"The Times They Were A-Changin'": A Database-Driven Approach to the Evolution of Harmonic Syntax in Popular Music from the 1960s

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ABSTRACT: The goal of this research is to investigate the pitch structures of popular music in the 1960s through a large corpus study in order to identify any consistent changes in harmonic and tonal syntax. More specifically, two studies based on the Billboard DataSet (Burgoyne, Wild & Fujinaga, 2011; Burgoyne, 2011), a new corpus presenting transcriptions for more than 700 songs, are presented. The first study looks at the incidence of multi-tonic songs throughout the decade, while the second study focuses on the incidence of flat-side harmonies (e.g. bIII, bVI, and bVII) over the same period of time. While no difference was observed in the frequency of multi-tonic songs, the study showed a significant increase in the incidence of flat-side harmonies during the second half of the decade.

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IN January 1964 Bob Dylan released "The Times They Are A-Changin," a politically-charged protest song encouraging changes in American society. Indeed the 1960s were a time of great political, but also sociological and cultural changes, accompanied by equally important developments in popular music. Many music scholars have addressed the attitudinal shift associated with this period, noting that "[r]ock musicians no longer aspire[d] so much to be professionals and craftspeople" but "artists" (Covach, 2006, p. 38) and that the "later 1960s brought a respect for popular music and a popularity for complex artistic experimentation that had not been matched in any previous era" (Wald, 2009, p. 246).

In recent years, theorists have highlighted specific paradigms of pitch structures in popular music, especially associated with rock. Their observations include an increasing use of modal harmonies and modally-derived chord progressions (Moore, 1992, 1995; Biamonte, 2010), plagal progressions (Temperley, 2011) and an increasing use of chord loops (Tagg, 2009). While these authors seem to agree, at least partially, on some harmonic tendencies that characterize rock music, it is difficult to relate these new idioms to the early pop and rock 'n' roll music that predates the aforementioned shift. Even though attempts have been made in the past to empirically map these progressions onto a specific timeline (Everett, 2004; de Clercq & Temperley, 2011, 2013), no previous research has focused on change within a specific decade.

The goal of this research is to investigate pitch-based structures in this repertoire through a large corpus study in order to identify any consistent changes in harmonic and tonal syntax. The Billboard DataSet (Burgoyne, Wild & Fujinaga, 2011; Burgoyne, 2011) provides a collection of 743 transcriptions of music popular in the United States between 1958 and 1991.[2] The corpus was originally created to "enable significant advances in the quality of training for audio-chord-recognition algorithms" as well as to engage in "computational musicology" (Burgoyne, et al., 2011, p. 633). It consists of a random sampling from all the songs that made the weekly Billboard 100 charts throughout this time period. The content of the corpus is multigenre, primary consisting of rock 'n' roll, pop/rock, r 'n' b/soul, coutry & western, vocal, and folk material. Since Billboard is an American standard record chart, most of the songs come from the U.S.A, the U.K., and Canada, though other countries can be represented as well. The transcribing team consisted of more than two dozen people, all university-trained jazz musicians. Each selected song was annotated separately by two different transcribers, then the analyses were reconciled by a third.

Empirically oriented surveys of popular music are becoming more frequent. Perhaps the most important study for the field in recent years is that by de Clercq and Temperley (2011). They presented a 100-song corpus based on *Rolling Stone Magazine*'s "500 Greatest Songs of All Time," compiled in 2004.[3] Their study focused primarily on chord frequency, frequency of root motions, and patterns of co-occurrence between chords.

Although the Billboard DataSet focuses on popular music from the same time period as the

Rolling Stone corpus, its size is significantly larger. In fact, it is, to my knowledge, the largest collection of methodologically curated transcribed popular music annotations. Furthermore, it focuses on songs that were considered popular in their respective time, instead of songs that were considered important in retrospect. As such, it appeared to be the best available tool for the present research.

Two different aspects of the above-mentioned shift were tested in two different studies, the first dealing with modulation and the second with chord frequency. Since the primary focus of this research is the evolution of harmonic syntax throughout the 1960s, the time period under consideration is 1958 to 1971. These 14 years constitute a sub-corpus of 292 songs. A detailed list of the songs featured in this sub-corpus can be found in the Appendix.

