Evolving networks and the finest in jazz

David Grandadam*

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Abstract

Creativity is commonly viewed as a collective process involving the coordination of a variety of individuals who interact in a dense network and influence one another through time. In this paper, we study the evolution of the network of collaboration among artists in the particular case of the Blue Note jazz label. By analyzing the extent to which the collaboration structure relies on a star production model and the extent to which it relies on integrated and cohesive groups, we examine how the label combined creativity and the market for creative ideas so as to guarantee its economic viability. We suggest that the different artists and styles should not be considered as independent from each other, but rather should be considered as having emerged from an interconnected core. The Blue Note label has therefore been able to put forth simultaneously creative talents as well as established artists, which have all contributed in their own way to shape the evolution of jazz.

Keywords: networks, collaboration, creativity, small world, stardom, jazz

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*Bureau d'Économie Théorique et Appliquée (BETA UMR 7522), Université Louis Pasteur de Strasbourg, France. Address: Faculté des Sciences Économiques et de Gestion, 61 Avenue de la Forêt Noire, F-67085 Strasbourg Cedex. Email: grandadam@cournot.u-strasbg.fr
1 Introduction

Extensive work on cultural industries has led many researchers to consider creativity, not as originating from the talents of isolated geniuses, but rather as the result of a collective process involving the joint efforts of many different individuals who coordinate their actions in order to extend the boundaries of their art (see for example Becker, 1982). Jazz, more than any other musical genre, represents this collaborative creativity throughout the diversity of styles which have characterized its evolution.

Several labels have played a major role in fostering the creative process in the jazz world. As intermediate structures linking the creative ideas to the market for creative goods, these labels have supported the work of many artists and have therefore widely contributed to shape the different trajectories of music (Caves, 2003; Tschmuck, 2003). In fact, each label should be considered as characterized by the dynamic network connecting the different artists to each other, which is itself part of the global network formed by all the members of the jazz community. In this view, understanding how the structure of labels has evolved is the key to understanding how artistic talents were progressively brought together, and how these individuals matched their creative ideas in order to reach musical excellence, as well as prestige. Throughout this study, we analyze these webs of creativity, and therefore raise the following questions: Who connects to who? What are the mechanisms which drive the creation of links? And finally, to what extent do artists benefit from their multiple connections?

We focus on the famous Blue Note Records label. In order to do so, we constructed the collaboration network among the different artists who participated in the recording sessions organized by the label for each year from 1939 to 1979. We examine the evolving topology resulting from the multiple interactions among these individuals and propose several mechanisms which may explain the emergence of specific patterns of collaboration. We argue that the network structure directly reflects the label’s attempts to put forth number of artists with different musical expressions, which all however originate from a common base. Indeed, over time, the Blue Note network exhibits higher levels of relative cohesiveness and integration, with the progressive rise of highly connected artists. These stars should be understood as having played a major role in the creation, in the diffusion and in the success of jazz. We discuss their impact on structure throughout this work.

Most importantly, by analyzing how the different artists were combined in time, we suggest to look at how the label was able to overcome the problem of balancing both artistic as well as economic logics of practice. We therefore propose a general framework which may contribute to the understanding of creative production in a competitive context.
2 Collaboration and creativity

Social networks have received much attention in the past years, which has enabled the development of major tools for their analysis (see Wasserman and Faust, 1994). This has led to an important body of theoretical and empirical research, in various fields, which has helped uncover steady generic properties of real networks. In that respect, art worlds have been studied by several researchers. In their work, Gleiser and Danon (2003) for example, who focus on the collaborations among artists during the swing era, observe significant correlations between recording locations, racial segregation and community structure. Similarly, Smith (2006) analyzes the rap collaboration network and finds evidence of dissassortative mixing, in contrast to most social networks, suggesting rivalry among the highly connected (and most popular) artists. These art worlds share strong similarities with the scientific network of collaboration (for examples, see Newman (2001) in physics, Moody (2004) in sociology, and Goyal et al. (2006) in economics). We rely on their findings in order to carry out our analysis.

We expect two major mechanisms to drive the evolution of networks of collaboration in the particular case of jazz labels. As artists gradually contribute to create new styles, they often turn to fellow musicians who share similar tastes and expressions. The resulting network should therefore be formed by important clusters (or ‘islands’) encompassing each style, with a few connections between these clusters uniting the different artistic areas. This phenomenon is well illustrated in the small world model, as described by Watts and Strogatz (1998) in their seminal article (for specific examples, see Kogut and Walker, 2001; Baum et al., 2003; Davis et al., 2003). The power of these networks relies on their ability to bridge different groups together, in such a way that closely-knitted clusters can benefit from the necessary connectivity to nurture their new ideas on one hand, and from their proximity with other clusters to reach creative material on the other hand (Burt, 2004; Uzzi and Spiro, 2005). As a result, these small-world networks should offer each label the possibility to develop variety and specialization simultaneously and should therefore be expected to greatly influence the collective process of creation.

