny Clark, Sonny Rollins, Sonny Stitt, Tadd Dameron, Thelonious Monk, and Wes Montgomery.

[11] The non-innovative musicians are: Al Haig, Al McKibbon, Andrew Simpkins, Benny Carter, Bobby Tucker, Charlie Shavers, Chuck Thompson, Clifford Jordan, Doug Watkins, Elmon Wright, Elvin Jones, Ernie Henry, Fats Heard, Gene Ammons, George Joyner (Jamil Nasser), J.C. Heard, Joe Gordon, John Lewis, Johnny Board, Jymie Merritt, Kenny Hagood, Leonard Gaskin, Maurice Simon, Richard Davis, Slim Gaillard, Stanley Turrentine, Teddy Edwards, Tony Bazley, and Vic Dickenson

The data was collected from Tom Lord's *The Jazz Discography (Lord 2013)* which is regarded by jazz historians and record collectors as comprehensive (Phillips and Kim 2009). Descriptive statistics on musician and their respective instrument are presented in Table 1. In this project I seek to capture the relationship between musicians. Therefore, producers, engineers, directors, arrangers, and any other occupations or positions associated with a record in a way that is not directly making music are omitted. Also, due to the nature of the data and that the jazz network is expansive and has no formal boundaries (Heckathorn and Jeffri 2001), I do not capture the musicians who were well-known but never recorded.

I collect live and studio albums where at least two musicians are present but omit boxed sets and complete recordings as these are typically reissues of a previous record. I also omit records that were organized by third party groups such as film soundtracks, V-Discs, the Jazz at the Philharmonic concert series, and the Armed Forces Radio Service (AFRS) Jubilee. I omit these recordings because the musical groupings were often organized by the third party and given instructions or directed as to the style of music the organizer desired to be played. By omitting these records I capture the connections between musicians that were organized by the musician themselves, not a third party with a possible alternate agenda.

Table 1. Descriptive Statistics of Instrument and Gender

Instrument	Frequency	Percent
Piano	298	12.30
Ball	267	11.02
Drums	232	9.57
Trumpet	331	13.66
Saxophone	269	11.23
Vocal	237	9.78
Guitar	124	5.12
Trombone	230	9.49
Baritone Saxophone	64	2.64
Multi-Instrumentalist	48	1.98
Percussion	16	0.66
Organ	2	0.08
Tuba	9	0.37
Latin Percussion	36	1.49
French Horn	11	0.45
Vibraphone	15	0.62
Clarinet	19	0.78
Accordion	1	0.04
Strings	37	1.53
Harp	2	0.08
Kanoon	2	0.08
Woodwinds	168	6.93
Oboe	1	0.04
Harmonica	2	0.08
Flute	1	0.04
Bassoon	1	0.04
Male	2,311	95.4
Female	112	4.62
Total	2423	100

In the sample, an undirected tie exists between musicians who recorded an album together. The tie exists in the year the record was recorded. However, at the time a single album was often recorded over multiple years with several possible contributing members. An example of this is Thelonious Monk's *Genius of Modern Music, Volume 2* which was recorded on July 23, 1951 and May 30, 1952. Aside from Monk, the musicians that recorded in each session were entirely separate groups. Art Blakey, Sahib Shihab, Al McKibbon and Milt Jackson recorded the 1951 session, while Kenny Dorham, Lou Donaldson, Lucky Thompson, Nelson Boyd, and Max Roach recorded in 1952. In this instance, and others like this, I collect the data by recording session. Those musicians who recorded the portion in 1951 share ties with one another, but not with the musicians who recorded in the 1952 session as it would be erroneous to suggest they recorded together when in fact they did not. It was common practice that individual songs received playtime over the radio, although may have not been released to the public for several years. Therefore a tie exists between musicians at the time of recording and not necessarily the time the record was release to the public for purchase, when those years differ. By collecting the data by session in the year of the session I accurately measure who recorded with whom instead of connecting musicians whose recordings happened to end up on the same album, or compilation record.

I compile the data into a 2-mode matrix or actor by event where the actors are rows and events are columns. In this instance the actor is the musician and the album or session is the column. I then convert the data into a 1-mode matrix or actor by actor as

many measures in SNA require the matrix to be square. A 1-mode actor-by-actor matrix meets this requirements as well as facilitates interpretation.

As with other types of historical research, historical network analysis brings a number of added complications. Because of modern technological advancements, collecting data via datasets and databases has become increasingly easy, although still quite painstaking at times. Collecting historical network data is also becoming more common and possible, though it has not reached the network analysis mainstream as of yet. However, some empirical data that was not collected in its present time cannot be easily located, collected, or recreated.

I encountered much difficulty when deciding on a dependent variable. Ideally, I would capture some quantifiable measure of success such as record sales, radio play time, data on concert attendance, etc… However, since the sample was actively recorded so long ago there is very little quantifiable data on the musicians' success. Instead, I focus on proxy measures. The dependent variables in question are designed to answer three specific questions. The first queries about innovation and the historical importance of certain musicians. In essence I seek to understand if the musicians'

network influences whether or not historians will consider them important and innovative. There clearly is some room for argument as to which historian says what about the musicians as some historians may consider Miles Davis a hard bop innovator and others may not. In order to limit such discrepancy I collect the names of innovators from numerous reputable sources. However, admittedly there is room for heterogeneity here.

The second variable addresses how the jazz community views the musicians and measures whether or not the musician has been inducted into the DownBeat Hall of Fame. There are three ways that a musician can be inducted into the DownBeat Hall of Fame: readers' poll, critics' poll, and veterans committee. The induction is meant to be for jazz musicians by jazz musicians. Thus it is a genre-specific award. The third variable is an industry specific variable, whether or not the musicians has won a Grammy Lifetime Achievement award. This variable examines the extent to which the jazz musician is regarded as successful to the overall music industry.

Table 2. Descriptive Statistics of Select Variables

Year	Number of Musicians	Mean Degree	SD Degree	Mean Ego Density	SD Ego Density	Mean Structural Folds*	SD Structural Folds*	Mean Discrete Core-Periphery	SD Core-Periphery
1945	406	16.57	10.75	0.86	0.22	4.71	19.23	0.14	0.35
1946	446	17.57	11.23	0.84	0.23	5.51	19.21	0.1	0.3
1947	433	15.86	10.14	0.85	0.22	12.34	48.09	0.09	0.29
1948	209	14.01	9.29	0.86	0.22	7.41	24.55	0.13	0.34
1949	368	15.89	9.59	0.87	0.21	21.38	118.73	0.08	0.27
1950	314	13.33	8.96	0.86	0.23	5.18	24.62	0.14	0.35
1951	307	11.42	8.19	0.87	0.23	5.65	39.18	0.13	0.34
1952	356	12.16	8.91	0.84	0.24	3.91	18.03	0.07	0.27
1953	381	13.43	10.58	0.85	0.24	10.39	47.69	0.09	0.29
1954	341	10.84	8.25	0.85	0.24	5.26	30.42	0.07	0.26
1955	373	13.16	11.73	0.84	0.25	31.96	177.31	0.09	0.28
1956	457	17.16	15.31	0.78	0.27	109.93	516.2	0.19	0.39
1957	519	17.43	15.33	0.78	0.27	549.43	3391.54	0.24	0.43
1958	620	17.76	16.99	0.79	0.27	248.21	1647.45	0.23	0.42

*Presented as the clique median

(5)

The independent variables are the measure outlined above and computed in Ucinet. I use the results of the network analysis as predictive variables. As some of the network measure are uninterpretable I only include descriptive statistics of variables with substantive meaning. They are presented in Table 2.

Outliers in Network Analysis

While doing preliminary analyses on the data I noticed something that caused some concern. Namely, the degree centrality of a few actors are significantly higher than the mean (see Figure 17). There are some important implications of this. Primarily, while degree centrality is only one network measure several other measures are based on it. For example, eigenvector centrality, effective size, and constraint all incorporate degree centrality into their equations.

To complicate the matters, when analyzing the measures mentioned above in ego-networks the centralities of one actor influence the centralities of their alters. For example, eigenvector centrality identifies how well the ego's alters are connected. By definition then, the alter of an actor with high degree centrality will be identified as more connected to the network. Thus one interpretation could suggest that this actor is important to the overall structure of the network, when in fact they are only connected to one actor with high degree. While this interpretation is not incorrect outright, it does require, at minimum, a deeper understanding of the network.

To illustrate these points we must examine the data more closely. As identified if footnote 9, Charlie Shavers was one of the randomly selected 29 non-innovator

musicians mentioned above. Shavers was one of the great trumpet players to emerge in the swing era (Bogdanov, Woodstra and Erlewine 2002). Although very important to the numerous big bands with whom he recorded, Shavers rarely stepped into the center stage, figuratively. He did, however, record prolifically with a number of swing bands. According to the Tom Lord Discography, Shavers is the 34th most recorded jazz musician of all time (Lord 2013). Additionally, as mentioned above Shavers was a big band musician while most of the other musicians in the sample are small group musicians. This means that if Shavers recorded on one album in a given year, his degree centrality would be around 25 while the small group musician's degree would be around 4. The differing qualities of the two types of musician's networks create the possibility of skewing the outcomes of the network measures.

The literature referring to outliers in network analysis is non-existent. There are a number of reasons for this. First, network researchers often create a network from a given group, a group of workshop attendees for example, and outline the parameters of the data they are collecting. For example, a sample dataset included with Ucinet builds a network of workshop attendees by asking them to name the top three people they spent time with over the past week. Each participant, assuming they follow directions, would name three people. There is little room for an outlier to emerge is such a network. Second, historical network analysis, an area in which outliers may be more likely to emerge, is only a budding topic of study (Vedres and Stark 2010). Therefore, I have not found any generally accepted methods to control or correct for network outliers.