The first study focuses on modulation in the 1960s. Different scholars have discussed modulatory devices in popular music, especially in rock. Everett (1997) mentioned how the "truck driver's" modulation by semitone can be motivated by various reasons, such as "signaling transcendence in a story line," "portray[ing] […] the passage of time," or "provid[ing] a change of colour for the 'big finish.'" (p. 151). Similarly, Osborn (2013) discussed how "experimental rock artists regularly end songs with completely new material designed to be more memorable than anything previously presented—the terminal climax" and how these "dramatic endings come about through any combination of amplitudinal climax, harmonic modulation, and changing meter. " (p. 23). Alternatively, Tagg (2009) noted how dominant modulations are so "indicative of European art music that they can be inserted as genre synecdoches in a context of non-classical harmony (e.g. pop and rock) to connote, seriously or humorously, high art rather than low-brow entertainment, deep feelings and the transcendent rather than the superficial and ephemeral" (p. 111). Considering the premise introduced earlier in this paper that songwriters tried to move from craftspeople to artists during this time period, it is reasonable to think that different devices might have been experimented with to achieve this goal, including modulation. As such, the proposed theory for this first study is that the incidence of songs featuring modulations increased through the decade.

The second study focuses on the frequency of chords bIII, bVI, and bVII[4], the so-called "flat-side" harmonies. As Everett (2001) mentions, "[f]lat-side scale degrees appear primarily within the minor key […] and through mode mixture in the major key." (p. 53). De Clercq and Temperley (2011) investigated chord frequency, frequency of root motions, patterns of co-occurrence between chords, and melodic organization in popular music. Their findings include a dramatic shift between chords used during the 1950s and the 1960s to 2000s, the 1950s being "completely dominated" (p. 63) by I, IV, and V. Conversely, the authors discussed how, in the 1960s onward, flat-side harmonies bVII, bIII, and bVI "emerge as a group in which all three pairs are highly correlated" (p. 66). These findings match the modal characteristics associated with rock (Moore, 1992, 1995; Everett, 2004; Biamonte, 2010), a genre that became very popular during the late 1960s. Taking into consideration this shift between the 1950s and the later decades, the proposed theory for this second study is that, as we go further into the decade, chords bIII, bVI and bVII increased in frequency.

HYPOTHESES

Formally, the hypothesis for the first study is:

H1 Songs featuring more than one tonal center will increase in frequency over the studied time period of 1958-1971.

For the second study, the formal hypothesis is:

H2 Songs featuring flat-side harmonies (i.e. bIII, bVI, and bVII) will increase in frequency over the studied time period of 1958-1971.

To anticipate the conclusions, the results were inconsistent with the first hypothesis, but consistent with the second.

METHOD

Parsing the Database

The present study relies on the Billboard DataSet, which presents a corpus of harmonic transcriptions for 743 different songs, including 292 in the studied period of 1958-1971. The chronological distribution of the 292 songs is presented in Table 1.

Table 1: Distribution by year of Songs in the Billboard DataSet for 1958-1971.

Year	*Number of Transcribed Songs*
1958	7
1959	14
1960	9
1961	20
1962	27
1963	20
1964	25
1965	20
1966	18
1967	28
1968	26
1969	24
1970	22
1971	32

The transcriptions were created in plain-text format. Each file starts with a header that includes meta-information related to each song: title, artist, meter, and key. Those lines are preceded by the comment character hash (#) to distinguish them from the actual annotation. The notational system used is based on a standardized approach (Harte et al., 2005), with vertical slashes (|) used to represent barlines. Each individual line of annotation is preceded by the timestamp of the beginning of the phrase, expressed in seconds. Annotators could freely add other information before or after the vertical slashes, such as form, instrumentation, etc.

This transcription format proved to be polyvalent yet created some obstacles. In order to rapidly and automatically parse through the large number of transcriptions, a UNIX tool was created. This script allows the user to use regular expression (regex, a character string used for pattern-matching) to establish proper queries. However, since the files feature extra information such as audio timing and annotators' comments, reading a file as a long single line would fail to have the progressions adjacent to one another. Therefore, the files were processed to remove all inessential information: in every line that started with a comment character (#) as well as every blank line was kept exactly the same, while in all other lines any characters not enclosed by vertical slashes were removed.