In this setting, some individuals generally are much more favored than others. In fact, art worlds, and labels in particular, commonly rely on major ‘stars’ with a considerable reputation. In most cases, these artists appear on more sessions, sell more records, and therefore are relatively advantaged in terms of revenue (Rosen, 1981; MacDonald, 1988; Anderson, 2006). These stars will be considered to occupy a central position in the collaboration network, which allows them to be much more influential than their poorly connected counterparts. Through time, more and more artists will be expected to collaborate with these high status artists in order to increase their own status, as it is the case for academic researchers (Merton, 1968; Allison et al., 1982). The connected stars should therefore progressively reinforce their position, leading to important inequalities among the different individuals.
This mechanism, also known as preferential attachment, is the main feature of scale-free networks (Barabási and Albert, 1999). The label should then be expected to favor the few responsible for connecting the network, and therefore will assure its economic viability by benefiting from the success of these important artists.

In this study, we analyze the extent to which the evolution of a creative network is dependent on small-world behavior and the extent to which evolution is governed by a star production model. In other words, we examine how labels have shown to combine artistic and economic values, by promoting collective creativity as well as individual performance.

3 The Blue Note success story

Blue Note is probably the most representative label of the evolution of jazz, not only because most of the main jazz artists have recorded for the label, but also because it has captured a diversity of styles that no other jazz label can claim to have fully reviewed (Cook, 2003). Blue Note has therefore been a benchmark label throughout the 20th century, and is still, to this day, an active player on the jazz scene – as suggested by the enormous success of Grammy award winner Norah Jones, in 2002. In fact, it is one of the only jazz labels to have frequently reached the Top 200 Billboard charts in the sixties and in the seventies, at a time where the rock n’roll business far outweighed the jazz sales.

Blue Note was founded in 1939 in New York by German migrants Alfred Lion and Francis Wolff. Originally focusing on traditional hot jazz and swing with artists like Albert Ammons and Meade Lux Lewis, Blue Note released its first hit a few months after its establishment with a performance by clarinetist Sidney Bechet. From that time onwards, the label rapidly became known for treating musicians particularly well, allowing them to intervene in all aspects of production. The way the label honored the artists soon became the Blue Note landmark, and translated into an unconditional passion and devotion for jazz. This commitment to the music, as well as the desire to document at best the evolution of jazz, has always been the main goal of the label, as illustrated on a 1939 flyer for one of Blue Note’s early releases:

“Blue Note records are designed simply to serve the uncompromising expression of hot jazz and swing, in general. Any particular style of playing which represents an authentic way of musical feeling is genuine expression. By virtue of its significance in place, time and circumstance, it possesses its own tradition, artistic standards and audience that keeps it alive. Hot jazz, therefore, is expression and communication, a musical and social manifestation, and Blue Note Records are concerned with identifying its impulse, not its sensational and commercial adornments.”
By the end of World War II, after having ceased to record for a few years, the Blue Note label started to focus on bebop, with artists like Ike Quebec, Tadd Dameron, Fats Navarro, Howard McGhee, and James Moody. These artists were not the main innovators of the era, which is why the label was never really associated to the style created by Charlie Parker and Dizzy Gillespie (who both had contracts with other labels, like Dial, Savoy and Verve). Between 1947 and 1952 however, Blue Note released the first recordings of pianist Thelonious Monk as a leader, which did not sell well at the time, but have since come to be considered as some of the most important records of the bebop style. Until 1954, Blue Note recorded sessions with other important bebop artists, such as Bud Powell, J.J. Johnson or Miles Davis, but by then, hard bop, which Blue Note is most commonly affiliated to, was diffusing rapidly. Art Blakey and Horace Silver (who both founded the Jazz Messengers) soon became the main artists of the label and were to remain devoted to Blue Note for many years (Rosenthal, 1992).

During the fifties, new talents, such as Milt Jackson (founder of the Modern Jazz Quartet), or Clifford Brown (who first recorded with the Jazz Messengers) were starting to emerge. With the help of sound engineer Rudy Van Gelder (who contributed to most records of the fifties and the sixties), Blue Note distinguished itself from other independent jazz labels of the time, such as Prestige or Riverside, by paying for rehearsals prior to the recording sessions. This allowed Blue Note to considerably enhance the quality of its recordings and has probably contributed to its success in many aspects. The organist Jimmy Smith, who began as a leader in 1956, was the first Blue Note artist to enter the charts in 1962. This eventually opened the way to several other hard bop musicians like Lee Morgan, Donald Byrd, Lou Donaldson, or Stanley Turrentine, among the most successful. All through the late fifties and early sixties, some of the most important artists of the era recorded their debut albums for the label (among which Cannonball Adderley, Sonny Rollins, Dexter Gordon, Kenny Burrell, Kenny Dorham, Hank Mobley, Jackie McLean, Freddie Hubbard, Herbie Hancock, Wayne Shorter, Ron Carter, Grant Green, Joe Henderson and many others). These artists are all considered to be part of the Blue Note hard bop ‘family’, and would commonly work as sidemen on each other’s albums, before recording their own sessions as leaders (see Goldsher, 2002). In fact, during that period, the label scored a certain number of major hits, and therefore benefited from its wide exposure to enrich its catalog. The label could thus focus on the acts of established musicians, as well as the recordings of more novel artists, who all contributed, in their own way, to create the Blue Note sound and signature.¹