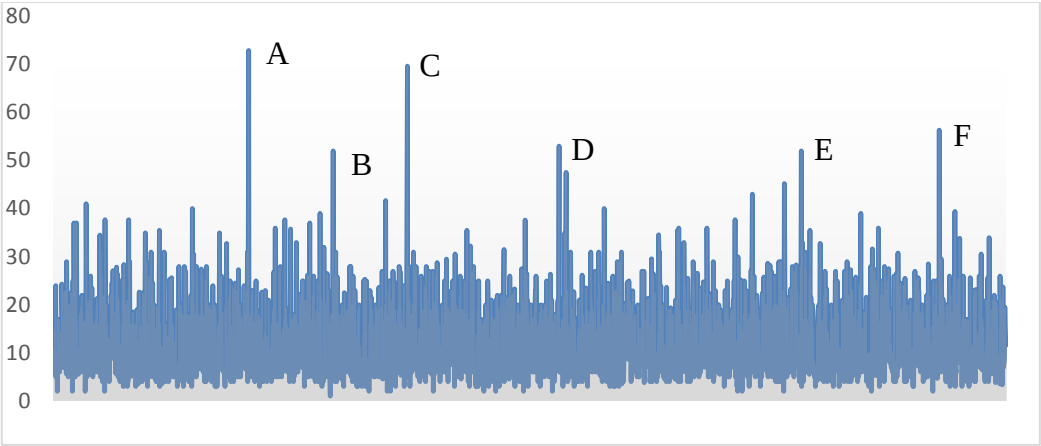


Figure 17. Average Individual Degree Centrality 1945-1958

I suggest that handling an outlier is different in network analysis from other statistical methods. To illustrate, Figure 17 is the average degree centrality for all musicians between 1945 and 1958. I label the musicians with an average degree centrality greater than 50 (letters A through F, presented in Table 3). As stated above, in SNA one actor's centrality affects their alters' centralities and when collecting ego networks an individual actor's presence in the network is dependent on other network actors. To illustrate, in Figure 17 letter A is Charlie Shavers and actors C, D, E, and F are Shavers' alters. Those individuals are in the network only because they are connected to Shavers. With this in mind I suggest that when omitting outlying cases in network analysis the individual and their ego network should be omitted. Therefore, when results differ I present them with and without Charlie Shavers' ego network.

Table 3. Musicians Whose Average Degree > 50

	Average Degree
A. Charlie Shavers	73
C. Frank Rehak	70
F. Tom Mitchell	56
D. Jim Dahl	53
B. Donald Byrd	52
E. Phil Bodner	52
Mean average degree of all musicians	13

CHAPTER V

RESULTS

The results of the statistical analyses are presented in the tables below. I use personal characteristics, i.e., primary instrument and gender, and genre identifiers (i.e., hard bop and cool) as control variables. The genre identifier is a period specific effect which controls for the influence of the sample year on the dependent variables. Ideally, an analysis would include more controls in the statistical model. However due to information constraints of the historical data there are few measures to include. With the control variables I seek to separate any personal effect from the network effect. Thus the result will capture the effect of the network independent of some individual characteristics.

As stated above I measure three dependent variables: whether or not historians consider the musician a hard bop innovator, whether or not the musician is in the DownBeat hall of fame, and whether or not the musician has won a lifetime achievement award. As all three are measures of success they are significantly correlated at the $p<.01$ level as shown in Table 4. However, substantively these measures come from three distinct approaches; where innovation can also be considered as a measure of historical significance as it is derived from jazz historians, the Grammy Lifetime achievement award is a measure of success in the musical industry, and the DownBeat hall of fame induction is a measure of genre specific success or success within the jazz industry.

Table 4. Bivariate Correlation Matrix for Innovation, DownBeat Hall of Fame and Grammy Lifetime Achievement

	1.	2	3
Innovation	1.00		
DownBeat	0.42**	1.00	
Grammy	0.33**	0.55**	1.00

(n=5533) **p<.01

The results for the logistic regressions are presented in tables 5 through 10. There were, however, no statistically significant results in predicting the likelihood of winning a Grammy Lifetime Achievement award. I find no support for any hypothesis regarding this variable. An explanation to this may be the basis on which an individual would win the award. The award is given to individuals who have made significant contributions to the field of recording. Therefore, it is possible that the individuals in the sample who have won the award were important to jazz, but whose interpersonal networks expanded beyond the sample thus making them peripheral actors in the jazz specific network.

In several models the results for the variable Female (0=male, 1=female) suggests that there is a positive relationship between women and success in this jazz market. These results seem rather odd given the percentage of female jazz artists at the time and in the sample (3.51%). These results must be interpreted within the context of the sample, which is made up of relatively successful jazz musicians, or those who have "made it." This is to suggest that being a female *in this sample* may increase the likelihood of having an overall successful career according to the measured dependent

variables. It is not to suggest that female jazz artists are inherently successful. Rather, that female artists in a network of musicians that have "made it" are likely to stand out among their counterparts and be recognized for their achievements. Given that the sample is over 96% male it is safe to presume that there are likely many female jazz musicians who struggled in their careers based on gender inequality in the jazz industry. The logistic regression coefficients for the other dependent variables are presented in Tables 5 through 10.

The results from table 5 suggest that there are some measures of centrality that significantly predict the likelihood of being considered a hard bop innovator. Specifically, there is a positive relationship between degree and innovation that is significant at the $p<.05$ level. This suggests that those who have a higher number of ties to other musicians are more likely to be considered a hard bop innovator. An interpretation of this coefficient in percent change in odds ratio suggests that for every one additional tie added to ego's network ego is 4.6% more likely of being considered an innovative hard bop musician. This finding support the Hypothesis 1. I also find a marginally significant ($p<.1$) relationship between closeness and innovation which suggests that individuals who are closer to all other actors in the network are more likely to be considered a hard bop innovator. This finding give marginal support for Hypothesis 4. The results for eigenvector and betweenness do not suggest a significant relationship exists. I thus find no support for Hypotheses 2 or 3 regarding innovation.

Table 5. Summary of Logistic Regression Coefficients Predicting Likelihood of Being Considered a Hard Bop Innovator - Centrality

	Model 1	Model 2	Model 3	Model 4	
Degree		0.045*			
		(0.023)			
Eigenvector			1.255		
			(5.284)		
Betweenness				5.0 E-4	
				(1.9 E-4)	
Closeness					-7.4 E-4^{+}
					(5.7 E-4)
Piano	0.9511	1.235	0.568	0.796	1.618
	(1.689)	(1.649)	(1.751)	(1.794)	(1.628)
Bass	-1.259	-1.592	-1.677	-6.559**	-1.273
	(2.397)	(2.448)	(2.126)	(2.539)	(2.035)
Drums	-0.536	-0.613	-1.115	-0.741	-.0841
	(2.015)	(1.969)	(2.014)	(2.206)	(1.958)
Trumpet	0.535	0.710	0.284	0.468	0.397
	(1.714)	(1.667)	(1.765)	(1.812)	(1.709)
Saxophone	1.857	1.612	0.876	1.793	1.575
	(1.622)	(1.578)	(1.729)	(1.715)	(1.601)
Other	-6.454**	-7.032**	-2.687	-6.75**	-2.466
	(1.716)	(1.657)	(2.359)	(1.767)	(2.989)
Cool	0.319	0.577	0.232	0.393	0.212
	(0.691)	(0.708)	(.765)	(0.709)	(0.769)
Hardbop	0.137	0.099	-3.0 E-3	-0.072	0.077
	(0.624)	(0.643)	(0.686)	(0.661)	(0.687)
Constant	-19.912**	-22.168**	-22.885**	-21.256**	-22.374**
	(1.611)	(1.606)	(1.681)	(1.695)	(1.777)
LR $\chi 2$	1503.38**	1417.58**	1505.70**	1414.47**	1485.12**
Wald $\chi 2$	78.62**	93.14**	7.05	99.87**	9.86

N of Person-Years=5533 $^{+}$p<.1 *p<.05 **p<.01 (two-tailed test)

Table 6. Summary of Logistic Regression Coefficients Predicting Likelihood of Induction in the DownBeat Hall of Fame - Centrality

	Model 1	Model 2	Model 3	Model 4	Model 5
Degree		0.023^{+}			
		(0.014)			
Eigenvector			0.527		
			(3.356)		
Betweenness				2.7 E-4*	
				(1.2 E-2)	
Closeness					-8.1 E-4**
					(3.2 E-4)
Female	1.676*	1.540^{+}	1.621^{+}	1.459^{+}	1.689*
	(0.847)	(1.191)	(0.949)	(1.125)	(0.842)
Piano	2.288*	2.991**	2.313*	2.984**	2.431*
	(1.0165)	(1.165)	(1.025)	(1.129)	(1.053)
Bass	0.575	-0.480	0.498	-0.091	-0.062
	(1.104)	(1.296)	(1.059)	(1.261)	(1.115)
Drums	0.566	0.821	0.546	1.087	1.216
	(0.999)	(1.229)	(1.018)	(1.219)	(1.108)
Trumpet	0.658	0.887	0.635	1.294	1.122
	(0.964)	(1.181)	0.982	(1.161)	(1.064)
Saxophone	1.833*	2.870**	1.839*	2.678**	1.919^{+}
	(0.956)	(1.108)	(0.971)	(1.089)	(1.051)
Other	-2.336*	-1.493	-2.55**	-0.638	-0.964
	(0.953)	(1.172)	(0.983)	(1.146)	(1.062)
Cool	0.364	0.631^{+}	0.366	0.563^{+}	0.344
	(0.383)	(0.426)	(0.391)	(0.413)	(0.359)
Hardbop	0.244	0.377	0.241	0.329	0.351
	(0.350)	(0.388)	(0.358)	(0.379)	(0.332)
Constant	-11.976**	-16.656**	-12.012**	-14.889**	-10.138**
	(0.899)	(1.108)	(0.961)	(1.061)	(1.087)
LR $\chi 2$	2601.33 **	2543.46**	2597.88**	2492.59**	2492.80**
Wald $\chi 2$	70.75**	64.09**	70.27**	46.20**	46.86**

N of Person-Years=5533 $^{+}$p<.1 *p<.05 **p<.01 (two-tailed test)

The results for the centrality hypotheses with whether or not the musician has been inducted into the DownBeat Hall of Fame are presented in Table 6. I find marginally significant results ($p<.1$) for degree centrality. This interpretation in percent change in odds ratio suggests that for each additional tie added the actor is 2.3% more likely of being inducted into the DownBeat Hall of Fame. These results offer marginal support for Hypothesis 1. Musicians who occupy a gatekeeping position are also more likely to be in the DownBeat Hall of Fame as suggested by the significant results for betweenness centrality. This result supports Hypothesis 3. Finally, I find strong support for Hypothesis 4 ($p<.01$) which suggests that there is a strong relationships between closeness centrality and the DownBeat Hall of Fame. I find no support for Hypothesis 2 regarding the likelihood of being inducted into the DownBeat Hall of Fame.

