An Empirical Study of Syncopation in American Popular Music, 1890–1939

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A study of syncopation in American popular music was carried out based on analyses of sound recordings spanning the period 1890 to 1939. Sample measures were randomly selected and the presence and rhythmic character of syncopations were tabulated. Several trend-related hypotheses were tested. While some changes in the patterns of syncopation were evident over the 50-year period of the study, the principal change was an increase in the quantity of syncopation rather than an increase in the variety of syncopated patterns.

Keywords: Syncopation, Recording, Empirical, Historical, Meter

INTRODUCTION

Syncopation is a topic that frequently arises in the context of other musical discussions. Scholars often mention syncopation when discussing such diverse topics as jazz, Renaissance motets, improvisation, and certain non-Western musics. However, scholarly studies that focus specifically on syncopation have been less common, though not entirely absent.[1]

Our aim in this essay is to better understand both the nature of syncopation and its manifestations in a particular time and place. While syncopation is common in many different types of music, it is widely associated with popular music, especially American popular music. The point at which syncopation came to be considered a hallmark of American popular music is open to dispute. Less contentious, however, is the idea that syncopation became increasingly prevalent in the United States in the latter decades of the 19th century and the early decades of the 20th century.

In this study we propose to test this latter intuition empirically. In addition, we propose to examine the phenomenon of syncopation and what stereotypic trends may appear, as well as possible differences over time.

WHAT IS SYNCOPATION?

Syncopation has been variously defined by a number of music scholars. Popular sources, like the *New Harvard Dictionary of Music* define syncopation as:

> A momentary contradiction of the prevailing meter or pulse. This may take the form of a temporary transformation of the fundamental character of the meter, e.g., from duple to triple or from $\frac{3}{4}$ to $\frac{3}{2}$, or it may be simply the contradiction of the regular succession of strong and weak

1 See for example Johnson-Laird 1991; Simpson and Huron 1993; and Temperley 1999. Further discussions of syncopation within more general theories of rhythm include: Cooper and Meyer 1960; Handel 1998; Hasty 1997; Kramer 1988; Krebs 1987 and 1999; Lerdahl and Jackendoff 1983; London 2004; Povel and Essens 1985; Povel and Okkerman 1981; and Zbikowski 2002.

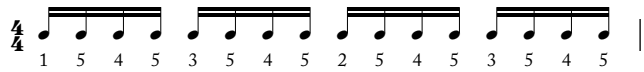
beats within a measure or a group of measures whose metrical context nevertheless remains clearly defined by some part of the musical texture that does not itself participate in the syncopation.[2]

Notice that this definition distinguishes between hemiola (where there is a metrical contradiction) and unusual event placements within an established metrical hierarchy. Here, we focus exclusively on the latter type of syncopation. That is, we do not consider cases of hemiola.

In pursuing any empirical study, it is important that the analysis be based on a well-defined and replicable procedure. This can be done only when terms are unambiguously defined. An "operational definition" is intended to provide the basis for an analytic procedure; it is not intended to fully grasp or define some theoretical essence. In forming an operational definition of syncopation, our goal is to capture as much as possible our intuitions about what syncopation might be. However, we acknowledge at the outset that our procedure will necessarily fall short of the rich connotations evoked for musicians by the word "syncopation."

Example 1 shows a series of sixteenth notes within a $\frac{4}{4}$ metrical context. Below each note is a number representing the position in the conventional metrical hierarchy as commonly conceived in Western music theory. The number 1 identifies the downbeat, while the number 2 identifies the half-measure position. The number 3 identifies the second and fourth beats. The numbers 4 and 5 identify the half-beat and quarter-beat positions respectively.[3]

Example 2 provides several examples of what most music scholars would agree to call syncopated events. As in Example 1, the numbers indicate positions within the metrical hierarchy for $\frac{4}{4}$ meter. For illustration purposes, examples are shown at the (a) sixteenth level, (b) eighth level, and



EXAMPLE 1. *Numerical representation of the metrical hierarchy for $\frac{4}{4}$ meter. The value "1" designates the highest value in the hierarchy.*

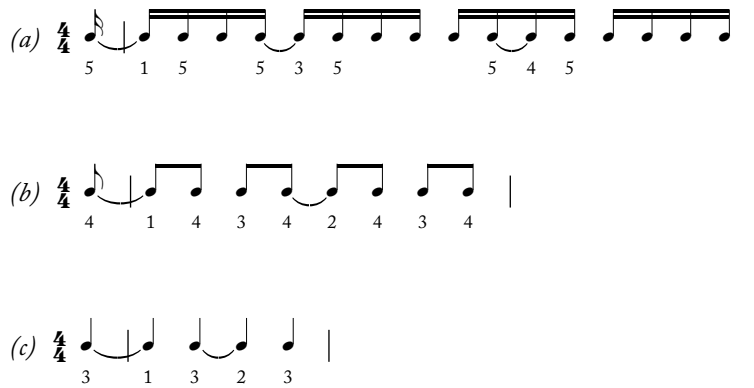
(c) quarter level. With each syncopated event, a note onset occurs at a relatively low metrical level (i.e., a higher number), and is sustained through a moment in the metrical hierarchy that has a higher metrical level (i.e., a lower number) and that does not manifest a corresponding event onset. A syncopation appears to occur when an onset fails to occur at a higher metrical level than that of the previous onset. That is, syncopation appears to arise because of the absence of a note onset. More specifically, it appears to arise because of the absence of a note onset in a relatively strong metric position compared with the preceding note onset.

In examining the syncopations in Example 2, a useful question to ask is where, precisely, the moment of syncopation occurs. For instance, in Example 2(a), one might ask whether the first syncopation coincides with the first note onset, the first downbeat, or the first note onset following the downbeat. While people may agree that a syncopation has occurred, they may not agree on where the precise moment of syncopation lies. Some musicians might suggest that the first note is "the syncopated note." Others might suggest that the syncopation occurs at the moment of the missing downbeat. Yet others might suggest that it is the "weak" note occurring after the absent downbeat that creates the syncopation.

As these issues remain contentious, we will avoid any strong claims here and attempt to provide a theoretically more neutral language in describing the succession of events that are involved in a syncopation. For the purposes of this paper we distinguish three syncopation-related rhythmic moments:

2 Randel 1986.

3 This system is logically equivalent (though reversed) to the dot notation introduced by Lerdahl and Jackendoff. Our numerical system proved easier to implement in a computer program.