¹The well-known cover art of Reid Miles, who started working for the label in 1956, has significantly contributed to forge the image of Blue Note. In fact, because of their unique character, most Blue Note releases are easily recognizable and have gained an important reputation among collectors, fans and many others. The Blue Note artwork has since influenced the covers of many recordings.
Lion thought it was important to document the new developments in jazz, and therefore also recorded some of the leading artists of the avant-garde and free jazz movement. After having released the first album by John Coltrane as a leader (the well-known *Blue Train*), the label recorded musicians such as Andrew Hill, Eric Dolphy, Ornette Coleman, Cecil Taylor or Bobby Hutcherson. These artists did not sell like some of the hard bop records, but have made some major pieces of work, which have significantly altered the history of jazz.

In 1965, the Blue Note label was sold to Liberty Records, and therefore ceased to be independent. Soon after, in 1967, Lion retired, leaving Francis Wolff and pianist Duke Pearson as the main producers. Liberty Records was purchased by United Artists two years later. All through the seventies, although Blue Note still benefited from a certain commercial success, some of the main rules which had helped characterize the label’s specificity were being questioned. Many critics have therefore considered this period as a rather uncreative era, in terms of artistic achievements. This is probably what led the EMI executives to phase out the Blue Note label in 1979, after having acquired United Artists. The label was however revived six years later, in 1985, and has since released the work of several new artists, as well as a series of re-issues of past recordings.

The Blue Note label has recorded a variety of young talents and well-established musicians, who can all be associated to several different styles, but who have all contributed to define the Blue Note specificity. By frequently interacting together in various sessions, these artists have all benefited from the influence of many others to collectively develop specific artistic expressions. As a result, Blue Note should be considered as having evolved according to the changes in the collaboration pattern among artists, as some were replaced in time, while others were gradually reinforced. This collective process of creation is expected to be the main reason for the Blue Note success.

## 4 Data and methods

We analyze the evolution of the Blue Note network during the period from 1939 to 1979. For each year, we constructed the cumulated network of collaboration among artists, by focusing on the different sessions and on the many artists who participated in these sessions. The data has been collected from the Jazz Discography Project, and is freely accessible on the internet (www.jazzdisco.org). We made the necessary modifications in our dataset to not have different individuals appearing with the same name or the same individual appearing with different names.\(^2\)

\(^2\)For this special task, we relied on the information in the *Allmusic Guide to Jazz* (Bogdanov et al., 2002), as well as in *The Encyclopedia of Jazz* (Feather, 1960, 1966; Feather and Gitler, 1976).
our dataset. The different artists who have recorded for the label therefore represent the nodes in the network, and a link exists between two artists if they both played together in the same session. As we consider the cumulated network, once a link is established, it remains active for the entire period. We thus obtain a single network for each year characterizing the multiple interactions that each artist has had with others since 1939.

Formally, let \( M = \{1, 2, \ldots, m\} \) be the set of sessions recorded at a specific time, where \( m = |M| \) corresponds to the total number of these sessions. Similarly, let \( N = \{1, 2, \ldots, n\} \) be the set of artists present in a network at that time, with \( n = |N| \) the total number of these artists. For each year, we construct the affiliation network, in which artists are connected to each other by common membership in sessions, also known as the unipartite projection of the bipartite graph linking the artists to the sessions they participated in. For simplicity, we consider the relationship between two artists \( i, j \in N \) as defined by \( \alpha_{ij} = \{0, 1\} \), with \( \alpha_{ij} = 1 \) if both played in the same session, and \( \alpha_{ij} = 0 \) otherwise. At each time step, the network of collaboration we study is therefore represented by the collection of artists as well as the links between them. Our methodology is illustrated in Figure 1.