Table 7. Summary of Logistic Regression Coefficients Predicting Likelihood of Being Considered a Hard Bop Innovator - Brokerage and Closure

	Model 6	Model 7	Model 8	Model 9
Density	-6.669**			
	(1.346)			
Effective Size		0.085**		
		(0.0289)		
Constraint			-2.560^{+}	
			(1.435)	
Structural Folds				2.2 E-4
				(2.4 E-4)
Piano	1.086	1.199	0.807	0.517
	(1.829)	(2.116)	(1.680)	(1.696)
Bass	-7.086*	-5.474*	-1.273	-1.541
	(2.213)	(2.521)	(2.035)	(2.655)
Drums	-1.488	1.422	-0.841	-0.616
	(2.215)	(2.971)	(1.958)	(2.189)
Trumpet	0.140	0.532	0.397	0.720
	(1.840)	(2.120)	(1.709)	(1.698)
Saxophone	1.527	1.902	1.575	1.608
	(1.769)	(2.252)	(1.590)	(1.614)
Other	-7.502**	-6.682**	-2.466	-6.209**
	(1.816)	(2.252)	(2.987)	(1.658)
Constant	-17.738**	-19.491**	-22.374**	-19.979**
	(1.919)	(2.085)	(1.777)	(1.603)
LR $\chi 2$	1174.34**	1358.41**	1485.12**	1492.34**
Wald $\chi 2$	101.19**	59.64**	103.19**	94.09**

N of Person-Years=5533 $^{+}$p<.1 *p<.05 **p<.01 (two-tailed test)

The results for the brokerage and closure hypotheses are presented in Table 7 and 8. These results highlight the most compelling argument in the study; namely, the benefit of sparse networks. I find a strong and negative relationship between density and the likelihood of being considered a hard bop innovator, which does not support Hypothesis 5. This result suggests that if a musician is part of a closed network, or as their ego-network approaches closure, they will be significantly less likely to be considered an innovator. Similarly, I find strong support for effective size, which measures the presence or absence of structural holes. The positive coefficient suggests that individuals whose immediate network is rich with structural holes is like to be considered innovative. These results support Hypothesis 6. The results also suggest there is a marginally significant relationship between constraint and innovation, thus yielding marginal support for Hypothesis 7. Finally, I find no support for the structural fold argument or Hypothesis 8.

Table 8. Summary of Logistic Regression Coefficients Predicting Likelihood of Induction in the DownBeat Hall of Fame - Brokerage and Closure

	Model 6	Model 7	Model 8	Model 9
Density	-3.238**			
	(0.697)			
Effective Size		0.044**		
		(0.017)		
Constraint			-0.158	
			(0.640)	
Structural Folds				7.7 E-5
				(1.0 E-4)
Female	2.100*	1.601^{+}	1.362^{+}	1.615^{+}
	(1.098)	(0.924)	(0.954)	(0.987)
Piano	2.679^{+}	2.023*	2.309**	2.251*
	(1.464)	(0.926)	(0.977)	(1.038)
Bass	-0.686	-1.336	0.291	0.486
	(1.585)	(1.056)	(1.343)	(1.064)
Drums	0.692	0.525	0.209	0.396
	(1.541)	(1.081)	(1.137)	(1.021)
Trumpet	1.088	0.410	0.675	0.624
	(1.494)	(0.963)	(0.952)	(0.974)
Saxophone	2.374^{+}	1.689^{+}	1.833	1.824*
	(1.436)	(0.936)	(0.940)	(0.968)
Other	-1.167	-2.477**	-1.494^{+}	-2.766**
	(1.477)	(0.987)	(0.958)	(0.983)
Constant	-12.561**	-14.159**	-11.636**	-12.207**
	(1.502)	(0.888)	(0.915)	(0.910)
LR $\chi 2$	2268.74**	2492.25**	2574.52**	2597.01**
Wald $\chi 2$	62.05**	66.62**	44.71**	72.74**

N of Person-Years=5533 $^{+}$p<.1 *p<.05 **p<.01 (two-tailed test)

Similarly with Table 7, I find significant results for sparse networks and their effect on the likelihood of being inducted into the DownBeat Hall of Fame, presented in Table 8. These findings support Hypotheses 6 and do not support Hypothesis 5. These results also suggest that actors whose immediate networks are rich with structural holes and are sparsely connected are more likely to be inducted into the DownBeat Hall of Fame. I find no support for Hypotheses 7 or 8, regarding the effect of constraint and the presence of structural folds.

I present the regression coefficients for the movement from a periphery to core location in Tables 9 and 10. If the theory was supported in this network I would expect a negative and significant relationship in the years 1945-1949 (models 10 and 11) and a positive and significant relationship between the years 1954-1958 (models 12 and 13). As the results suggest, the core periphery hypotheses are not supported. While one result is statistically significant (Model 11 in Table 10) it's corresponding component of movement from core to periphery is not. Therefore the hypothesis is still not supported.

Perhaps the theory refers less to the network structure of core and periphery and more to a position of status. As Schumpeter (1948) suggests, core actors are incumbents who are then challenged and replaced by peripheral actors or innovators. The logic is sound, although it is questionable if Schumpeter was referring to a network structure instead of a social or industry status quo. The results suggest there is no support for Hypotheses 9 and 10.

Table 9. Summary of Logistic Regression Coefficients Predicting Likelihood of Being Considered a Hard Bop Innovator - Core & Periphery

	Model 10 1945-1949	Model 11 1945-1949	Model 12 1954-1958	Model 13 1954-1958
Core-Periphery	-0.709		-0.326	
(Discrete)	-1.209		(0.798)	
Coreness		7.212		9.201^{+}
(Continuous)		(6.915)		(4.930)
Piano	1.957	1.203	6.956**	6.551**
	(2.397)	(2.372)	(2.328)	(2.081)
Bass	-0.508	-1.814	0.690	0.166
	(2.813)	(3.131)	(2.663)	(2.291)
Drums	0.906	-0.573	3.843	0.852
	(2.515)	(2.647)	(4.003)	(2.294)
Trumpet	8.3 E-3	-1.027	7.195**	6.558**
	(2.433)	(2.483)	(2.334)	(2.090)
Saxophone	2.003	1.522	8.366**	7.836**
	(2.370)	(2.393)	(2.320)	(1.989)
Other	-1.567	-2.481	-0.826	-1.003
	(2.576)	(2.543)	(2.457)	(2.137)
Constant	-18.645**	-20.883**	-19.512**	-16.544**
	(3.152)	(2.107)	(2.648)	(1.896)
LR $\chi 2$	332.65**	307.25**	503.38**	477.35**
Wald $\chi 2$	6.4	8.08	60.23**	73.95**
N of person-years	1141	1141	1273	1273

$^{+}$p<.1 *p<.05 **p<.01 (two-tailed test)

Table 10. Summary of Logistic Regression Coefficients Predicting Likelihood of Induction in the DownBeat Hall of Fame - Core & Periphery

	Model 10 1945-1949	Model 11 1945-1949	Model 12 1954-1958	Model 13 1954-1958
Core-Periphery	-0.574		-0.103	
(Discrete)	(0.633)		(0.606)	
Coreness		8.307*		4.543
(Continuous)		(3.901)		(3.613)
Female	1.553^{+}	1.823^{+}	8.503**	3.989**
	(0.996)	(1.225)	(2.822)	(1.134)
Piano	2.842^{+}	4.265**	7.684**	2.727*
	(1.605)	(1.709)	(1.574)	(1.396)
Bass	0.106	1.715	6.264**	1.369
	(1.683)	(1.891)	(1.955)	(1.465)
Drums	1.760	3.353*	7.013**	2.136^{+}
	(1.671)	(1.773)	(1.938)	(1.438)
Trumpet	0.142	1.728	7.386**	2.294^{+}
	(1.605)	(1.759)	(1.627)	(1.423)
Saxophone	1.939	3.454*	8.530**	3.617**
	(1.609)	(1.707)	(1.601)	(1.424)
Other	-0.483	1.102	-1.135	-1.363
	(1.564)	(1.644)	(1.567)	(1.421)
Constant	-8.504**	-10.694**	-17.699**	-12.847**
	(1.916)	(1.720)	(1.835)	(1.299)
LR $\chi 2$	556.88**	508.03**	802.96**	808.91**
Wald $\chi 2$	24.02**	15.21*	134.52**	45.15**
N of person-years	1141	1141	1273	1273

$^{+}$p<.1 *p<.05 **p<.01 (two-tailed test)

CHAPTER VI

CONCLUSIONS AND DISCUSSION

In this project I analyze the structural network influences on historical importance and innovation and career success in the jazz labor market. I tested a variety of structural indicators and existing hypotheses to determine if a relationship exists between one's structural position the larger network and the likelihood of being a successful jazz musician according to three proxy measures of success.