EXAMPLE 2. *Examples of syncopation. As in Example 1, numerical values represent positions in the metrical hierarchy. With each syncopated event, a note onset occurs at a relatively low metrical level (i.e., a higher number), and is sustained through a moment in the metrical hierarchy that has a higher metrical level (i.e., a lower number) and that does not manifest a corresponding event onset.*

Lacuna: a relatively strong metric position that does not coincide with a note onset and that is preceded by a note onset in a weaker metric position;

Pre-Lacuna: a note onset that occurs in a relatively weak metric position and that is not followed by an ensuing note onset in a following stronger metric position;

Post-Lacuna: the first note onset occurring after a lacuna.

Referring back to Example 2(a), the first, second, and third note heads may be dubbed the pre-lacuna, lacuna, and post-lacuna respectively. In introducing this nomenclature, we acknowledge that these terms may not capture all notions of syncopation. Moreover, some might regard this conceptual framework as excessively broad.[4]

Notice that it is theoretically possible for a syncopation to involve more than one lacuna. Example 3 provides an illustration. The first note in this example is the pre-lacuna tone. It is followed, first, by a lacuna on the fourth beat of the measure, and then spans across the downbeat of the next measure. Notice that a syncopation would occur even if a note onset were to appear on the downbeat, but the missing downbeat adds yet another lacuna. In this case, the second lacuna involves a stronger metric position than the first lacuna. However, it is also possible for syncopations to occur where the first lacuna represents a stronger metrical level than the second lacuna.

EXAMPLE 3. *Example of a "multiple-lacuna" syncopation. The first note is designated the "pre-lacuna" note. It is followed, first, by a "lacuna" on the fourth beat of the measure, and then a second "lacuna" on the downbeat of the next measure. The "post-lacuna" note follows on beat two.*

4 Our definition of syncopation can be applied at any metrical level, from sub-beat levels to hypermetric levels. Some might wish to restrict syncopation to the level of the tactus.

Note that all of the above analyses rely on prior assumptions about the relative weights of the different beats and sub-beats. For example, we have assumed that the third beat is more metrically weighted than the second beat in a quadruple meter. Similarly, we have assumed that the second half of the third beat is equivalent in weight to the second half of the second beat. What is the origin of these assumptions about the metrical hierarchy? Is there any justification for the assumptions made about the relative weights of different beat positions?

Some psychologists have proposed that the metrical hierarchy arises from integrally-related mental oscillators that coordinate auditory attending. However, recent psychological research more strongly suggests that rhythmic perceptions arise from simple exposure to rhythmic stimuli rather than via mental oscillators. This research suggests that patterns of auditory attending arise through the mechanism of statistical learning. Listeners are sensitive to the frequency of occurrence of sound events, and these distributions appear to become internalized as mental "schemas."[5] In the case of rhythm, perceptual research further suggests that listeners are most sensitive to sound onsets.[6] Example 4 shows a frequency distribution of note onsets for a large sample of music in $\frac{4}{4}$ meter. The sample consists of 1,537 Germanic folk melodies from the Essen folksong collection.[7] The graph plots the total number of note onsets that are initiated in each of 16 metric positions corresponding to successive sixteenth notes in a $\frac{4}{4}$ measure. As can be seen, the most frequently occurring onset position is at the beginning of the measure (i.e., the downbeat). The second most common onset position coincides with the third beat. Next most common is the fourth beat, followed by the second beat position. Sub-beat positions and sub-sub-beat positions are proportionally less common.

The histogram shown in Example 4 is similar though not identical to the conventional metrical hierarchy. For example, in the histogram, beat four is considerably "stronger" than beat two, whereas these two beats have been commonly regarded as equivalent in weight. Nevertheless, there appears to be a notable correspondence between the hierarchy of event onsets and the conventional metrical hierarchy. The causal relationship here is unknown. It is possible that the metrical hierarchy originates in the distribution of event onsets. Alternatively, the distribution of event onsets might simply reflect a pre-existing metrical hierarchy that influences the composition of music.

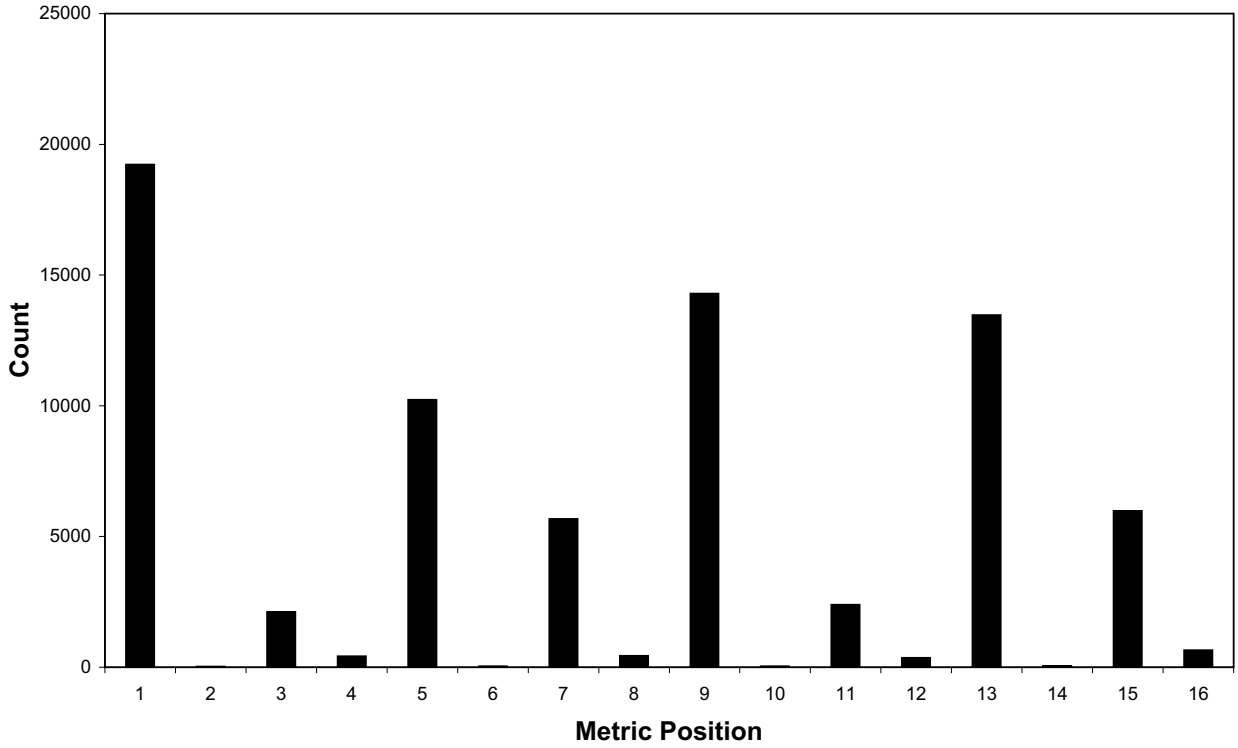
Whether the metrical hierarchy arises from theory or from practice, the agreement between the two commends the use of the metrical hierarchy as a tool for describing the relative weights of different metric positions. This hierarchy, in turn, provides an unambiguous basis by which we can operationally define the pre-lacuna, lacuna, and post-lacuna moments in a syncopated passage.

hypotheses

Given this concept of syncopation, we set out to test the following three hypotheses:

(1) that the density of syncopated moments in syncopated American popular music increases throughout the early years of the twentieth century;
(2) that the variety of syncopated patterns in this music increases throughout the early years of the twentieth century; and
(3) that the patterns of syncopation exhibited in this music become increasingly adventurous (in the sense of being statistically less probable) over time.