For each period, let \( N_i = \{j \in N : \alpha_{ij} = 1\} \) be the set of individuals with whom artist \( i \) has collaborated, also known as \( i \)'s neighborhood. The number of artists the individual \( i \) collaborates with is \( k_i = |N_i| \). This quantity is commonly referred to as the degree of individual \( i \) in the network. The average degree, at a specific
time, is therefore

\[ \bar{k} = \frac{\sum_{i \in N} k_i}{n} \]  

(1)

The degree distribution, denoted by \( P(k) \), can be calculated by measuring the probability that an individual has a degree higher than \( k \). We obtain a scale-free network if this distribution decays with a power law tail. In this case, the \( P(k) \) distribution should appear as a straight line in a log-log scale.

At a specific time, the (geodesic) distance between two individuals \( i \) and \( j \) in a network is given by the length of the shortest path between them, denoted by \( l_{ij} \), where a path between two artists \( i \) and \( j \) exists if there is a set of intermediate artists \( j_1, j_2, \ldots, j_n \) such that \( \alpha_{ij_1} = \alpha_{j_1 j_2} = \ldots = \alpha_{j_{n-1} j_n} = 1 \). In other words, if artists \( i \) and \( j \) participated in the same session (and therefore \( \alpha_{ij} = 1 \)), the distance between both individuals equals 1. If both individuals have collaborated with a third individual, but have not played together, then the distance between the two artists is 2, and so forth. Two individuals are said to belong to the same component if and only if a path exists between them. As a result, we define the main component to be the one which connects the highest number of individuals. When the network is fully connected, the average path length of the network for each period is given by

\[ PL_{actual} = \frac{\sum_{i \in N} \sum_{j \in N} l_{ij}}{n(n-1)} \]  

(2)

The clustering coefficient shows the extent to which the neighbors of an individual collaborated among each other. In other words, it defines the percentage of transitive triads in a network, where transitivity represents the fact that if a tie exists between artists \( A \) and \( B \) and between \( A \) and \( C \), then \( B \) and \( C \) are connected together. The clustering coefficient for the entire network is then defined by

\[ CC_{actual} = \frac{3 \times \delta}{\tau} \]  

(3)

where \( \delta \) is the number of closed triangles in the network (such that three links can be found among three artists) and \( \tau \) corresponds to the number of connected triples in the network (with only two links connecting three individuals). In this respect, if \( CC_{actual} \) is equal to 0, then there is no clustering, and if \( CC_{actual} \) is 1, the network is fully clustered. As we study the unipartite projection of a bipartite graph, this coefficient describes whether artists tend to participate in sessions with the same individuals, or whether these artists play with many different individuals in each session. The level of clustering therefore indicates the extent to which sessions overlap.

In order to study whether the collaboration network is a small-world, we compare the observed level of clustering and the average path length to the same parameters in the case of a random network of equal size, for which clustering
and distances are expected to be low, as suggested by Watts (1999). We rely on the Newman et al. (2001) solution to correct the estimates of these parameters for random bipartite graphs. As a result, the network will be said to exhibit increasing small-world behavior, the lower the relative average path length and the higher the relative clustering level. We therefore compare the two random values to those we obtain in our empirical analysis by calculating a $PL_{ratio}$ (given by $PL_{actual}/PL_{random}$), as well as a $CC_{ratio}$ (equal to $CC_{actual}/CC_{random}$). The closer the $PL_{ratio}$ is to 1, the shorter distances are among connected artists, and, in the same way, the more the $CC_{ratio}$ exceeds 1, the higher the amount of clustering in the network. These two ratios are combined to measure the small-world quotient $Q = CC_{ratio}/PL_{ratio}$. As this quotient grows and exceeds 1, the network becomes more interconnected, which means that more ties between clusters will form, therefore leading to higher levels of group overlap. We should expect $Q$ to raise in time whenever the network of collaboration is driven by the small-world effect.

5 The evolution of the collaboration network

In this section, we present our main results. We begin with details on how new artists and new sessions are progressively added to the network. We then turn to the main structural features of the Blue Note network, and their evolution in time. Rather than studying each year separately from 1939 to 1979, we concentrate on ten year intervals which gives a relatively clear insight on the different trends we observe throughout the entire period of analysis.

5.1 Artists and sessions

Each year, new sessions are recorded and ‘new’ artists (who have not previously worked for the label) are added to the network. This process significantly effects the global structure of collaboration among individuals, and therefore should be carefully studied. In Figure 2, we present the number of new sessions and the number of new artists for each year.

Although we expected that these two quantities might be correlated in some way or another, the results clearly show that this is not always the case (with an exception in the seventies). In other words, more new sessions do not necessarily entail more new artists. From 1939 to 1979, the label recorded on average 32 sessions per year, with a peak in 1969, during which 83 sessions were put together. In fact, a majority of sessions were recorded in the sixties, which corresponds to the most prolific era for the label. During that period, Blue Note did not introduce many new artists, generally relying on those individuals which had helped create its specific sound. Hard bop was then at its peak and the main artists were well
established in the Blue Note family. For the entire time interval we study, 46 individuals on average were added to the network each year, with the biggest change in 1976, corresponding to a total of 177 new members.