Other problems were linked to using the script. Since the command searches strings of characters, it was impossible in this transcription format to search for a single progression across songs in different keys. Indeed, when dealing with strings of characters, "D:min7 G:7" in C is different from "C:min7 F:7" in Bb, even though both progressions bear the same relation with their respective tonal center. One way to overcome this problem is to convert the original transcriptions into a tonic-neutral format, where the root of each chord is replaced with integer notation (where t and e stand for 10 and 11, respectively). The conversion was done automatically with a second script that relied on custom dictionaries for every possible tonic, including enharmonic equivalence. The script would read the tonic of each song, as notated in the header, decide which dictionary to use, and then convert every root to its neutral equivalent. Songs featuring more than one tonal center (69 in total) were dealt with manually—separated into single-tonic sections, converted using the same procedure, and then reassembled. The newly formatted files were then saved using the same name as their original counterpart, but with a different extension. The new files kept the information in the same order as the original files, allowing the user to easily go back and forth between this format and the original transcriptions. Figures 1.1 and 1.2 show an original transcription and a reformatted one for comparison.

```
# title: Sidewalk Surfin'
# artist: Jan & Dean
# metre: 4/4
# tonic: D

0.0       silence
0.417959183   Z
6.455147392   A, intro, | N | N | D:maj | D:maj |, (voice
13.860249433 B, verse, | D:maj | D:maj | D:maj | D:maj |
20.848208616 | A:maj | A:maj | D:maj | D:maj |
27.804195011 | G:maj | G:maj | D:maj | D:maj |
34.786371882 | A:maj F:maj | G:maj A:maj | D:maj |
A:maj |
41.907936507 B', verse, | D:maj | D:maj | D:maj | D:maj |
48.9092517     | A:maj | A:maj | D:maj | D:maj |
55.906621315 | G:maj | G:maj | D:maj | D:maj |
62.862471655 | A:maj F:maj | G:maj A:maj | D:maj | Eb:7
|, voice)
# tonic: Eb
70.032675736 C, solo, | Eb:maj | Eb:maj | Eb:maj |
Eb:maj |, (saxophone)
```

Fig. 1.1. An excerpt of a transcription as presented originally in the Billboard DataSet.

```
# title: Sidewalk Surfin'
# artist: Jan & Dean
# metre: 4/4
# tonic: D


| N | N | 0:maj | 0:maj |
| 0:maj | 0:maj | 0:maj | 0:maj |
| 7:maj | 7:maj | 0:maj | 0:maj |
| 5:maj | 5:maj | 0:maj | 0:maj |
| 7:maj 3:maj | 5:maj 7:maj | 0:maj | 7:maj |
| 0:maj | 0:maj | 0:maj | 0:maj |
| 7:maj | 7:maj | 0:maj | 0:maj |
| 5:maj | 5:maj | 0:maj | 0:maj |
| 7:maj 3:maj | 5:maj 7:maj | 0:maj | 1:7 |
# tonic: Eb
| 0:maj | 0:maj | 0:maj | 0:maj |
```

Fig. 1.2. The transcription shown in Fig. 1.1 converted to a tonic-neutral format and cleaned of all non-essential information.

Subdividing the Corpus

In order to identify any significant changes in harmonic syntax throughout the studied time period, the 14-year time span was divided into two subspans of seven years each: the early 60s (1958-64) and the late 60s (1965-71). Those two subspans contain 122 and 170 songs, respectively. This important difference between the two subspans is due to two main factors. First, the Billboard Hot 100 charts (and thus the database) started in August 1958, whereas all the other years start in January. This explains why the year 1958 features only 7 songs. Second, the random sampling procedure used by Burgoyne et al. created a discrepancy between the different years. Figure 2 reprints Figure 1 from Burgoyne et al. (2011, p. 634) and explains in detail the sampling algorithm used to create the database. While most years in the 14-year period under study feature between 20 and 30 songs, 1959

and 1960 are outliers with 14 and 9 songs, respectively. Conversely, 1971 features 32 songs, which is higher than average.

This important discrepancy between the two subspans had an impact on the methodology used to analyze the data. Originally, a methodology was designed which aimed to look for gradual linear changes across the whole 14-year period. However, considering that the number of songs available for each year varies substantially, the results would have been distorted by this approach. Instead, a methodology was used which compared the early 60s with the late 60s, avoiding oversampling any single year due to a larger number of songs in the database for that year, and instead considered broader changes between the beginning and the end of the decade.

1. Divide the set of all chart slots into three eras:
   (a) 4 August 1958 to 31 December 1969,
   (b) 1 January 1970 to 31 December 1979, and
   (c) 1 January 1980 to 30 November 1991.
2. Subdivide the chart slots in each era into five subgroups corresponding to quintiles on the chart:
   (a) ranks 1 to 20,
   (b) ranks 21 to 40,
   (c) ranks 41 to 60,
   (d) ranks 61 to 80, and
   (e) ranks 81 to 100.
3. Select a fixed percentage p of possible chart slots at random from each era-quintile pair.
4. For each selected chart slot:
   (a) attempt to acquire the single at the target slot;
   (b) if that fails, toss a virtual coin to choose between either the single directly above or directly below the target slot on the chart from the same week;
   (c) if that fails, choose the single that was not selected by the coin toss in 4b;
   (d) if that fails, toss a virtual coin to choose between either the single two ranks above or two ranks below the target single on the chart from the same week;
   (e) if that fails, choose the single that was not selected by the coin flip in 4d; and
   (f) if that fails, consider the chart position to be a missing data point.