5 Desain and Honing 2003; Desain, Honing, and Sadakata 2003; Krumhansl 1990; and Saffran, Johnson, Aslin, and Newport 1999.
6 Clarke 1999.
7 See Schaffrath 1995.



EXAMPLE 4. *Frequency distribution of note onsets from a sample of 1,537 Germanic folksongs in $\frac{4}{4}$ meter. Numbered positions on the horizontal axis represent successive sixteenth notes within a bar. The pattern of onset counts is similar (though not identical) to the beat-weights assigned in the conventional metrical hierarchy.*

SAMPLE

In order to test the above hypotheses an appropriate musical sample is needed. One might choose to sample either published scores or commercial recordings. A disadvantage of notated scores is that, especially in the case of syncopated music, performance practices did not always conform to the published musical notation. On the other hand, music recordings were not commonplace before 1890. Therefore a disadvantage of sampling from sound recordings is that it precludes looking at music from earlier decades. We decided, however, that the advantages of examining actual musical performances outweighed the loss of earlier materials. Consequently, our sample consists of examples from the early decades of music recording (specifically, the first 50 years).

In order to assemble a sample of sound recordings from the desired period we made use of four compilations of early American popular music recently re-issued in digital formats. Specifically, we selected the "Brown Wax Cylinder Recordings" (14 CDs issued by Tinfoil.com), "American Pop and Audio History" (a 9-CD set issued by West Hill Audio Archives), 19 CDs from the catalogue of Archeophone Records, and five volumes of public domain audio files from Dismuke.org. These recordings span the period 1890–1939, and include a total of 1,131 musical selections. A handful of the selections appear multiple times, including both exact duplications as well as different renditions of the same work. In our sampling, we excluded exact duplications but made no effort to exclude different renditions of the same work.

These collections include a mix of syncopated and un-syncopated works in various meters and styles. In order to focus our efforts, we decided only to study syncopated works in duple or quadruple meter. To this end, one of us (Ommen) audited all the works and judged (by ear) which works failed to exhibit any syncopation or failed to adhere to the duple /quadruple meter selection criterion. These works were then discarded from further consideration. In judging which works might be deemed syncopated, no special attention was placed on thematic or melodic elements. If syncopation was evident in accompaniment or non-expository passages then the work was deemed syncopated.

For the remaining musical works a single sampled measure was selected. Our sampling procedure was organized so that each measure in any given work was equally likely to be sampled. The total duration of each work (in seconds) was determined and a random number generator used to select a random second. If a syncopation occurred within roughly a second of the sampled second, then the rhythm for the corresponding one- to two-measure passage was transcribed. If the passage corresponding to the sampled second was determined to be un-syncopated, then the absence of a syncopation was recorded; however, the work continued to be audited until a syncopation was encountered. This syncopation and the second in which it occurred were transcribed and recorded. All transcriptions were performed by the second author (Ommen). Our final sample included 437 transcribed syncopated passages from 437 individual works: 25 from the 1890s, 70 from the 1900s, 109 from the 1910s, 152 from the 1920s, and 81 from the 1930s. A complete list of works studied is provided in Appendix I.

In our sampled materials only the rhythmic information was transcribed. Transcription efforts were generally restricted to the predominant musical line. In some circumstances, more than one main musical line was relevant and each was transcribed accordingly. These transcriptions were then encoded using the Humdrum format,[8] which provided the basis for our statistical analyses.

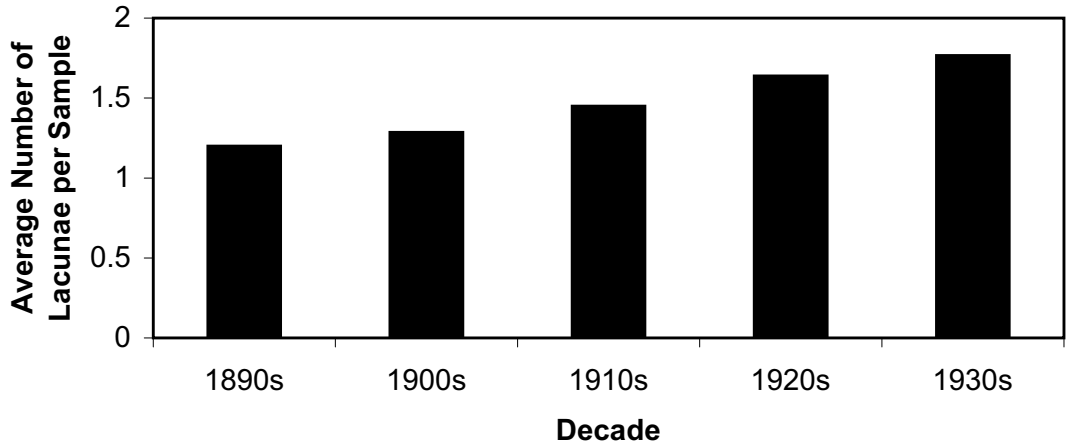
analytic method

All hypotheses were tested using the Humdrum Toolkit software. A special-purpose computer script was written to identify lacunas, pre-lacunas and post-lacunas. All of the outputs from this script were manually checked. In some cases modifications were introduced due to multiple lacunas and to handle multiple transcribed musical lines.

results

Hypothesis 1. Hypothesis 1 predicted that the density of syncopated moments in syncopated works would increase over the five-decade span of the study. In order to test this hypothesis we used two different criteria for calculating the density of syncopations. The first was the number of syncopations per sampled passage. Specifically, we counted the number of lacunas in each of the 437 samples. Example 5 displays the results according to decade.