![chart](chart1.png)

(a) Number of new sessions per year  
(b) Number of new artists per year

**Figure 2:** Artists and sessions in the Blue Note network

The fact the early years did not bring any important modification in contrast to the later years is not surprising. During the forties and early fifties, Blue Note was still a small independent label and, in consequence, probably did not have the necessary financial resources to record a lot of sessions. With its commercial success in the sixties, Blue Note began to appear as a major actor on the jazz scene, and, therefore, benefited from a wide exposure which allowed the label to reinforce its dominant position. During the seventies however, after having endured many organizational changes, and given the decreasing popularity of jazz, Blue Note was forced to considerably renew its pool of artists. The label was then under the custody of United Artists, which probably helped finance its restructuring. Even so, this was not sufficient to guarantee economic viability on the short term.

### 5.2 Collaboration and star production

In most dynamic models of network formation, average degree is considered to be independent of the number of active individuals (i.e. the size of the network) and, as a consequence, is supposed to remain relatively constant in time. The fact some individuals have a high degree is compensated, in these situations, by the low degree of newcomers. In the case of the Blue Note network, however, the average degree progressively increases, as shown in Table 1, suggesting that artists have a tendency to multiply and diversify collaborations over the years. The various individuals, therefore, do not always play with the same group of artists, but rather, favor different arrangements and organizational settings throughout time. Our analysis shows that the values for the average degree range from a
minimum of 5 in 1939, to a maximum of approximately 23 in 1979. Considering the fact that the most commonly found ensemble is the quintet, this means that any individual should generally have at least four distinct collaborators. As a result, an artist would have to play in three different quintets with dissimilar people each time to have a degree equal to 12. The hypothesis according to which any individual only collaborates with different people is however quite unrealistic. In most situations, artists frequently interact with the same musicians over and over again. So if an individual always plays with one similar person each time, and if all the other members of the group change for each session, the individual would have to participate in at least four quintets to have 12 different connections, and this number will increase as the artist continues to regularly play with the same musicians.

Table 1: Star production statistics

<table>
<thead>
<tr>
<th></th>
<th>1949</th>
<th>1959</th>
<th>1969</th>
<th>1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of artists</td>
<td>226</td>
<td>662</td>
<td>1212</td>
<td>1942</td>
</tr>
<tr>
<td>Average degree of artists</td>
<td>8.67</td>
<td>11.54</td>
<td>16.07</td>
<td>23.07</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>5.5</td>
<td>10.61</td>
<td>18.39</td>
<td>26.56</td>
</tr>
<tr>
<td>Size of main component*</td>
<td>200</td>
<td>621</td>
<td>1173</td>
<td>1897</td>
</tr>
<tr>
<td>— in %</td>
<td>88.50</td>
<td>93.81</td>
<td>96.78</td>
<td>97.68</td>
</tr>
<tr>
<td>Main component sensitivity b</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>— without top 2.5%</td>
<td>82.3</td>
<td>87.31</td>
<td>94.22</td>
<td>93.61</td>
</tr>
<tr>
<td>— without top 5%</td>
<td>74.34</td>
<td>82.33</td>
<td>90.84</td>
<td>91.09</td>
</tr>
<tr>
<td>— without top 10%</td>
<td>59.73</td>
<td>67.97</td>
<td>77.56</td>
<td>83.83</td>
</tr>
<tr>
<td>— without top 20%</td>
<td>23.45</td>
<td>34.59</td>
<td>46.04</td>
<td>63.9</td>
</tr>
</tbody>
</table>

*The size of the main component corresponds to the number of individuals which form this component. The values in percentage are obtained relatively to the total number of individuals in the network.

bWe present here the size of the main component relatively to the total number of individuals after the removal of a fixed percentage of the most connected artists.

In fact, as Table 1 indicates, the standard deviation of average degree appears to increase quite rapidly, which means that the disparity between the highest and the lowest connected individual tend to amplify in time. In this case, the artists with many links tend to contribute significantly more than others to the increase in average degree, and therefore benefit from a much wider variety of collaborations. In Figure 3, we represent the degree distribution in log-log scale for the different years we study. The same trend is observed throughout the period. Although we do find a certain amount of skewness, the power law behavior of these distributions
appears to be truncated, and does not follow a linear progression as it would be the case with scale-free networks. In other words, the averagely linked individuals are relatively important in the network and tend to significantly outnumber the most connected individuals. As a result, high-status artists will have a tendency to lose some of their attractiveness through time, which will significantly alter the preferential attachment process.