As stated in the previous chapter, the primary results of the longitudinal logistic regression support the sparse networks and structural holes theories. Specifically, the likelihood that musicians will have successful careers increases significantly as their networks become less densely connected or closed. This study lends additional support to the extensive research on network sparseness, structural holes, weak ties, and brokerage.

These conclusions may lead the reader to ask what the importance is in doing another analysis in which the results are the same, namely closure is bad in American markets. Or why does a network analysis of the jazz market shed any light on network structure and career success? This question is deserving of some focus.

Primarily, the jazz network, and potentially the music industry in general, is a good area to focus on brokerage and closure simply because music is recorded in groups. Even more so in the 1940s and 1950s, the time in which the networks of study were being formed. As mentioned above, the spontaneous nature of jazz creates incentives to

form a secure and steady group in which all members can trust and rely on one another. Thus, the closed formation is a logical choice for creating the best product (record) possible. As Obstfeld (2005) suggests, the dense or closed network reduces the obstacles to initiating a coordinated plan and purpose and may assist in the implementation of innovative practices.

The second reason to why jazz is a good network of study is embedded within the first reason mentioned above, namely that jazz is created within groups and is a spontaneous art form. Bebop brought improvisation to the core of small group jazz. Improvisation, or the spontaneous creation of music, required that the group be able to communicate musically with one another. As improvisation became increasingly important in jazz so did the ability for the musicians to work in a cohesive fashion. Additionally, in creating the musical conversation improvisers often used musical hints or cues that the other musicians would respond to. These musical cues required that the musicians be familiar with each other's styles which further amplifies the logic of creating a cohesive subgroup.

The jazz network, therefore, offers a good platform to find statistical significance for the closure argument. Several other studies that support the structural hole or sparseness argument focus on individuals and fail to analyze individuals within groups. The jazz network is comprised purely of individuals performing within groups and therefore is a good area to test brokerage and closure. However, even though the jazz network is a good area for structural closure I find overwhelming support for the brokerage theoretical tradition.

These results may also give credence to jazz as an improvisational and rapidly changing art form. As mentioned above, Gioia (1997) states that the jazz musician has a restless soul, constantly moving forward from one tradition to the next. Furthermore, Post WWII jazz styles changed frequently for a number of years which may influence the negative effect of committing to a closed group of musicians. Instead, those musicians whose networks were more expansive were likely able to change from one style to another with ease.

The jazz network also was not specifically incorporated into the capitalistic competitive environment. The structural hole argument, which may be the most widely known network application, takes a very strategic approach to maximizing the resources embedded in one's network. In a sense, the framework may be overly rational and the outcomes of several of Burt's analyses (e.g., promotions and profit) are independent of any group cohesive characteristics. Additionally, the language of structural holes theory is often a language of competition, control, relative advantage, and manipulation. Musicians who recorded together sought to create the best music possible which required all members to perform well. In the jazz scene then, there was no *tertius gaudens* (third who enjoys) as explained by Simmel (1950). The study instead may provide support for the *tertius iungens* or "as a means to the ends of the group" framework (Simmel 1950: 154). The *tertius iungens* logic, similar to Lawler's (2000) work on the productive exchange, offers a different form of cooperative strategy that constitutes a loss of broker control but offers a potential for long-term artistic creation and group cohesion (Obstfeld 2005). Differing from Burt's view, Obstfeld (2005)

suggests that brokers can exist for a mutually beneficial purpose. This, I suggest, is more fitting to the jazz community.

The *iungens-gaudens* paradox also offers explanation as to why Density and Effective Size were significant while Constraint was not. As Burt (1992: 54) indicated, "Contact j constrains your entrepreneurial opportunities to the extent that: (a) you've made a large investment of time and energy to reach j, and (b) j is surrounded by few structural holes with which you could negotiate to get a favorable return on investment." Despite the strong correlation between density and constraint (.436, $p<.000$, two-tailed test) the failure to predict success as induction in the DownBeat Hall of Fame suggests that while sparse networks are highly predictive of success, ego's behavior being strategically constrained by their alters does not predict success or artistic innovation. Therefore, the *tertius iungens* tradition is particularly applicable to the jazz network and warrants further investigation aside from this initial project.

There are several avenues to extend this research. As the sample is longitudinal I intend to more fully incorporate a dynamic or time sensitive component to extend the analysis. Specifically, I intend to identify whether network change influences one's likelihood of success. This project clearly implies that sparsely connected networks are beneficial in jazz but it does not discuss network change. To illustrate, a musician may have a sparsely connected network in every year, but his or her alters may also be the same every year. This measure does not capture the extent to which the actor is gaining new alters and losing old alters. These results would suggest the importance of changing alters in a changing network.

Also, recently I was able to collapse the fourteen years of network data into one large network. This larger network in comprised of ties across all actors in all years and incorporates them into one network matrix. Essentially this allows me to analyze network characteristics across time. One limitation of longitudinal network data is that the data essentially resets itself in each year. Empirically, however, cliques or groups or any set of relations do not reevaluate the content of their ties on December 31st each year. Therefore, network relations likely exist across time. While this train of thought is relatively young and I am unaware of any studies that follow such an orientation, I hope to identify ways to analyze networks collected over time independent of time.

Finally, I wish to address to what extent this analysis and subsequent findings are generalizable to other areas of network research. This project is essentially a structural network analysis. The results from the previous chapter suggest that only on rare occurrence is there consistent statistical significance of a qualitative or individually descriptive characteristic. Thus the findings are generalizable to other networks that share similar characteristics (i.e., large fluid networks with low whole-network density).