8 Huron 1995.



EXAMPLE 5. *The average number of lacunas per sampled passage. The graph suggests an increase in the density of syncopation over five decades.*

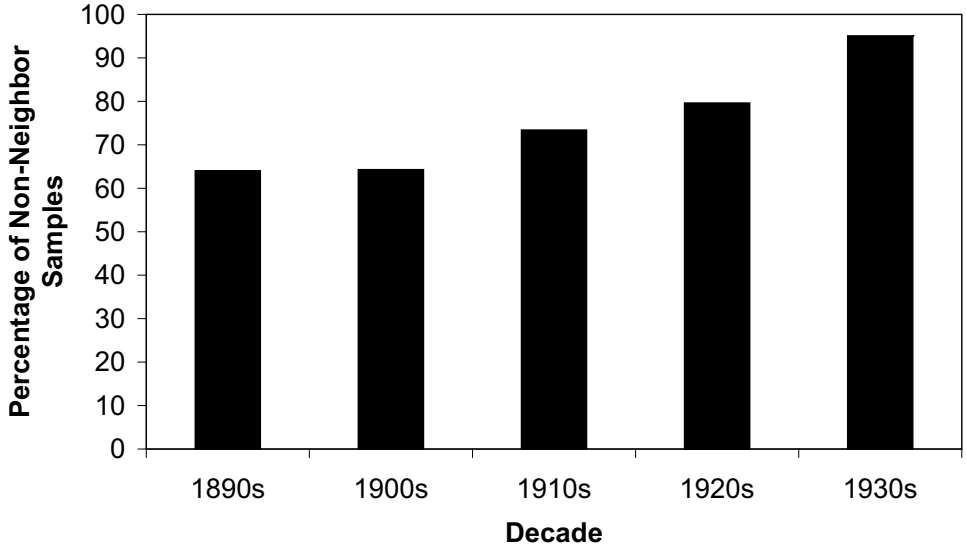
As can be seen, the number of lacunas per sampled measure increases over the period of the study, from an average of 1.2 syncopations per measure in the 1890s to nearly 1.8 syncopations per measure in the 1930s. These results are consistent with hypothesis 1.

An alternative way of testing hypothesis 1 might focus on the difference between the random sample time and the actual sample time. Recall that for some works the random sample time did not coincide with a syncopation. As a result we selected a nearby or ensuing syncopation. The need to locate a "neighbor sample" may be indicative of less syncopation in the target work as a whole. Works with more syncopation would therefore be less likely to require a "neighbor sample." Example 6 shows the proportion of "non-neighbor samples" to total number of samples for each decade. As can be seen, over the five decades, fewer neighbor samples were required. By the 1930s, there was a 95 percent chance that a randomly sampled moment coincided with a measure that contained a syncopation.

By way of summary, these results are consistent with a general increase in syncopation over the period of this study. The number of lacunae within a syncopated measure tends to increase, and the proportion of syncopated measures appears to do the same.

Hypothesis 2. Hypothesis 2 suggests that the variety of syncopation patterns increases over time. This idea can be operationalized in a variety of ways. We will distinguish eight approaches (Hypotheses 2.1 to 2.8).

Hypothesis 2.1. One source of variety is the number of lacunas that are involved in a syncopation. The majority of syncopations include just a single lacuna. As noted earlier, however, some syncopations include two or more lacunas. Accordingly, one estimate of syncopation variety might be the proportion of multiple-lacuna syncopations to the total number of syncopations. Hypothesis 2.1 predicts that this proportion will increase over time. Example 7 shows the percentage of multiple-lacuna syncopations by decade. As can be seen, the proportion of syncopations that involve multiple

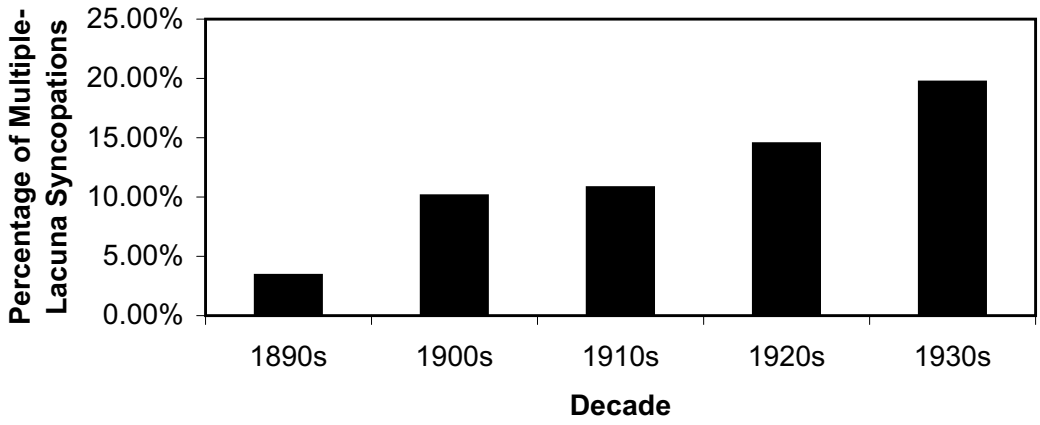


example 6. *The percentage of randomly sampled bars containing a syncopation. The graph shows that the probability of finding a syncopation in a randomly sampled bar increases from 64% (in the 1890s) to 95% (in the 1930s).*

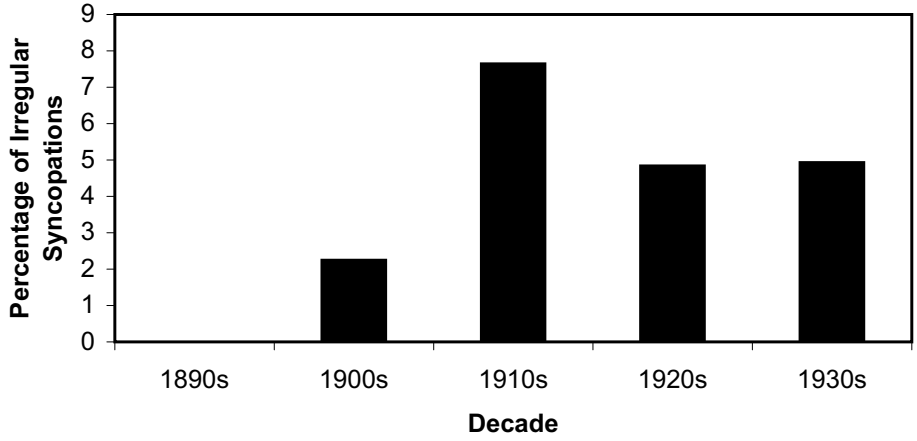
lacunas increases over the period of the study from 3 percent to nearly 20 percent. This is consistent with the view that a greater variety of syncopation patterns occurs in later years.