Figure 3: Degree distribution in the Blue Note network

This phenomenon may partly be explained by the presence of ageing (Amaral et al., 2000). As we study a fairly long period, we expect those artists who were very active in the early years of the label to cease recording at a given time. This can happen for different reasons, such as new contracts with other labels, retirement, death etc. At some point, these individuals are therefore replaced by newer artists who will strengthen their status until they are themselves substituted by other individuals. Art Blakey, for example, who actively worked for the label during a long period and who encouraged many young musicians with his Jazz Messengers, released his last record for Blue Note in 1964, and was gradually superseded by Donald Byrd – one of his numerous students – as the most connected artist. In this analysis, we have not taken into account decay. In other words, important artists may still appear in the network even though they are not active any more, therefore introducing a certain bias in our measures. A closer look at the dynamics underlying the evolution process is however necessary in order to fully conclude on that matter.

As we find a highly skewed distribution, we may expect some artists to be much more influential than others, even though we do not observe a scale-free network.
Therefore, in order to assess the extent to which degree of artists impacts on the connectivity of the network, we study the component sensitivity. In that respect, we show, in Table 1, the size of the largest component when the 2.5%, the 5%, the 10%, and finally the 20% most connected artists are removed from the graph. The results suggest clearly that the network remains well connected and only collapses when we remove almost 20% of the most linked individuals. This phenomenon is observed throughout the period we study, although it appears to be more intense during the early years of the label, as stars probably play a more important role given the fewer individuals present in the network. The most connected individuals therefore do not contribute relatively more than others to the general unification of the network. In consequence, these artists may be stars in the sense that they are well connected from a local point of view, but do not however influence the global formation of the network.

5.3 The emerging small-world

We examine the small world characteristics of the Blue Note network, by focusing on the average distances, and the average clustering coefficient. Our main results are presented in Table 2.

In general, average distances in a network are expected to be a function of its size. Hence, as the network grows, we commonly observe a relative dispersion among individuals. Our results seem to suggest quite the opposite as average distances, after having increased during the label’s first years, tend to stabilize and slightly decrease, eventhough the network continues to expand at a relatively high rate. The decreasing path length ratio supports these findings. In fact, the new individuals which are progressively added to the network, as well as the new links which are created among present artists, contribute to unify the different entities, as suggested by the increase in the relative size of the main component. This process indicates that, over time, the different groups are not necessarily scattered across the network, and therefore appear to be more or less integrated to each other. As a result, distant individuals share an increasing number of common collaborators, which multiplies the various paths between them and shortens the separation among the different artists. Two mechanisms are therefore expected to take place simultaneously. On one hand, new groups integrate the network, probably increasing its decentralization. On the other hand, this greater dispersion is compensated by the creation of new links between old artists, and between old and new artists, which globally results in higher proximity among individuals.

The average clustering coefficient defines the level of cohesiveness (or interconnectedness) among the different individuals in the network. As we study a unipartite projection of a bipartite graph, this coefficient indicates whether different groups combine common artists (in which case the clustering is high), or
### Table 2: Small-world statistics

<table>
<thead>
<tr>
<th></th>
<th>1949</th>
<th>1959</th>
<th>1969</th>
<th>1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Path Length*</td>
<td>3.48</td>
<td>3.65</td>
<td>3.42</td>
<td>3.27</td>
</tr>
<tr>
<td>Random Path Length</td>
<td>2.26</td>
<td>2.23</td>
<td>2.15</td>
<td>2.14</td>
</tr>
<tr>
<td>Path Length ratio</td>
<td>1.54</td>
<td>1.64</td>
<td>1.59</td>
<td>1.52</td>
</tr>
<tr>
<td>Actual Clustering</td>
<td>0.565</td>
<td>0.416</td>
<td>0.366</td>
<td>0.374</td>
</tr>
<tr>
<td>Random Clustering</td>
<td>0.327</td>
<td>0.226</td>
<td>0.174</td>
<td>0.170</td>
</tr>
<tr>
<td>Clustering ratio</td>
<td>1.73</td>
<td>1.84</td>
<td>2.1</td>
<td>2.2</td>
</tr>
<tr>
<td>Small world $Q$</td>
<td>1.12</td>
<td>1.12</td>
<td>1.32</td>
<td>1.45</td>
</tr>
</tbody>
</table>

* Average distances were computed on the main component only.

whether the ensembles are formed by distinct individuals (leading to low values of concentration). Unsurprisingly, the clustering coefficient appears to be globally decreasing over time, before stabilizing substantially, as suggested in Table 2. In other words, from a global point of view, individuals are less interconnected to others over time. However, if we take into account the network growth, the evolution of the clustering coefficient ratio indicates relatively higher levels of interconnection, in comparison to the random network of equal size. We consider the presence of two opposite mechanisms acting simultaneously. On one hand, the addition of perfectly connected cliques contributes to increase levels of clustering from a local perspective. On the other hand, the fact these groupings are not fully connected to the network in general lowers the global clustering, and therefore partly eliminates the previous effect.