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APPENDIX A

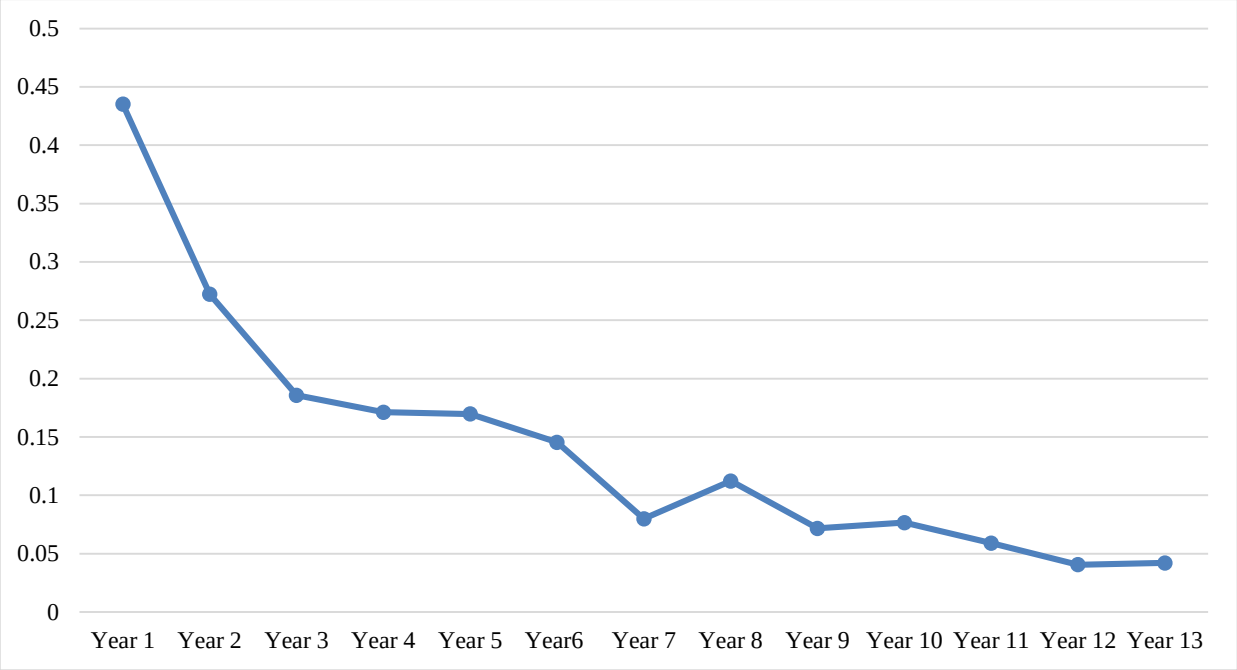


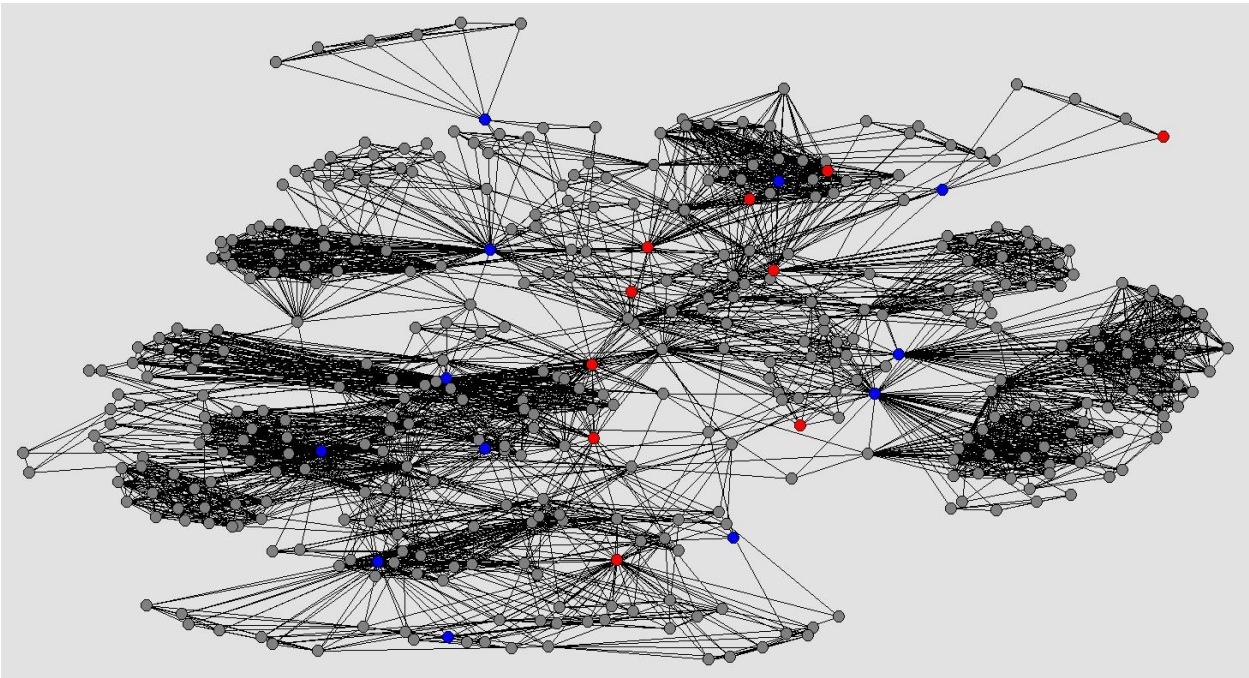
Figure 18: Average Matrix Correlations by Year

The above graph show the decrease in matrix correlations between each year and the years following. The matrix correlation is a network tool used to determine the similarities between two matrices with similar actors. In this case I correlate each matrix with the matrix at year + 1, year + 2, year + 3, etc… For example, if the year in question is 1948, year +1 is 1949, year + 2 is 1950, etc… Essentially this graph suggests that the average matrix correlation between a given year and year +1 is .44, approximately. The correlation with year and year + 2 drops to roughly .265. The same interpretation can be made with year and year + 3 and so on. This graph shows that the jazz network changed

quite rapidly which is particularly relevant given the characteristics of jazz improvisation and small groupings in the period of study.

Network Graphs

To visualize the network component of the project, below I provide the network map or diagram from each year. As mentioned above, the node is the individual and the tie represents a relation created through recoding a session mutually. Within the graph the red nodes are the 28 historically important and innovative musicians while the blue are the 29 musicians chosen at random to balance the sample.



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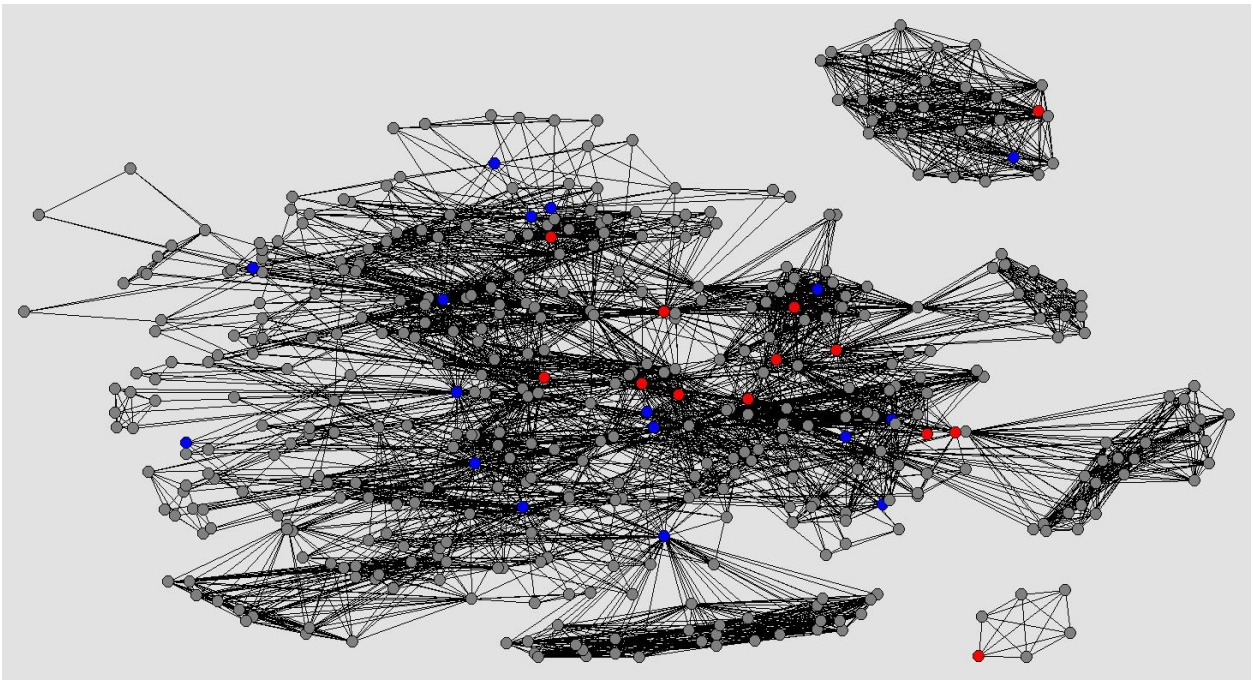

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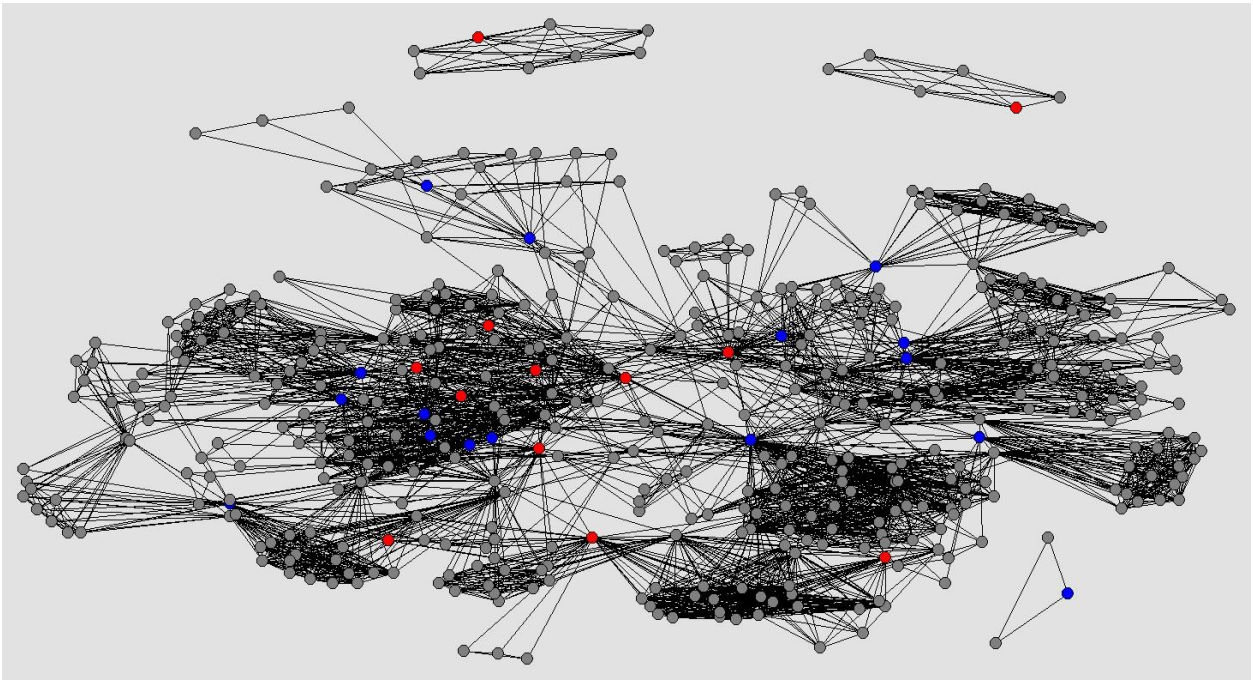

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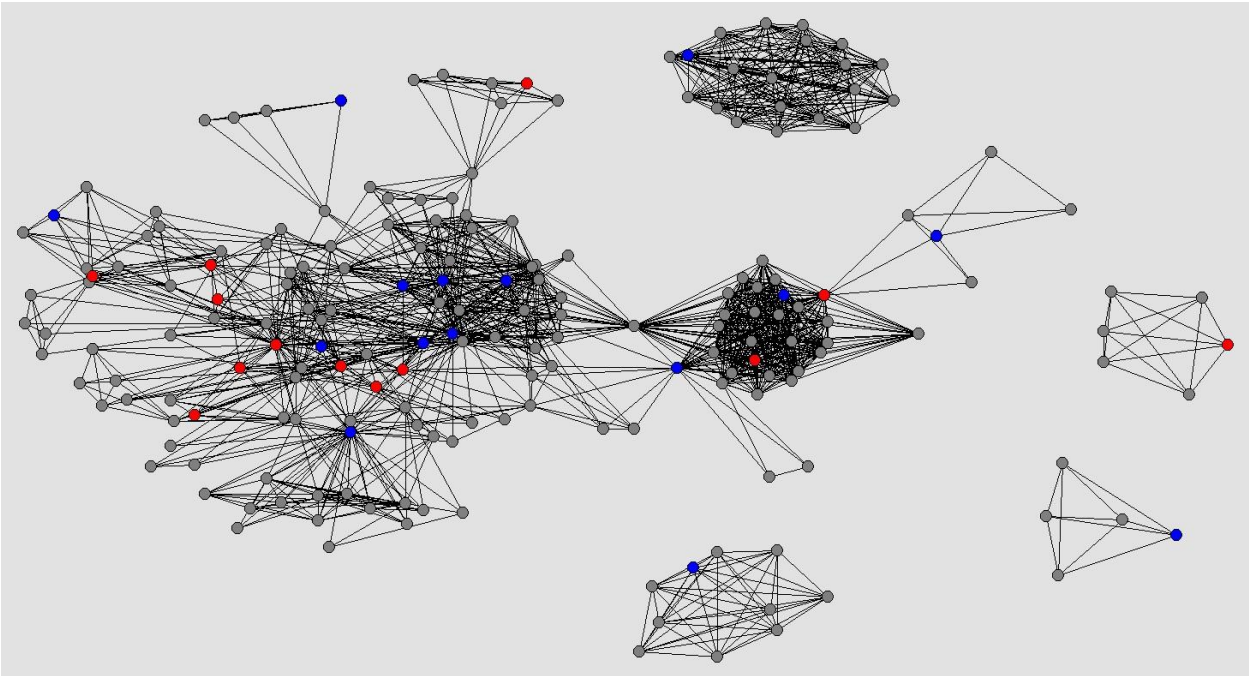