Hypothesis 2.2. In coding our sampled syncopations, a number of syncopations proved difficult to categorize. For example, some syncopations arose due to the interaction of two musical lines rather than within a single line. Other syncopations occurred because of accentuation patterns rather than the omission of particular note onsets; that is, some syncopations arose from what Cooper and Meyer, and Lerdahl and Jackendoff have described as stressed weak beats. While all of the passages were ostensibly in simple-duple or simple-quadruple meters, some passages momentarily shifted to a sort of compound pattern (such as triplets) within which a syncopation occurred. In coding our passages, we marked these occurrences "irregular syncopations." Example 8 displays the proportion of such irregular syncopations by decade. The results are equivocal. Irregular syncopations appear to increase over the first three decades and then drop. Accordingly, these results are not consistent with Hypothesis 2.2.

Hypotheses 2.3, 2.4, and 2.5. Since the majority of syncopation patterns involve a single lacuna, it may be helpful to characterize the variety of patterns exhibited by the single-lacuna syncopations. For Hypotheses 2.3, 2.4 and 2.5 we classified each single-lacuna syncopation according to the metric positions of the lacuna, pre-lacuna and post-lacuna respectively. Since the number of sampled syncopations differs from decade to decade, we re-sampled our data in order to maintain an equivalent sample size in each decade. Specifically, we randomly selected a sub-sample of 27 single-lacuna syncopations from each decade.



EXAMPLE 7. *The percentage of multiple-lacuna syncopations by decade. (Multiple-lacuna syncopations are those that span two or more strong metric positions.) Multiple-lacuna syncopations increase from 3% to nearly 20% over these five decades.*



EXAMPLE 8. *The percentage of irregular syncopations by decade. (Irregular syncopations include those created via dynamic accents or through the interaction of multiple musical lines.)*

In calculating variety, a useful measure is provided by information theory: the variety evident in a collection of objects can be calculated using the so-called Shannon-Weaver equation. For any combination of possibilities, this equation generates a single number that expresses the amount of variety (in bits). A high degree of variety results in a high bit value, while a low degree of variety results in a low bit value. The Shannon-Weaver equation is given in many sources and will not be presented here.[9] But the essence of the equation can be conveyed by some examples. The variety possible with a coin (heads or tails) is precisely 1 bit. Similarly, if there are four equally likely outcomes, the number of bits is 2. If there are 8 equally likely outcomes, then the variety is 3 bits ($2 \times 2 \times 2$). Unlike these examples, the Shannon-Weaver equation handles also those circumstances where not all possibilities are equally likely, as is the case in the present study.

Example 9 shows the average information for the sample of 27 single-lacuna syncopations by decade. Higher values indicate a greater variety in the metric placement. Column 1 shows the decade; columns 2, 3, and 4 give the information values (in bits) for the pre-lacuna, lacuna, and post-lacuna metric positions. As we can see, there is no increasing trend evident in any of the three positions. That is, no increasing variety is evident in the metric placements of the pre-lacuna, lacuna, and post-lacuna moments. These results are not consistent with the idea that the variety of syncopation forms increased over the five decade period.

Hypothesis 2.6. The preceding hypotheses treated the pre-lacuna, lacuna, and post-lacuna moments independently. Arguably, it is the combination of these moments as a single syncopation that creates the distinctive rhythmic pattern. Consequently, an alternative approach to Hypothesis 2 would predict increasing variety for the combination of these three component moments. Example 10 shows the information (in bits) for 27 sampled syncopations from each decade.

9 See, for example, Moles 1968.

Average Metric-Position Variety for Sampled Syncopations (in bits)

Decade	Pre-Lacuna	Lacuna	Post-Lacuna
1890s:	2.56	2.35	2.78
1900s:	2.74	2.56	2.82
1910s:	2.30	1.92	2.54
1920s:	2.66	2.17	2.73
1930s:	2.84	2.00	2.48

EXAMPLE 9. *The average variety of metrical positioning of each moment within a syncopation by decade. Higher values indicate greater variety in the metrical placement of note onsets.*

Decade	Average combined metric-position variety (in bits)
1890s:	3.26
1900s:	3.53
1910s:	3.42
1920s:	2.95
1930s:	3.16

EXAMPLE 10. *The average variety of metrical positioning of the collective moments within a syncopation by decade. Higher values indicate greater variety.*

Compared with Example 9, the bit values are larger, reflecting the greater variety of combinations of metric positioning. However, once again, there is no evidence of increasing variety over the five decades.

Hypothesis 2.7. Instead of looking at the metric positions of the pre-lacuna, lacuna and post-lacuna, perhaps an increase in variety is evident in the relative durations between these three moments. Ignoring metric position information, we calculated the metric distance (duration) between the

pre-lacuna, lacuna, and post-lacuna for each syncopation. For example, where the pre-lacuna, lacuna, and post-lacuna onsets coincided with metric positions 5, 9 and 13, the elapsed duration between pre-lacuna and lacuna would be 4 units, and the elapsed duration between the lacuna and post-lacuna would be similarly 4 units.

We might code this syncopation as 4–4. Once again, we re-sampled our data to select 27 single-lacuna syncopations from each decade. The information theoretic measures are shown in Example 11. Once again, no increase in information is evident.

Hypothesis 2.8. As a final test, we recoded the durational information as ratios. For example, where the pre-lacuna, lacuna, and post-lacuna onsets coincided with metric positions 5, 9 and 13, the duration-difference (4–4) would be coded as a ratio as 1:1 (or 1.0). Using this approach, particular patterns of syncopation at the beat level could be equated with similar (faster) patterns at the sub-beat or sub-sub-beat level. The results are shown in Example 12.

In general, our results suggest that single-lacuna syncopations showed no obvious increase in variety over the five decades. The only evidence supporting an increasing variety of syncopations is found in the increasing proportion of multiple-lacuna syncopations.

Decade	Average syncopated variety (in bits)
1890s:	2.66
1900s:	2.13
1910s:	2.50
1920s:	1.83
1930s:	2.46

EXAMPLE 11. *The average variety in metrical distance between the moments of a syncopation by decade. Higher values indicate greater variety.*

Decade	Average Duration-Ratio Syncopation Variety (in bits)
1890s:	1.62
1900s:	1.81
1910s:	1.47
1920s:	1.53
1930s:	1.96

EXAMPLE 12. *The average variety in metrical distance ratios between the moments of a syncopation by decade. Higher values indicate greater variety.*

HYPOTHESIS 3

In the previous hypotheses, we examined the variety of syncopations without considering possible perceptual phenomena. It is likely that some patterns of syncopation are perceptually more "disruptive" than other patterns. It is possible that, over the decades, musicians tended to use patterns of syncopation that are more "adventurous" from a cognitive or perceptual perspective. In short, syncopation might have become "spicier" over time.

One way to operationalize this idea of perceptual adventurousness draws on recent research on statistical learning. Research by Jenny Saffran and her colleagues lends considerable support to the idea that listeners form mental schemas based on exposure to sounds.[10] Research by Peter Desain and Henkjan Honing has established that such statistical learning is evident in the case of rhythm.[11] According to the precepts of statistical learning, a listener will find "disruptive" those rhythms that are not common in their sonic environment.