Figure 1. Sampling algorithm for the *Billboard* "Hot 100." The algorithm is designed to minimize the distortion from "convenience sampling" while reducing the expense of collecting an audio collection. We believe that this algorithm yields a data set that, as cost-effectively as possible, is valid for drawing conclusions about relative positioning and changes in the behavior of music on the charts over time.

Fig. 2. Sampling algorithm for the Billboard DataSet. Reproduced from Burgoyne et al. (2011).

RESULTS

Study 1: Evaluating Modulation Frequency

The first study focused on modulation. In order to find the number of modulating songs, every file featuring the character string "tonic:" more than once was counted. For example, Jan & Dean's *Sidewalk Surfin'*, previously presented in Figures 1.1 and 1.2, features two tonics, D and Eb, and so would qualify as a modulating song. Out of the 292 songs searched, 31 multi-tonic songs were found. Figures 3.1. and 3.2 present the distribution of the results.

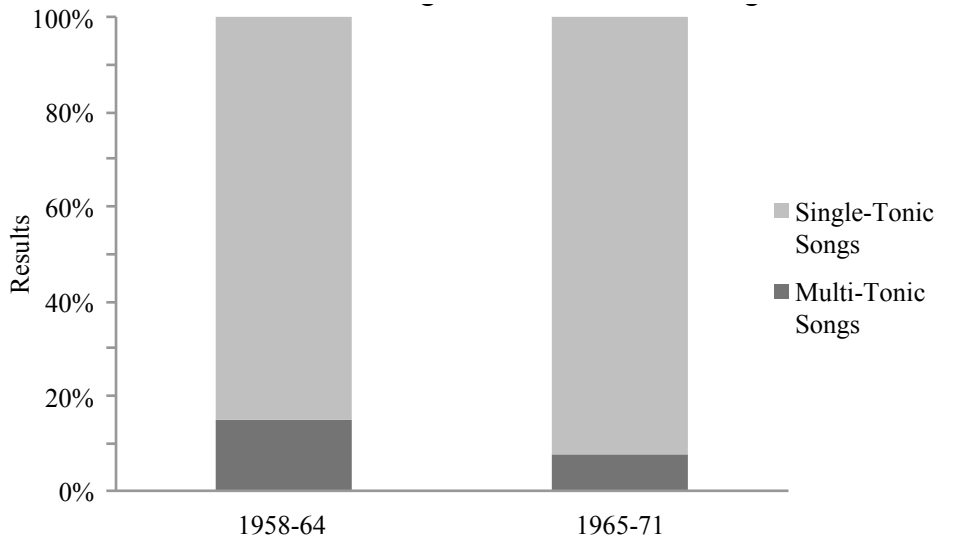

Fig. 3.1. Distribution of single- and multi-tonic songs in the Billboard DataSet between 1958 and 1971, arranged in five-year bins.

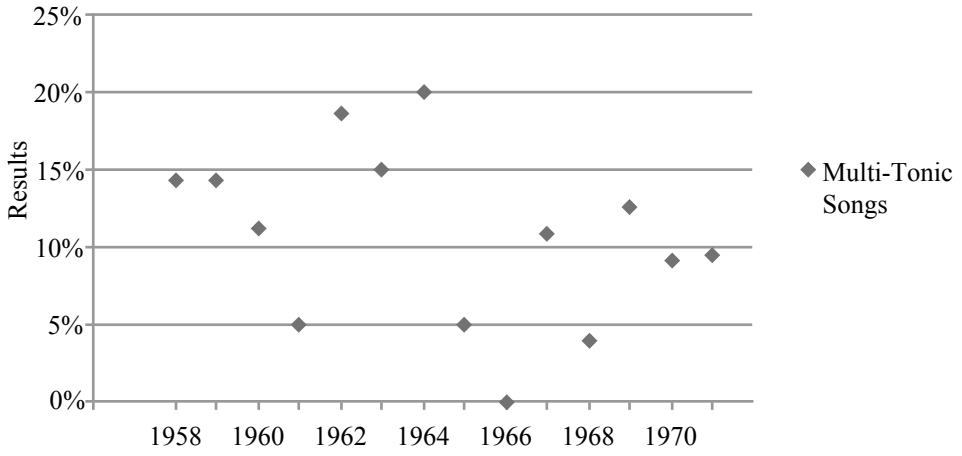

Fig. 3.2. Frequency of multi-tonic songs in the Billboard DataSet between 1958 and 1971, plotted by year.

Using a chi-squared test at a confidence level established at 99%, the difference between the number of multi-tonic songs found in 1958-64 and 1965-71 was not statistically significant (χ^2= 3.78; df=1; p=.05). As such, there appears to be no significant change in the frequency of multi-tonic songs over time.