Our findings demonstrate important modifications throughout time in the collaboration structure among artists. In Figure 4, we present the corresponding network for the years 1949, 1959, 1969 and 1979. As we have shown, and as illustrated by this figure, the Blue Note network has progressively become more and more integrated and interconnected, which is suggested by the relative decrease of average path length and relative increase of average clustering. These structural features have significantly supported the development of the label. Over time, local and global mechanisms therefore add up and allow for a specific equilibrium to emerge, in which artists benefit from their intense interaction in fully connected groups to progressively develop specific styles, but also from their encounters with distant (and nonetheless close) collaborators so as to reach creative material. These results are consistent with the main hypotheses of the small world model.
Figure 4: The evolution of the Blue Note network
6 Success and collaboration

So far, we have focused exclusively on the structural characteristics of the collaboration network, suggesting strong interdependence between local incentives and global behavior. However, we have not taken into account any measure of success whatsoever. It is therefore necessary to ask ourselves to what extent performance is correlated to the structural position of artists. As we do not have the sufficient amount of data to be able to measure the actual performance of each session and artist, these questions are not easily and straightforwardly answered. We attempt to tackle these problems by using the information we have collected on the Blue Note label. We focus on the artists who reached the well-known Billboard charts, which gathers the best-selling records for each year.

During the period from 1939 to 1979, a total of 41 Blue Note albums appeared in the Top 200 Billboard charts, with often the same musicians leading the way. In Table 3, we present the 14 artists which appeared in these charts as leaders. We have ordered these musicians according to their first recording for Blue Note. Unsurprisingly, these artists are those which are most commonly remembered as being the main representatives of the label. Albums such as Lee Morgan’s *The Sidewinder*, Donald Byrd’s *A New Perspective*, who both reached the charts in 1964, or Horace Silver’s *A Song for my Father* celebrated in 1965, have all been major acts for the Blue Note label, and have all acquired a wide recognition in the world of jazz. One element should however be mentioned. Because of the difficulty to deal with fixed (and isolated) groups, we voluntarily have not integrated in this table the group War, with its album *Platinum Jazz*, eventhough it is the first Blue Note record to have received a Gold award by the Recording Industry Association of America the year following its release, in 1977. This group has only recorded one session for the label, which is why its five members do not appear to be central players.

Several generations have contributed to forge the Blue Note success. In fact, as suggested by Table 3, we can more or less divide the artists who reached the charts into two categories. Until 1969, the most successful of them had all participated in a large number of sessions, and generally collaborated with many different individuals. With some exceptions (among which Jimmy Smith), these experienced musicians almost all started out in the Jazz Messengers during the fifties, and have all supported the development of the hard bop style. At the time, eventhough none of the artists really benefited from a star-like status (except maybe for Art Blakey), the label relied on a group of important individuals who helped connect the entire network. During that period, many fairly young talents took part in the different sessions, and progressively reinforced their position in the network by interacting with one another, sometimes as sidemen, sometimes as leaders. All these artists have played a major role in uniting the growing family of Blue Note musicians and
Table 3: The most successful artists from 1939 to 1979

<table>
<thead>
<tr>
<th>Artists</th>
<th>Debut&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Charts</th>
<th>Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horace Silver</td>
<td>1952</td>
<td>2</td>
<td>1965</td>
</tr>
<tr>
<td>Lou Donaldson</td>
<td>1952</td>
<td>8</td>
<td>1963</td>
</tr>
<tr>
<td>Donald Byrd</td>
<td>1955</td>
<td>7</td>
<td>1964</td>
</tr>
<tr>
<td>Jimmy Smith</td>
<td>1956</td>
<td>6</td>
<td>1962</td>
</tr>
<tr>
<td>Lee Morgan</td>
<td>1956</td>
<td>3</td>
<td>1964</td>
</tr>
<tr>
<td>Duke Pearson</td>
<td>1959</td>
<td>1</td>
<td>1969</td>
</tr>
<tr>
<td>Stanley Turrentine</td>
<td>1960</td>
<td>2</td>
<td>1967</td>
</tr>
<tr>
<td>Brother Jack McDuff</td>
<td>1961</td>
<td>1</td>
<td>1969</td>
</tr>
<tr>
<td>Lonnie Smith</td>
<td>1967</td>
<td>1</td>
<td>1970</td>
</tr>
<tr>
<td>Bobbi Humphrey</td>
<td>1971</td>
<td>3</td>
<td>1974</td>
</tr>
<tr>
<td>Marlena Shaw</td>
<td>1972</td>
<td>1</td>
<td>1975</td>
</tr>
<tr>
<td>Ronnie Laws</td>
<td>1975</td>
<td>1</td>
<td>1975</td>
</tr>
<tr>
<td>Earl Klugh</td>
<td>1976</td>
<td>3</td>
<td>1976</td>
</tr>
<tr>
<td>Noel Pointer</td>
<td>1976</td>
<td>1</td>
<td>1977</td>
</tr>
</tbody>
</table>

<sup>a</sup> We present in this column the year during which each artist made his first recording for the Blue Note label.