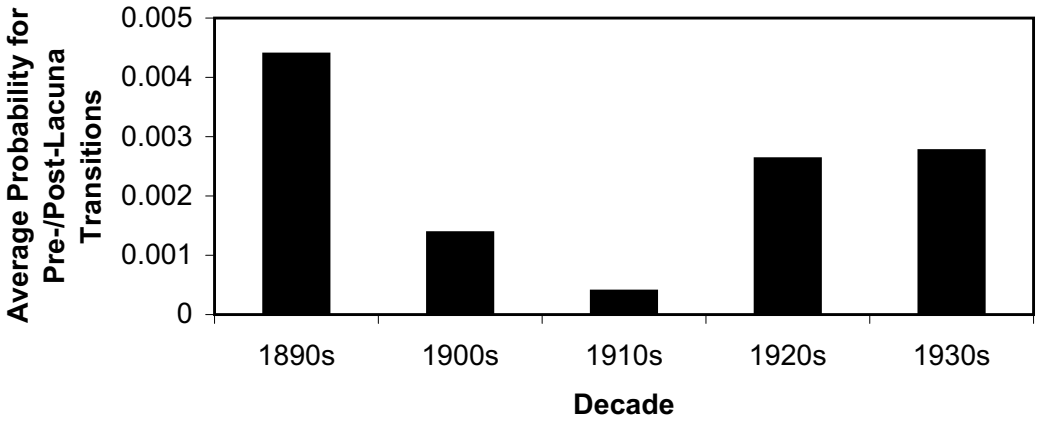
Accordingly, we can operationalize the notion of rhythmic adventurousness in terms of the normative likelihood

10 Saffran et al., 1999.

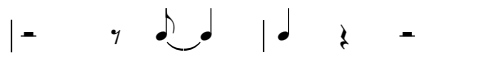
11 Desain and Honing, 2003; Desain, Honing, and Sadakata, 2003.

of the rhythmic pattern. In order to measure the probability of different rhythmic patterns we used a large collection of Germanic folksongs as a normative rhythmic corpus. Specifically, we calculated the transitional probabilities between metric moments for $\frac{4}{4}$ meter. Transitional probabilities were calculated for 26,775 note transitions. Using these note transitions we calculated the probability of the pre-lacuna moment being followed by the post-lacuna moment for all syncopations in each decade. By way of illustration, the most common syncopation pattern in our study had a pre-lacuna coinciding with the "and" of beat one, and a post-lacuna coinciding with the *and* of beat two (skipping the lacuna moment of beat two). Using the sixteen-fold division of the measure, this syncopation pattern might be numerically represented as 3-5-7. In our sample of Germanic folksongs, the transitional probability between these two metric moments is 0.00997. That is, approximately one percent of beat one *and*s are followed by beat two *and*s in Germanic folksongs.

Using the complete table of transitional probabilities we could calculate the average probabilities for the pre-/post-lacuna transitions for all of the sampled syncopations in each decade. These average probabilities are shown in Example 13. Lower values represent more unusual syncopations. As can be seen, no linear trend is evident. The average metric-transition probability is greatest for the 1890s. However, the lowest average metric transition probability is found in music from the 1910s. These results are not consistent with the view that syncopation became more adventurous over the five-decade span of the study, at least as understood within the framework of statistical learning. Nevertheless, these results corroborate those of Hypothesis 2.2 shown in Example 8. There appear to be more irregular syncopations in the



example 13. *The average probability of onset-to-onset transitions for the sampled syncopations. Probabilities have been calculated with respect to normative onset-to-onset transitions in a sample of Germanic folk songs. Each onset is represented by its metric position within the bar. Low average values represent more unusual patterns of syncopation. That is, low average values are consistent with greater rhythmic "adventurousness."*

number of occurrences	pattern	pattern notated
87	3-5-7	
83	7-9-11	
73	11-13-15	
26	7-9-13	
23	11-13-1	
22	5-9-11	
20	5-9-13	
18	3-5-9	
16	15-1-3	
10	15-1-5	

EXAMPLE 14. *Inventory of the ten most common syncopation patterns found in the sampled music. The column labeled "pattern" represents the metric positions (within a bar) for the pre-lacuna, lacuna, and post-lacuna moments.*

1910s, and the average syncopation in this decade is also less probable when compared with the normative rhythms of Germanic folksongs.

DESCRIPTIVE RESULTS

Readers may be interested to know the most common syncopation patterns evident in our study. Example 14 provides an inventory of (single lacuna) syncopation patterns for the 437 sampled passages. The patterns are ordered by the total number of occurrences. Only the top 10 patterns are shown. A sample transcription for each pattern is also provided. As noted earlier, syncopations can also be characterized as the ratio between pre-lacuna/lacuna and lacuna/post-lacuna durations. Example 15 shows the five most common syncopation ratios evident in our sample. Some sample transcriptions are also provided.

CONCLUSIONS

This study suggests two broad conclusions related to syncopation in American popular music of the early twentieth century. First, our results are consistent with the general idea that the amount of syncopation increases over the years from 1890 to 1939. Specifically, the number of syncopations in the sampled moments used in this study exhibited an increase in the proportion of syncopations over time. In addition, selecting a random moment in a sound recording is more likely to coincide with a syncopated passage in the later years than in the earlier years. Second, our results do not suggest that there is a greater variety of syncopation patterns in later years. An important exception to this is the occurrence of multiple-lacuna syncopations. Multiple-lacuna syncopations occur much more frequently in the sampled passages from the later decades. Combining the first and second observations, we might provide an informal summary by saying that the principal historical change in syncopation during this time pertains to *quantity* rather than *quality*.

This study raises a number of unanswered questions. Since it was based on recorded music, it would be appropriate to determine whether the same trends are evident in the contemporaneous published sheet music. The study could also be extended to examine music prior to 1890 and subsequent to 1940, and expanded beyond the domain of American popular music. Finally, in light of the results shown in Examples 8 and 13, further study of the variety of syncopation patterns in the decade of the 1910s may be worthwhile.

It is important to understand that the results of this study are contingent on a number of assumptions that bear reiterating. Our sample of music was limited to only American popular music spanning the period from 1890 to 1939, and relied on just four pre-existing non-random compilations of period sound recordings. Further unknown problems may have arisen in transcribing the materials and in computer processing. Finally, the results assume that the manner by which we have operationalized the notion of syncopation captures the main features of this important phenomenon.