Study 2: Evaluating Chord Frequency

The second study focused on the frequency of flat-side harmonies over time. For the sake of comparison, the frequency of 24 different chords was considered (12 chromatic roots, with either

major or minor triads). Table 2 shows the overall proportion of songs featuring those chords in each subcategory (i.e 1958-64 and 1965-71). The results for each subcategory were then compared with one another, again using a chi-squared test with a confidence level of 99%. Note that no significance test was done on chords featuring in less than 5% of the corpus (i.e. bii, biii, #IV, #iv, bvi, bvii, VII, vii), as the data collected for those chords was deemed to small to be representative. Due to the way truck-driver's modulations were notated in the Billboard DataSet, many chords immediately preceding a new tonic were originally notated as bVI in the original key, but acted as a tonicization of the tonic in the following key (e.g. V-I in the new key). To address this notational problem, multi-tonic songs featuring at least one bVI chord were manually verified. Songs where the only bVI chord present was immediately before a truck-driver's modulation were not taken into account in the following table. Admittedly, this creates a bias in the data. However, considering that there is no significant difference in the distribution of multi-tonic songs between the early and late 60s, the bias created appears to be less intrusive than the one created by the original notational process.

The results are summarized in the third column of Table 2. Starred (*) p values indicate statistical significance at the 99% confidence level.

Table 2: Distribution of songs featuring specific chords (in percentage).

	Early 60s (1958-64)	***Late 60s (1965-71)***	***Results***
I	98.36%	85.29%	χ^2=14.45; df=1; p<.01*
i	5.06%	22.36%	χ^2=15.04; df=1; p<.01*
bII	8.2%	5.88%	χ^2<.01; df=1; p=.96
bii	0%	0.59%	N/A
II	37.71%	29.41%	χ^2=2.21; df=1; p=.14
ii	33.61%	35.29%	χ^2=0.09; df=1; p=.77
bIII	10.66%	28.24%	χ^2=13.28; df=1; p<.01*
biii	2.46%	4.92%	N/A
III	19.67%	18.82%	χ^2=.03; df=1; p=.86
iii	19.67%	20.59%	χ^2=.04; df=1; p=.85
IV	89.34%	83.52%	χ^2=1.99; df=1; p=.16
iv	13.14%	21.18%	χ^2=2.51; df=1; p=.11
#IV	4.91%	2.36%	N/A
#iv	1.64%	0%	N/A
V	96.72%	80.59%	χ^2=16.71; df=1; p<.01*
v	5.74%	15.88%	χ^2=7.11; df=1; p=.01*
bVI	9.84%	21.77%	χ^2=7.24; df=1; p<.01*
bvi	0%	1.18%	N/A
VI	17.21%	18.24%	χ^2=.05; df=1; p=.82
vi	47.54%	39.41%	χ^2=1.92; df=1; p=.17
bVII	13.93%	39.41%	χ^2=22.5; df=1; p<.01*
bvii	0.82%	2.35%	N/A
VII	4.92%	3.52%	N/A
vii	0.82%	2.29%	N/A

The results presented above are consistent with the proposed hypothesis that songs featuring flat-side harmonies (i.e. bIII, bVI, bVII) increase in frequency over the studied time period.

DISCUSSION

The hypothesis for the first study arose from a simple premise: in order to move from craftspeople to artists, songwriters may have experimented with different compositional devices. As such, it appeared reasonable to question whether modulation was one such device. However, as the results of Study 1 showed, no significant change occurred between the early 60s and the late 60s.

Looking at the results in more detail, three different types of modulations can be distinguished. The first type, though sometimes bearing different names, is the truck driver's modulation: "a sudden shift from one tonal center to another—usually a half step [but sometimes a full step]—that is not functionally related to the first." (Everett, 1997, p. 118, comment in brackets mine). A second type of modulation can be described as a sectional modulation, where a specific section of a song is in a different key from the rest of the piece. With this type of modulation, a song begins and ends in the same tonality. A third type occurs when a song changes key permanently, but with a modulation that is

not a semitone or a tone. The distribution of these three types of modulation over the 31 multi-tonic songs found between 1958 and 1971 is presented in Figure 4.