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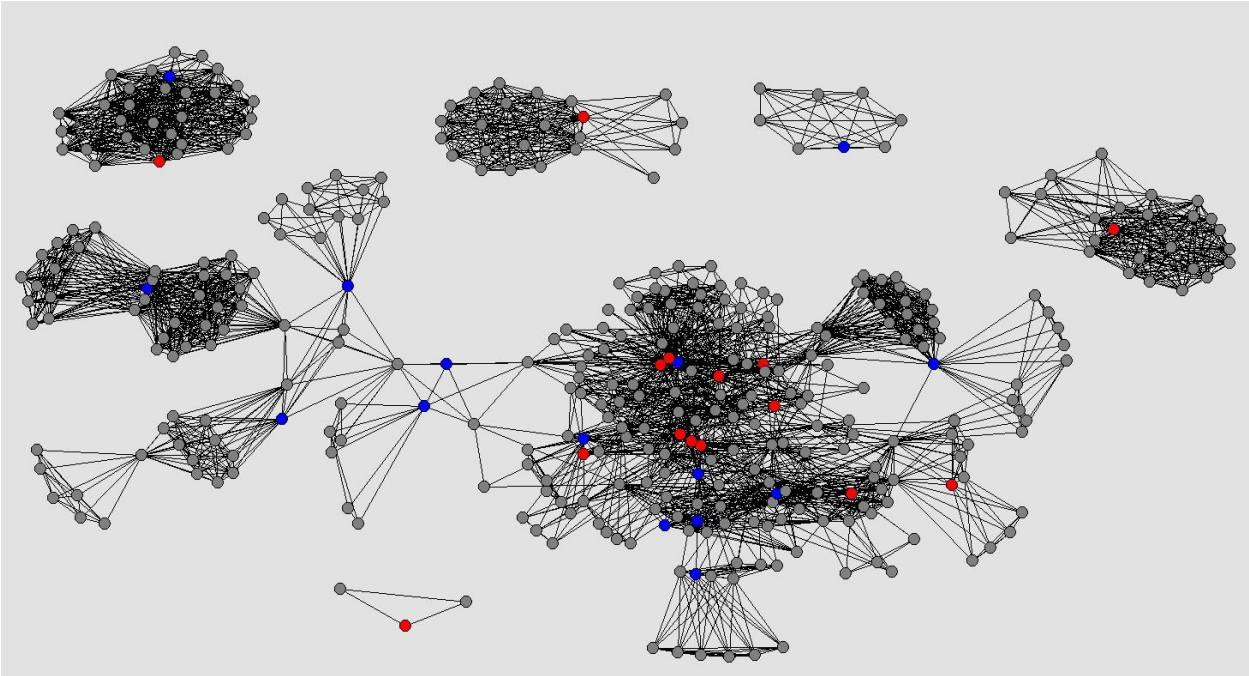
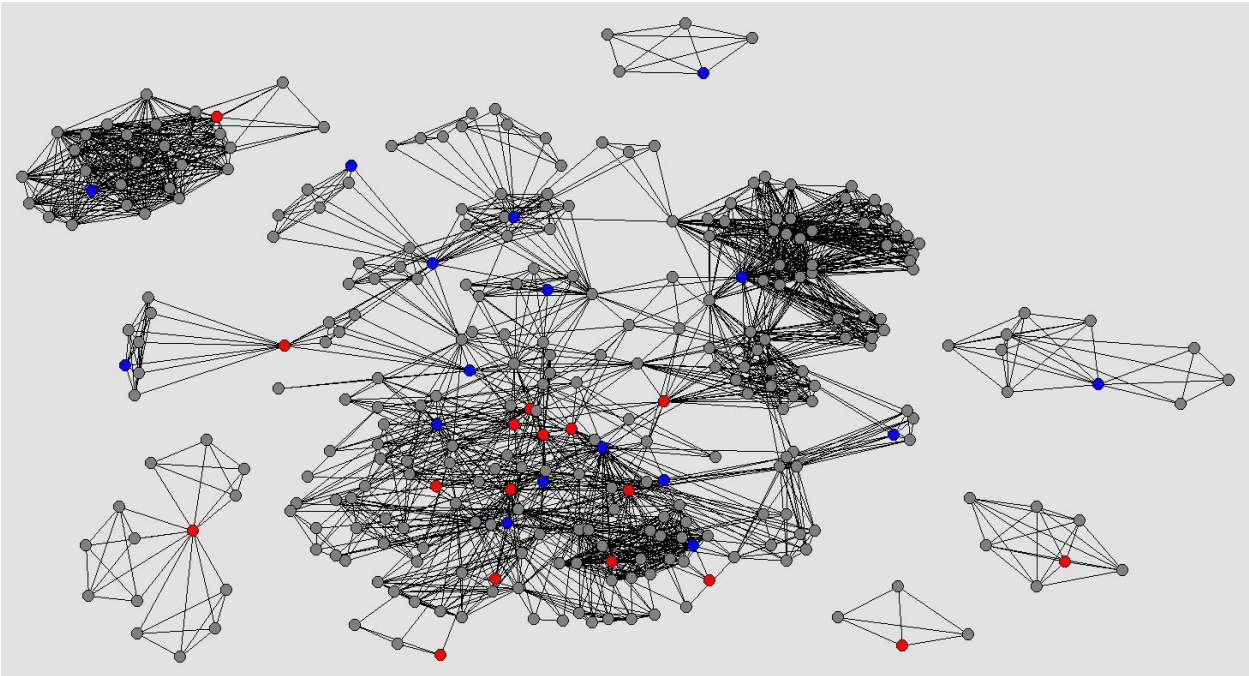


1949



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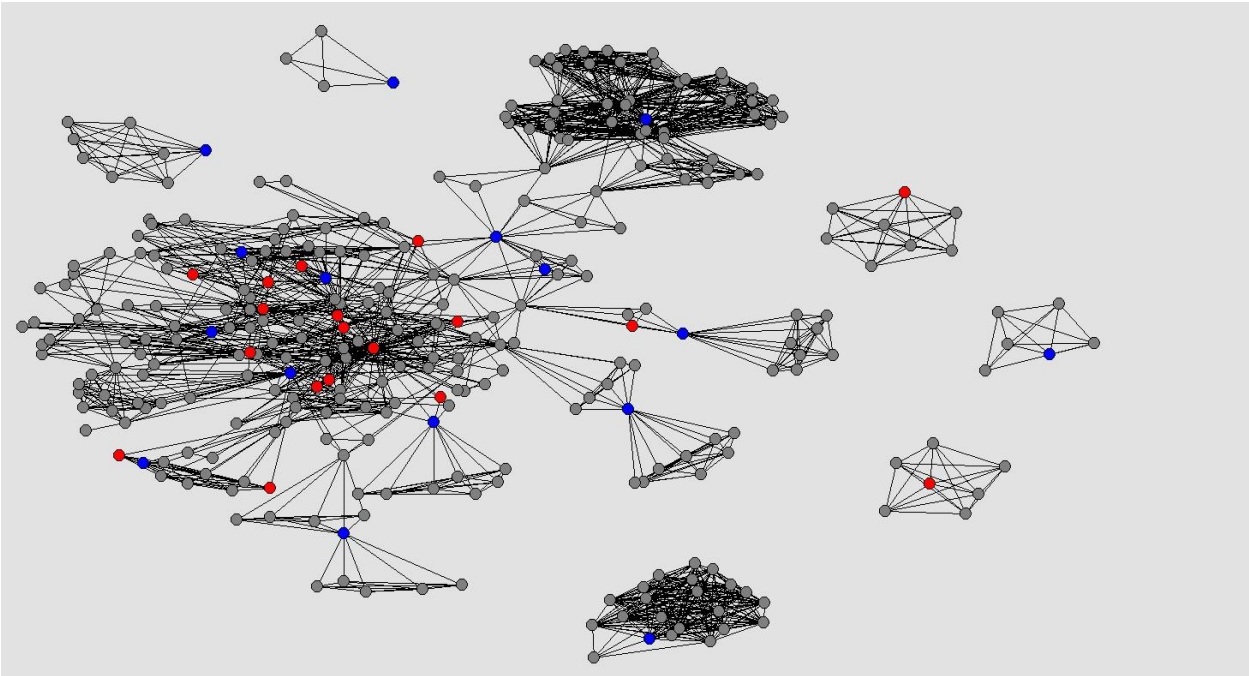