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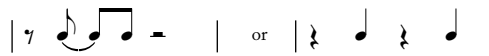
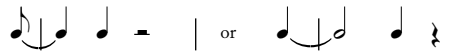
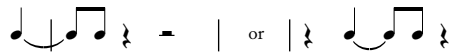
ratio	number of occurrences	notated examples of ratios
1:1	318	
1:2	97	
2:1	44	
4:1	7	
2:3	2	

EXAMPLE 15. *The five most common syncopation patterns when viewed as duration ratios (i.e., the ratio between the pre-lacuna/lacuna time difference and the lacuna/post-lacuna time difference). Notated examples represent only two of multiple possibilities. The great majority of syncopations found in this study are represented by the duration ratios 1:1, 1:2, and 2:1.*

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APPENDIX I: WORKS ANALYZED

A Band Contest
A Bunch of Rags
A Coon Band Contest (4 recordings)
A Jazz Holiday
A Year From Today
A.B.C.'s of the U.S.A.
Acorn Stomp
After You've Gone (2 recordings)
Ain't Dat a Shame Medley
Ain't Misbehavin'
Ain't That a Shame
Ain't We Got Fun
Ain't We Got Fun?
Alexander
All by Myself
All Coons Look Alike to Me
All She Gets From the Iceman Is Ice
All She'd Say was "Umh Hum"
American Cake Walk
American Fantasie
Amos 'n Andy
Any Old Time
Any Rags
At a Georgia Camp Meeting (2 recordings)
Bagdad
Bedelia
Big Chief DeSoto
Big City Blues
Bill Bailey
Bimini Bay
Black Beauty
Black Bottom Stomp
Blind Arthur's Breakdown
Blue Guitar Stomp
Bob White
Body and Soul
Booster Fox Trot
Borrow From Me
Bring Back Those Wonderful Days
Bring Up Breakdown
Broadway Melody
Brother Low Down
Butch the Beach Boy
By the Beautiful Sea
By the Sycamore Tree
Cake Walking Babies From Home
Cakewalk
California Here I Come
Canhanibalmo Rag
Carrie
Carve Dat Possum
Casey Jones
Charlestonette
Charley, My Boy
Checkers
Chicago Stomp
Chile Bean
Chili Bean
Circus Day in Dixie
Cocoanut Grove
Cohan's "Rag Babe"
Constantly

Crazy Blues
Creole Belles
Crooning
Cross Street Swing
Cuddle Up a Little Closer
Daddy Wouldn't Buy Me a Bow Wow
Dallas Rag
Dardanella
Darkies Awakening
Deed I Do
Deep Elm
Deiro Rag
Desecration Rag
Dill Pickles Rag
Diminuendo in Blue
Dinah (2 recordings)
Don't Be Blue
Don't Be Like That
Don't Go Away
Don't Make Me Laugh, Bill
Don't Take Me Home (track 19)
Don't Take Me Home (track 7)
Don't Wake Me Up Let Me Dream
Down Home Rag
Down on the Brandywine Medley
Down on the Old Plantation
Down South Camp Meeting
Dry Spell Blues
Dust on the Moon
El Capitan March
El Sombrero de Gaspar
Elephant's Wobble
Ev'ry Little Bit Added to What You've Got, etc.
Eve Cost Adam Just One Bone
Everybody
Everybody Rag With Me
Everybody Two-Step
Everybody Wants a Key to My Cellar
Everything's Gonna Be All Right
Fair One
Feelin' the Spirit
Five Minutes With the Minstrels
Flirting on the Beach
Floating Down the River on the Alabam'
Florida Rag
Fo' de Lawd's Sake Play a Waltz
Following the Sun Around
Freeze Out
Fur wen macht eine Frau sich schon?
Give Me Your Hand
Give My Regards to Broadway
Goin' Hollywood
Golden Trumpets
Good-Bye My Lady Love
Good-bye Summer! So Long Fall! Hello Winter Time!
Goodnight My Love
Happy Days are Here Again
Harmony Bay
He'd Have to Get Under - Get Out and Get Under
He's a Devil in His Own Hometown
He, She, and Me
Hello, Ma Baby
Highways are Happy Ways
Hold Me
Home Again Blues
Honeysuckle Rose
Honolulu Blues
Hopscotch March
Hot Time March
How Could Little Red Riding Hood
How Long
How'd You Like to Be the Iceman
Hu-la Hu-la Cake Walk
Humming Your Glum Times Away
Hungarian Rag (2 recordings)
I Adore You
I Can't Afford to Dream
I Can't Get Started
I Certainly Was Going Some
I Couldn't
I Faw Down an' Go Boom
I Found a Million Dollar Baby

I Guess I'll Have to Telegraph My Baby
I Hate a Man Like You
I Know Why
I Love a Piano
I Love You Sunday
I Married an Angel
I Thought I Was a Winner, or, I Don't Know, You Ain't So Warm
I Used to Love You but It's All Over Now
I Want to Know Where Tosti Went
I Want to Love You While the Music's Playing (track 13)
I Want to Love You While the Music's Playing (track 4)
I Want You By My Side
I Won't Dance
I Wonder What's Become of Joe
I'd Love to Fall Asleep and Wake Up in My Mammy's Arms
I'd Rather be a Minstrel Man than a Multimillionaire
I'll Always Be in Love With You
I'll Get By (As Long as I Have You)
I'll Lend You Anything
I'm a Member of the Midnight Crew
I'm Afraid to Come Home in the Dark
I'm an Old Cowhand
I'm Coming Virginia (2 recordings)
I'm Crazy About It
I'm Going Back to Dixie
I'm Gone Before I Go
I'm in the Market for You
I'm Needing You
I'm Sorry I Ain't Got It
I've Got My Captain Working for Me Now
I've Got my Fingers Crossed
I've Got Something in My Eye
I've Got You On My Mind
I've Never Seen a Straight Banana
Ice Water Blues
If Dreams Come True
If He Comes In, I'm Going Out
If I Could Be With You
If I Could Be With You One Hour Tonight
If I Could See as Far Ahead as I Can See Behind
If I Had a Talking Picture of You
In Apple Blossom Time
In Coonland
In the Heart of the Kentucky Hills
In the Land of Harmony and Stop Stop Stop
In the Right Church but in the Wrong Pew (track 10)
In Zanzibar
Indian War Dance
Indiana
Indoor Sports
Is There a Place Up There for Me?
It Ain't Gonna Rain No Mo?
It Goes Like This
It Had to Be That Way
It Makes My Love Come Down
It Must Be Someone Like You
It Never Dawned on Me
It's All Right Now
It's Nobody's Business But My Own
Johnny Dunn's Cornet Blues
Jump Steady Blues
June Moon
Jungle Fever
Just a Friend of the Family
Just Like a Rainbow
Just Too Soon
K-K-K-Katy
Kansas City Man Blues
Keep a Song in Your Soul
Keep off the Grass
Kentucky Jubilee Singers
Kiss Me, Honey, Do
Kitten on the Keys
Last Night
Left All Alone Again Blues
Left My Gal in the Mountains
Let George Do It
Let That Liar Alone
Let's Break the Good News
Let's Say Goodnight Till the Morning
Lindbergh
Little by Little