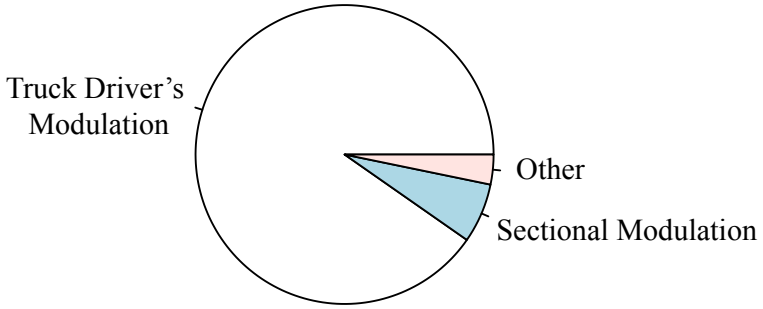

Fig. 4. Distribution of 31 multi-tonic songs between 1958-1971: Truck Driver's Modulation (28 songs, 90.32%); Sectional Modulation (2 songs, 6.45%); Other (1 song, 3.23%).

As shown in Figure 4, the truck driver's modulation is the most frequently used modulation technique between 1958 and 1971. The majority of the songs (23 songs, 82.14%) featuring this type of modulation only modulate once, while songs modulating two (3 songs, 10.71%) or three times (2 songs, 7.14%) are far less frequent. It also appears to be very infrequent for multi-tonic songs with truck driver's modulation to feature both modulations by semitone and by tone (1 song, 3.57%).

Although the hypothesis for the second study focused on only flat-side harmonies, the frequency of songs featuring 24 different chords was analyzed. As hypothesized, bIII, bVI, and bVII occurred in a significantly greater number of songs in the second half of the decade. A decrease was observed of roughly 15 % in songs featuring major tonic chords (i.e. I), matched by a similar increase in songs featuring minor tonic chords (i.e. i); moreover, minor dominant chords (i.e. v) also increased in frequency in the later 60s. Although it is not possible at this point to conclude that there is a correlation between both results, it would be worthwhile to follow this lead in future work and investigate whether minor songs become statistically more frequent in the second half of the decade.

Investigating Chord Patterns

Considering that bIII, bVI, and bVII became more prominent during the second half of the decade, it would be interesting to examine the harmonic context in which they were used. In their study using the *Rolling Stone* corpus, de Clercq and Temperley (2011) investigated the "frequency of relative-root 'trigrams,'" using this term to describe "groups of three adjacent chords" (p. 63). Table 3, reprinted from de Clercq and Temperley (2011), shows the most frequent harmonic trigrams ending with a tonic chord, for the 1950s through to the 1990s.

Table 3: Distribution of songs from de Clerq and Temperley's (2011) *Rolling Stone* corpus with harmonic trigrams ending in the tonic (and not beginning in tonic), in descending order of frequency (reproduced from de Clercq and Temperley, 2011, Table 7).

Trigram	***Instances***
IV V I	352
V IV I	292
bVII IV I	146
VI IV I	126
bVII bVI I	103
bIII bVI I	66
II V I	63
bVI bVII I	60
V VI I	42
IV bVII I	39

A similar approach was taken to observe the harmonic syntax involving flat-side harmonies. Using the chords presented in Table 2, every possible permutation featuring at least bIII, bVI, or bVII, and ending with a tonic chord was used to parse the database. However, the methodology differed from the one used by de Clercq and Temperley in two ways: chord mode (major or minor) was taken into account instead of only relative-root motion, and the number of songs featuring a specific progression was calculated, instead of instances of said progression. Chords could occur as simple triads or ornamented with extensions (e.g. maj6, maj7, add9). Moreover, major triads could also occur as dominant seventh or dominant ninth chords. Open-fifth chords ("power chords") were not taken into consideration. The parser was designed to look for continuous strings of characters; as such the search mechanism avoided progressions running over modulations, as both tonalities in the transcription file were separated by a comment line indicating the new key, as shown in Figure 1.2 (e.g. #tonic: Eb). For this reason, the line preceding the comment line may display some odd progressions, as the last chord of such lines is usually used to modulate to the new key. However, since the number of songs featuring a specific progression was taken into account, and not the specific instances of a progression, this potential distortion did not affect the parsing process. The results for the 1958-72 period are presented in Table 4.

Table 4: Distribution of songs from the Billboard DataSet with harmonic trigrams ending in tonic (and not beginning in tonic) and featuring at least one flat-side harmony, in descending order of frequency.

Trigram	*Early 60s (1958-64)*	*Late 60s (1965-71)*	*Total*
bVII IV I	0	14	14
bVII V I	4	8	12
bIII IV I	1	4	5
bVI V i	0	5	5
bIII V I	1	3	4
bVI V I	3	1	4

The table presented above gives us a more detailed account of how flat-side harmonies were used during the decade. Although it has been established previously that all three flat-side chords (i.e. bIII, bVI, bVII) increased significantly in frequency throughout the decade, there is a clear preference for the bVII-IV-I trigram. This progression is often referred to as a double plagal progression, as the movement from bVII to IV imitates the plagal movement going from IV to I, as Everett explains:

> In the double plagal progression a chain of descending fourth emerges, with a major IV of IV created by lowering the root of a vii chord to b7, creating the bVII-IV-I motion […] In this chord succession, bVII resolves to IV with a transposed version of the same descending neighbour motions (here 2-1 and b7-6) used by IV in resolving to I (6-5 and 4-3). Originally appearing in 1957-60 as an ornamental guitar figure […], this function emerged in broader rhythms in the soul music of late 1964 […] and early 1965 […] to become rock mainstay. (2009, p. 274).