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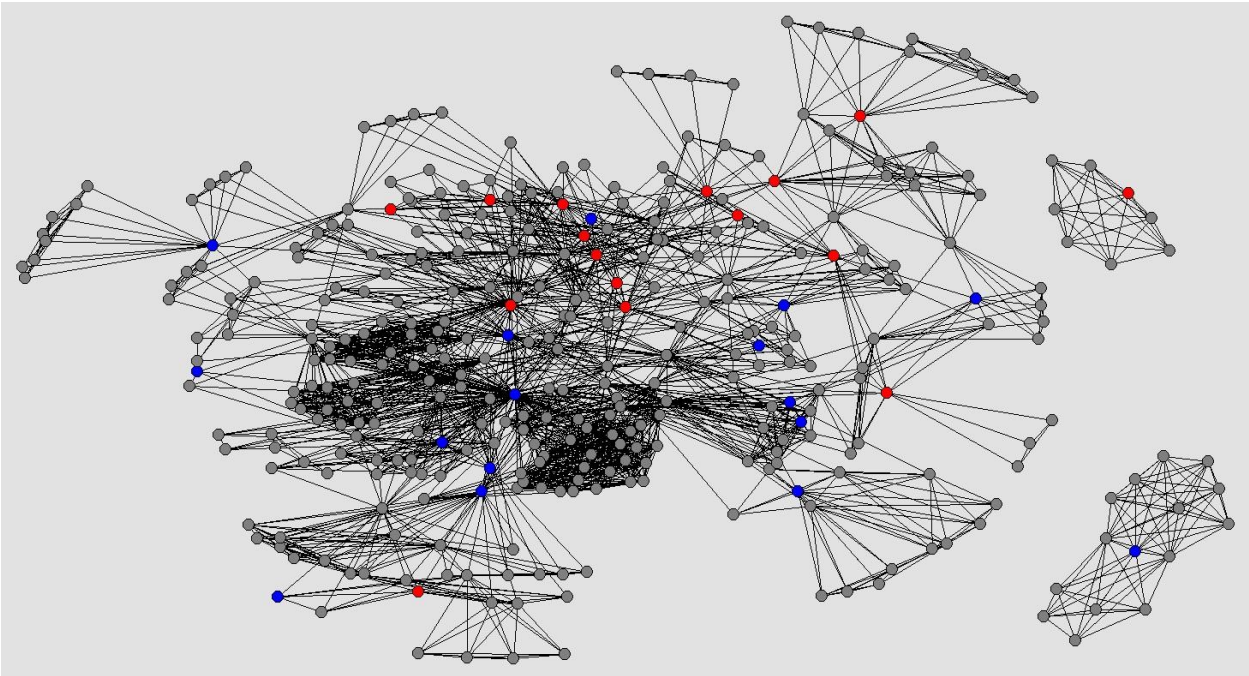

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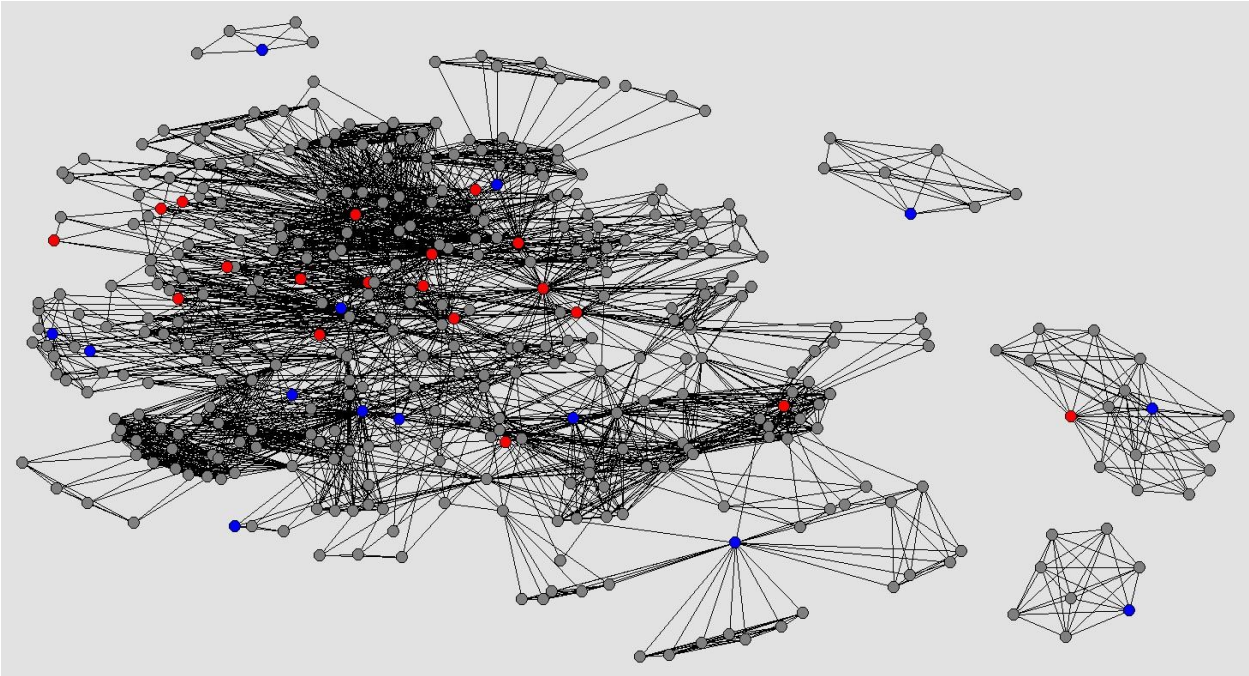

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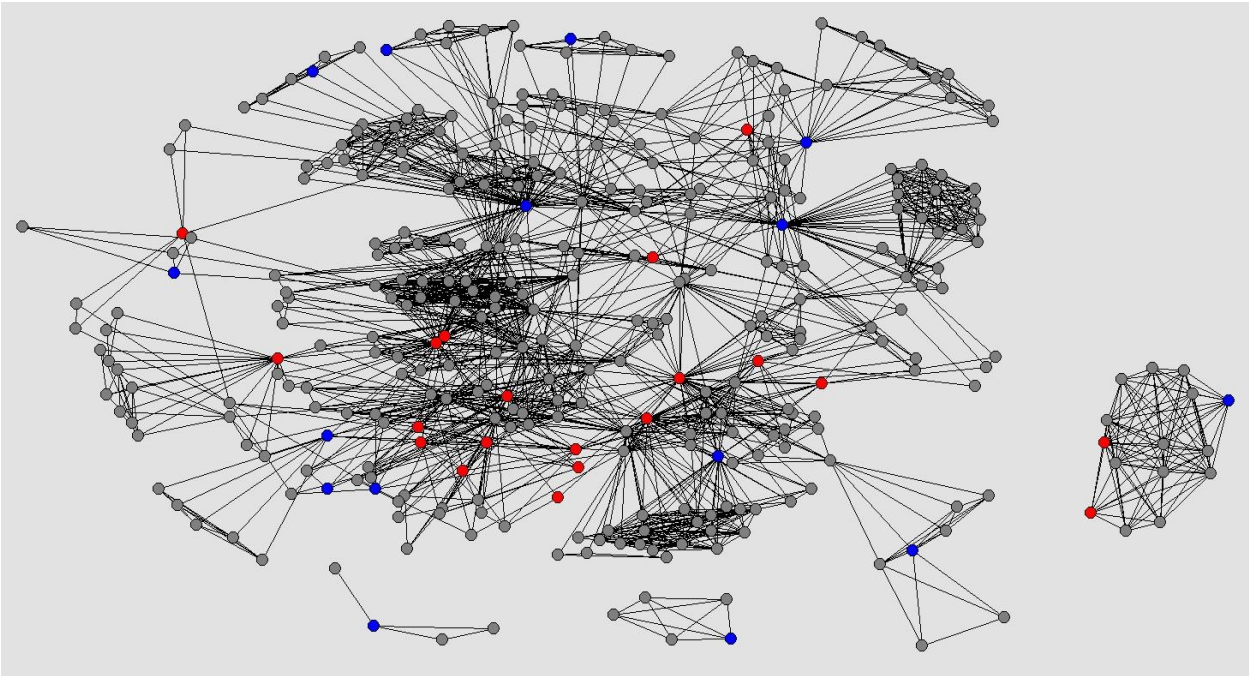

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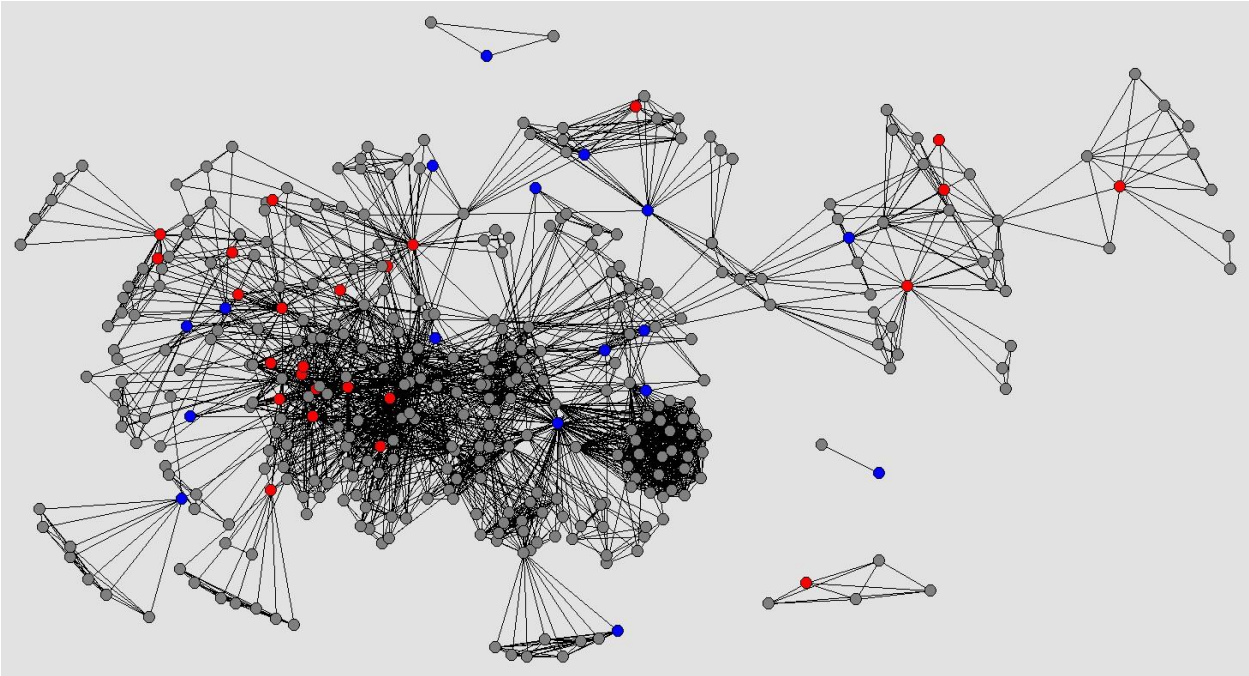