Little White Lies
Livery Stable Blues
Liza
London Rhythm
Lonesome Alimony Blues
Lonesome Swallow
Lounging at the Waldorf
Lucky Rock Blues
Lucky Strike Presents: I Love to Whistle
Ma!
Madhouse
Maple Leaf Rag
Marching Home From the War March
Mariuch Dance da Hootch-a-Ma-Kootch
Melinda's Wedding Day
Memphis Blues (2 recordings)
Minstrel First Part - Just One Girl
Mixed Salad
Moten Swing
Motherless Children
Music Makes Me Sentimental
My Baby Knows How
My Gal is a Highborn Lady
My Irish Rosie
My Little Bimbo
My Little Irish Queen
My Little Lovin' Sugar Babe
My Little Persian Rose
My Money Never Runs Out
My Own
My Pretty Girl
My Sunny Tennessee
New Orleans Joys
No One's Fool
No Trouble But You
Nobody (2 recordings)
Nobody Cares if I'm Blue
Not Lately
Nothin'
O Death, Where Is Thy Sting?
O-H-I-O (O-MY O!)
Oh Gee! Oh Gosh! (My Feet Won't Behave)
Oh You Blondy!
Oh! Lawdy
Oh, You Beautiful Doll
Old Dan Tucker
Old Eph's Vision
Old Folks Rag
Old Playmate
On a Beautiful Night With a Beautiful Girl
On the Right Road
On the Sunny Side of the Street
Original Charleston Strut
P.L.K. Special
Palesteena
Peg O' My Heart
Pick Poor Robin Clean
Play That Barber Shop Chord (2 recordings)
Pleading
Please Don't Tell My Wife
Pretty Baby
Prohibition Blues
Pullman Porter's Parade
Purpostus
Put Me Off at Buffalo
Ragged William
Ragging the Baby to Sleep
Ragtime Annie
Ragtime Cowboy Joe
Ragtime Regiment Band
Railroad Blues
Red Pepper: A Spicy Rag
Red Wing
Reuben Rag
Rhumbola
Riffin' At the Ritz
Roll Them Cotton Bales
Rose Room
Row! Row! Row!
Royal Garden Blues
Ruff Johnson's Harmony Band
Runnin' Wild

Russian Rag
Sadie Salome
Sailing Down the Chesapeake Bay
Samuel
San
Sans Souci
Save a Little Dram For Me
Scandinavia
Send for Me
Shake It and Brake It
She Really Meant to Keep It
Shine
Silhouette
Silver Bell
Silver Heels
Sing
Sing, Brothers
Singin' in the Rain
Smoke Gets In Your Eyes
Smoky Moke
Smoky Mokes
Snap Your Fingers
Snookey Ookums
Society Blues
Some Baby
Some of These Days
Somebody (2 recordings)
Somebody Lied
Someday You'll Realize You're Wrong
Somethin' Doin?
Something to Remember You By
Something You Don't Expect
Sounds of Africa
Southern Smiles Two-step
Spanish Doll
Spanish Shawl
Squabblin'
St. Louis Tickle
Stairway to the Stairs
Stardust
Stockyard Strut
Stop, Stop, Stop
Street Piano Medley
Suitcase Blues
Sunday
Sunny Side Up
Sunset Medley
Swanee
Swanee River
Sweet and Low Down
Sweet Georgia Brown
Sweet Man O' Mine
Sweetheart We Need Each Other
Take It Easy
'Taint Long For Day
Talk of the Town
Tell Me Little Gypsy
Tennessee Moon
Tenting on the Old Camp Ground
That Beautiful Rag
That Feeling is Gone
That Old Girl of Mine
That's Gratitude
That's the Doctor, Bill
That's the Kind of Baby for Me
That's What Puts the Sweet in Home Sweet Home
The Anvil Chorus
The Cubanola Glide
The Darktown Poker Club
The Directorate March
The International Rag
The King of Rags
The Lee Family
The Lonesome Road
The Mocking Bird (2 recordings)
The Model Minstrels
The Moon Shines on the Moonshine (2 recordings)
The New Yorkers
The Nightmare
The Party that Wrote "Home, Sweet Home" Never was a Married Man
The Peach the Tastes the Sweetest Hangs the Highest on the Tree

The Right Church but the Wrong Pew (track 5)
The Smiler
The St. Louis Blues
The Trail of the Lonesome Pine
The Yama, Yama Man
Then We'll All Go Home
Then You'll Remember Me
These Foolish Thing Remind Me of You
They All Laughed
They're on Their Way to Mexico
Tiger Rag (2 recordings)
Tight Like This
Till Times Get Better
Tillie's Downtown Now
Timbuctoo
Toddle, Introducing, "Maori"
Too Much Mustard
Top Hat
Topsy
Tuck Me to Sleep in My Old 'Tucky Home
Turn on the Heat
Twenty Years
Unlucky Blues
Until Today
Wabash Blues (2 recordings)
Waiting for a Certain Girl
Waiting for the Robert E. Lee (2 recordings)
Wandering in Dreamland
Wang-Wang Blues
Washboard Blues (2 recordings)
Watermelon Party
Way Down South (track 12)
Way Down South (track 5)
We Can't Use Each Other Anymore
What Can I Say After I'm Sorry
What Do We Do on a Dew Dew Dewy Day
What's The Reason
When It's Apple Blossom Time in Normandy
When My Baby Smiles at Me
When the Midnight Choo Choo Leaves for Alabam'
Where the Shy Little Violets Grow
Whipped Cream
Whistling Rufus (3 recordings)
Why Not Come Over Tonight
Wild Cherries Rag
Wild Cherry Rag
Wild Cherry rag
Woke Up With the Blues in My Fingers
Woodman, Spare That Tree
Working Man Blues
Wrappin' It Up
Yankiana Rag
Yesterday
You Ain't Heard Nothing Yet
You Ain't Talking to Me
You Can't Get Away From It
You Can't Trust Nobody
You Don't Understand
You Got To Wet It
You Made Me Love You
You'll Never Need a Doctor No More
You're a Grand Old Rag
You're a Great Big Blue-Eyed Baby
You're Okay
You've Been a Good Old Wagon But You Done Broke Down
You've Got to Be Modernistic
You've Got to See Mama Ev'ry Night
Zizzy Ze Zum Zum
Zonky

Music Theory Spectrum, Vol. 28, Issue 2, pp. 211–232, ISSN 0195-6167, electronic ISSN 1533-8339.