Everett's comments match very closely the results of this study, with the emergence of the double plagal progression during the late 60s. His description also exemplifies the modal aspect of the rock genre, suggesting a mixolydian sound created through the flattening of scale degree 7. The plagal direction of this progression also matches Stephenson's (2001) theory that, "[w]ith regard to harmonic succession, as with cadence placement, rock has, from its beginning, used a style opposed to that of common practice, a style that became increasingly standard during the late 1950s and the 1960s" (p. 103).

Other theorists have seen tonal processes in rock, despite its modal characteristics. For example, Biamonte (2010) has described how bVII-IV-I, along with the Aeolian progression bVI-bVII-I, tends to behave tonally: "Although their pitch syntax is not diatonically tonal, in many cases these two characteristic chord patterns express traditional tonal functions such as tonic prolongation and dominant preparation, both of which are often accomplished through elaboration of the tonic by subdominant harmony and cadential resolution." (p. 98).[5] This dual nature of the progression, a modal sound behaving tonally, may explain, at least partially, why this specific pattern was significantly favored over other progressions featuring flat-side harmonies, as it serves as a bridge between common and new practices.

The second most frequent trigram, bVII-V-I, is a modally-mixed progression particularly noticeable for its cross-relation between the flat and natural scale degree seven. This type of cross-relation occurs frequently in progressions using flat-side harmonies, and mostly results from guitar-

oriented gestures, using parallel barre chords up and down the fretboard. In an article discussing the topography of the guitar and its impact on pop-rock music, Koozin (2011) showed how "physical constraints inherent in guitar playing may shape musical material" (par. 23). Indeed, the same phenomenon happens with bIII-IV-I, bIII-V-I, and bVI-V-I. This reflects the idea that throughout the 1960s, music shifted from being primarily composed on the keyboard to being primarily composed on the guitar. This new practice became heavily associated with rock, so much so that by the late 1970s, "pop" referred to keyboard-based music while "rock" referred to guitar-based music. (Nobile, 2014, p. 8).

CONCLUSION

The goal of carrying out the studies presented in this paper was to test whether significant changes in harmonic practices during the 1960s matched the attitudinal shift discussed by popular music scholars. Two studies were conducted, the first focusing on modulating songs, the second focusing on flat-side harmonies. Although the results showed no significant difference between the use of modulation in the first and second half of the decade, there was a significant increase in frequency of flat-side harmonies in the second half of the decade, as hypothesized. However, it would be misleading to assume that this new genre, rock, and its new harmonic practices took over the entire popular music world. Though a new harmonic practice seems to be emerging during the studied period, it does not appear to replace more traditional diatonic harmony, but rather coexists with it. For example, the results presented in Table 4 show bVII-IV-I as the most frequent progression using a flat-side harmony, but the frequency of this progression is still relatively marginal, with only 14 songs out of 170 (8.24%) featuring this progression. By comparison, IV-V-I and V-IV-I, the two most popular diatonic trigrams identified by de Clercq and Temperley in Table 3, were featured in 91 (53.53%) and 50 (29.41%) songs, respectively. Furthermore, although flat-side harmonies increased in frequency through the decade, they did not do so through clearly established idiomatic progressions, bVII-IV-I and, to a lesser extent, bVII-V-I being exceptions. What may be misleading, then, is the tendency to consider harmonic progressions or songs that were historically significant the norm of a certain time period. Lists such as *Rolling Stone*'s "500 Greatest Songs of All Time," used by de Clercq and Temperley (2011; 2013), are useful to study characteristic tendencies of a specific genre, but fail to give a clear image of a time period as they present songs that were considered historically important *a posteriori*, and as such, are biased towards innovative or long-lasting, successful songs. When looking at the results presented here, based on a corpus of songs deemed popular in their own time, the attitudinal shift discussed by some scholars appears to be matched with new harmonic practices. However, those new practices established themselves over time.