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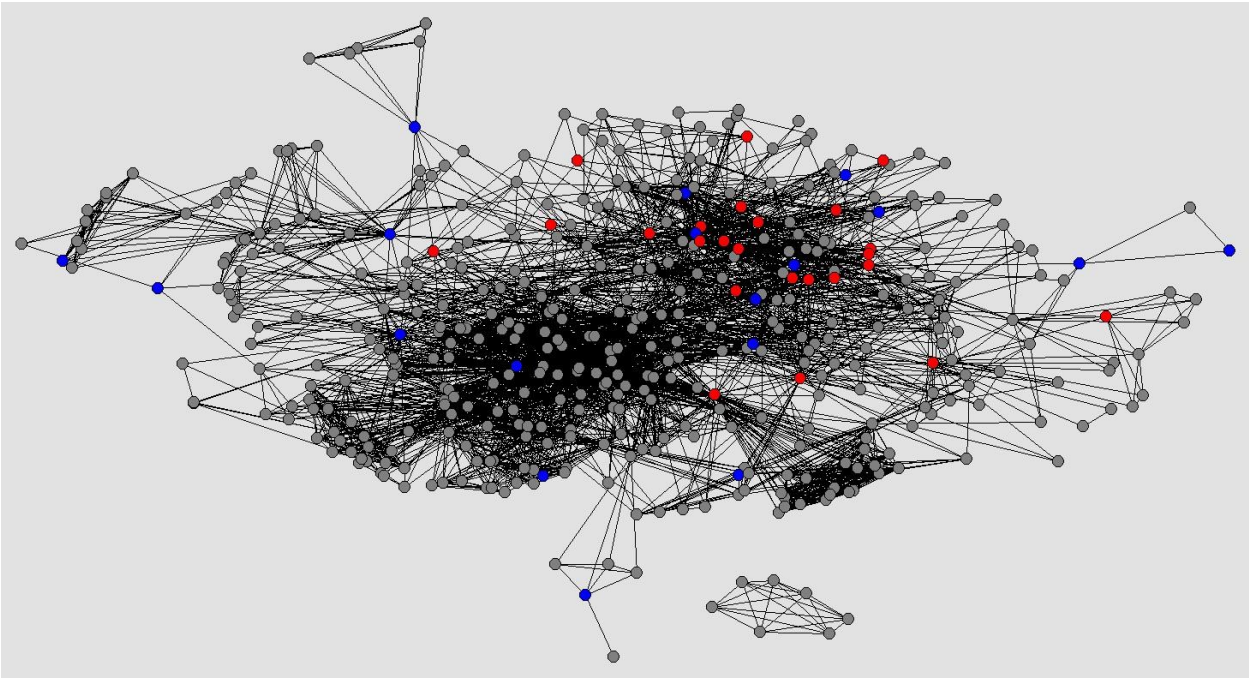

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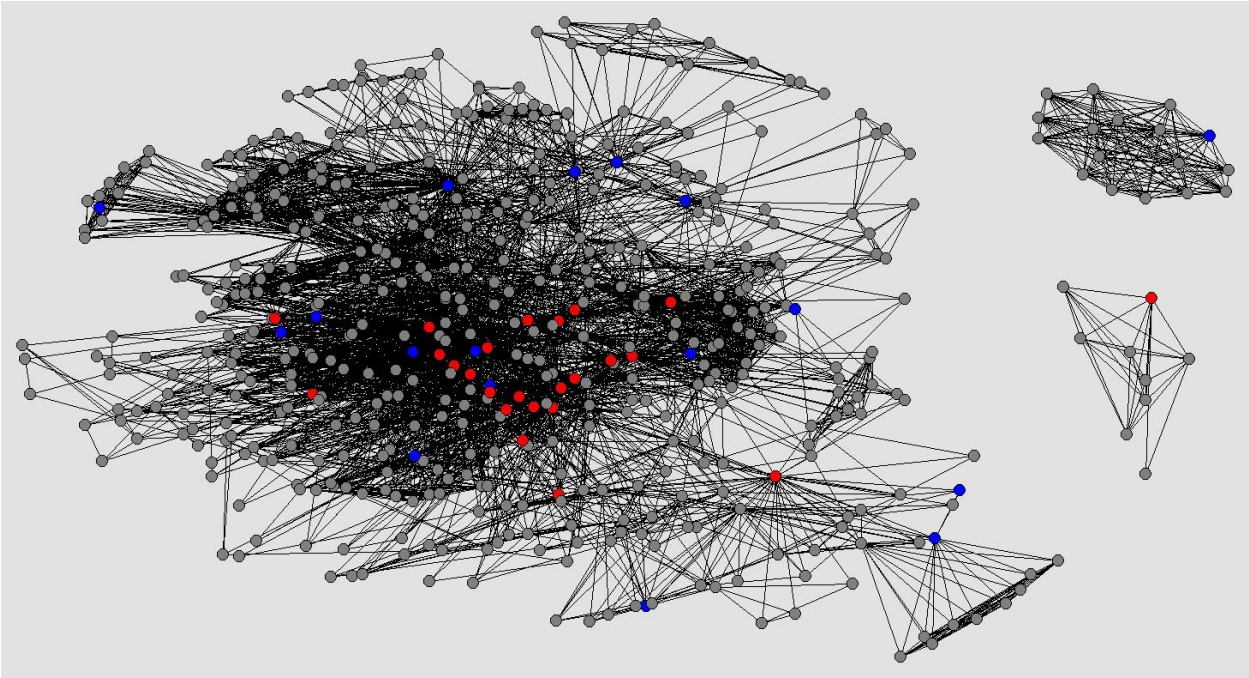

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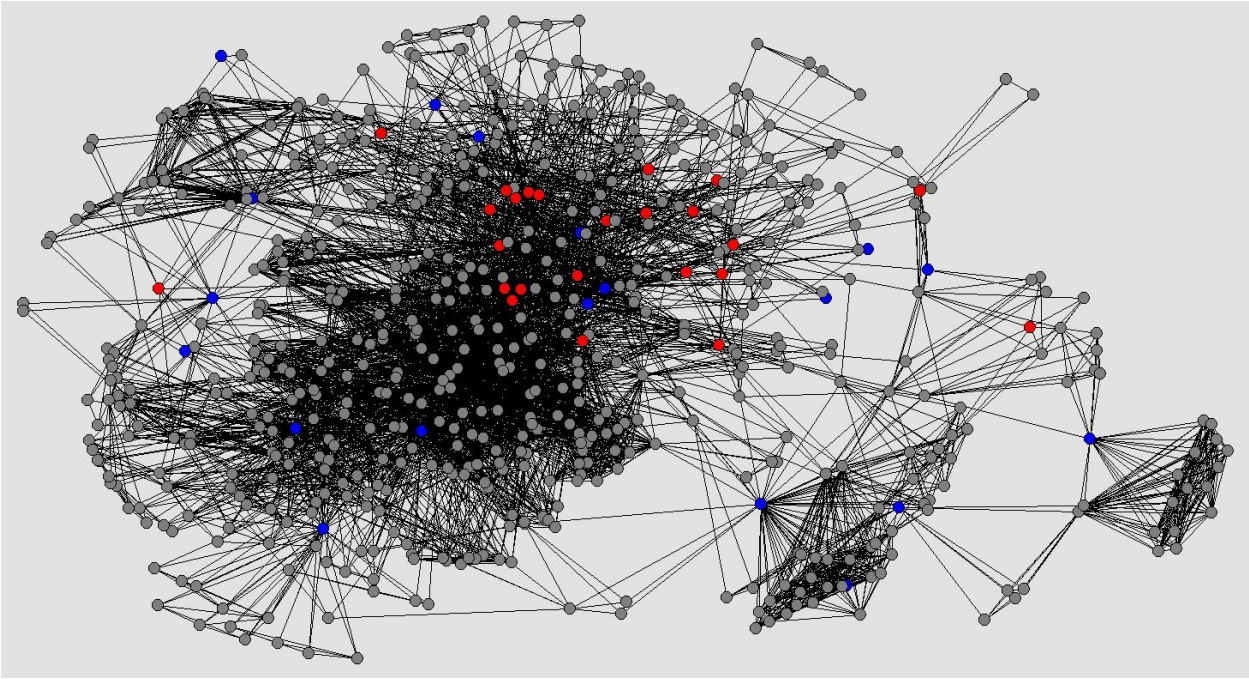

1958