<sup>b</sup> This column gives the number of albums which reached the charts with the artist as a leader.

<sup>c</sup> In this column, we indicate the year each artist first entered the Top 200 Billboard Charts either as a sideman or as a leader.

should be considered as forming the core of the Blue Note network.

As from 1970, many new artists reached the charts, with all of them associated to the jazz funk-soul movement. Most of them made their first recording for Blue Note during the seventies, and almost immediately became very successful. These individuals have not been as active as the previous generation, but appear to be fairly well connected. In fact, most of them recorded big sessions with more than twenty musicians each time. Earl Klugh, for example, who only participated in 15 sessions, collaborated with 126 other individuals, which contrasts with the 103 sessions Lee Morgan participated in, with a total of 143 collaborators. This may explain why we observe higher levels of interconnection during this period, and why the collaboration structure appears to be less dependent on stars. All through the seventies, the successful artists have contributed to promote the Blue Note label and have all played an important role in building the label’s reputation. Their commercial success did not however guarantee the label’s viability on the market on a medium-term basis. As a result, when the label was relaunched in 1985, it relied on the first generation of musicians who had created the Blue Note hard bop family, rather than on the funk-soul generation.

Should we conclude that the number of collaborators is the main determinant of individual success? We argue that this is probably not the case. In fact, we suggest
that success is most likely dependent on the work of many different artists, who contribute to reinforce specific conventions, therefore promoting the styles they are associated to. In other words, we consider success to be the result of a collective process, based on the integration of overlapping groups which benefit from each other in such way that creative material can progressively become widely accepted and prevail on the market. Catchy melodies, as well as captivating tunes may allow some artists to perform better than others. These individuals will generally increase their reputation through time, therefore increasing the number of sessions they participate in, as well as the number of their connections. However, their success can only last as long as other artists support their musical expressions.

By allowing the younger artists to reinforce their status through time, Blue Note has been able to guarantee the continuous renewal of its catalog, constantly adapting to the changes in jazz. The evolution of the Jazz Messengers illustrates this well. Throughout its history, the Blue Note label has launched many new artists, frequently associating them to established individuals. These new talents have therefore benefited from the experience of those forming the core of the label, which has allowed them to gradually occupy a central position in the network. In this context, the different styles of jazz, and particularly hard bop, have been constantly nourished by the work of a variety of artists. This process is probably the major reason for the label’s long-lasting success. As a result, if high-status artists appear to be an essential source of growing power and prestige on a rather short-term basis, they are not the promise of a long-term viability. They must therefore be progressively replaced in order for new creative talents to acquire a central position and eventually become tomorrow’s hit-makers. In this perspective, if success is a key mechanism leading to economic viability, it can also be the main reason explaining failure, in cases where strong dependence on several major stars inhibits the enforcement of change.

7 Concluding remarks

Since its establishment in 1939, “the finest in jazz” has been Blue Note’s slogan and motto. Many are those who would agree with this assertion. Indeed, the label has always taken great care in recording some of the most important artists of each era, who have all contributed by their multiple interactions to the creation of a variety of styles describing jazz. In that respect, the different musical expressions should be considered as having emerged from a cohesive core, in which integrated groups of artists overlap, forming one big whole.

Throughout this study, we have attempted to characterize the extent to which this musical creativity can be related to the dynamic network formed by the collaborations among the many different artists. Although we do not have the sufficient data to be able to fully address the many questions which are raised in this work,
our findings do suggest that the structure can be directly related to the recording strategy implemented by Blue Note in time. As a matter of fact, by intensively relying on the numerous artists who helped create hard bop, the label was able to benefit from an important success. This gave Blue Note the opportunity to also experiment new talents and record more novel artistic expressions, like avant-garde or free jazz. In other words, at any point of its evolution, the label has been able to find the right equilibrium between specialization and variety, recording well established musicians, as well as creative newcomers.

In this perspective, we have shown that some artists benefit from a much more important rank than others, and can reasonably be viewed as the actual stars in the collaboration structure. These stars however do not appear to be responsible for connecting the network. Hence, if artists with many collaborators may contribute to influence the creation of new musical expressions in some way or another, they must rely on the cohesive and interconnected regions of the network to diffuse their ideas, and to allow for commonly accepted conventions to develop. A closer look at the extent to which these stars bridge different styles and benefit from their creativity to reach success would be however necessary in order to fully conclude on that topic.

References