The two studies presented here focused on very specific aspects of harmonic syntax: modulation and flat-side harmonies. Yet, in order to have a better understanding of the evolution of musical tendencies, other aspects would benefit from a similar empirical approach. Broadening the queries to include progressions that do not necessarily feature tonic chords would help to provide a clearer image of harmonic practices. Similarly, secondary parameters such as hypermeter, form[6], rhythm, and timbre, should be taken into consideration. Although some scholars have looked empirically at those parameters (see Huron & Ommen, 2006; Serrà, et al., 2012; Biamonte, 2014), they still remain largely under-researched.

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NOTES

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[2] Burgoyne et al. explain the basis of the chronological span of this corpus as follows: "The date of the first chart, 4 August 1958, is a natural starting date for selecting songs, but choosing an end date is less straightforward. Hip-hop music does not lend itself readily to harmonic analysis as traditionally understood, and because hip-hop became more popular in the 1990s and 2000s, a larger portion of the music on the 'Hot 100' chart from these periods falls out of the scope of the data set. Furthermore, there have been several changes to the formula for computing the 'Hot 100' over time, including a particularly significant shift in December 1991 […]" (Burgoyne, et al., 2011, p. 634)

[3] Since the publication of their article in 2011, de Clercq and Temperley have expanded their corpus to 200 songs (Temperley & de Clercq, 2013).

[4] Throughout this paper, roman numeral are shown in relation to major, an approach used by Biamonte (2010), Temperley (2011), de Clercq (2012), Nobile (2014), among many others.

[5] For a more thorough discussion on double plagal progressions, see Everett, 2001, 2004; Carter, 2005; Spicer, 2005; Biamonte, 2010.

[6] Although the annotators working on the Billboard DataSet were encouraged to "use free comments in particular to denote major structural features such as verses, bridges, and choruses" (Burgoyne, 2011, p. 194), those formal labels were not properly curated, which make their use obsolete for anything other then informal discussion.

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APPENDIX

Songs Featured in the 1958-1971 Sub-Corpus

Year	Artist	Title
1958	Count Basie	Going to Chicago
1958	Chuck Berry	Sweet Little Rock And Roll
1958	Johnny Cash	The Ways of a Woman
1958	Jimmy Clanton	Just A Dream
1958	The Everly Brothers	Bird Song
1958	Peggy Lee	Fever
1958	Louis Prima & Keely Smith	That Old Black Magic

1959	LaVern Baker	I Cried a Tear
1959	Rod Bernard	This Should Go On Forever
1959	Chuck Berry	Almost Grown
1959	Johnny Cash	I Got Stripes
1959	Ray Charles	(Night Time is) The Right Time
1959	Fats Domino	Be My Guest
1959	Fats Domino	I Want to Walk You Home
1959	Johnny Horton	The Battle of New Orleans
1959	Johnny Horton	Johnny Reb
1960	Brenda Lee	Sweet Nothin's
1959	Elvis Presley	My Wish Came True
1959	Elvis Presley	One Night
1959	Cliff Richard	Living Doll
1959	Santo & Johnny	Sleep Walk
1959	Dinah Washington	Unforgettable
1960	Floyd Cramer	Last Date
1960	Bing Crosby	Silent Night
1960	Dion	Where or When
1960	Jimmy Jones	Handy Man
1960	Jimmy Reed	Baby What You Want Me to Do
1960	Charlie Rich	Lonely Weekends
1960	Marty Robins	Big Iron
1960	The Ventures	Perfidia
1961	Gary U.S. Bonds	Quarter to Three
1961	James Brown	Baby, You're Right
1961	James Brown	I Don't Mind
1961	The Crystals	(There's No Other) Like My Baby
1961	Dion	Runaround Sue
1961	Roy Drusky	Three Hearts in a Tangle

1961	The Everly Brothers	Ebony Eyes
1961	The Everly Brothers	Walk Right Back
1961	Don Gibson	Sea of Heartbreak
1961	Etta James	Fool That I Am
1961	Ben E. King	Amor
1961	Brenda Lee	Dum Dum
1961	The Miracles	Mighty Good Lovin'
1961	Gene Pitney	Town Without Pity
1961	Elvis Presley	(Marie is the Name) His Latest Flame
1961	Elvis Presley	Little Sister
1961	The Shirelles	Will You Love Me Tomorrow?
1961	The String-A-Longs	Wheels
1961	Johnny Tillotson	Jimmy's Girl
1961	Ike & Tina Turner	It's Gonna Work Out Fine
1962	Paul Anka	Love Me Warm and Tender
1962	The Beach Boys	Surfin' Safari
1962	Bruce Chanel	Hey! Baby
1962	Chubby Checker	The Twist
1962	Nat "King" Cole	Ramblin' Rose
1962	The Contours	Do You Love Me?
1962	Bing Crosby	White Christmas
1962	The Crystals	He's a Rebel
1962	Bo Diddley	You Can't Judge a Book by the Cover
1962	Dion	(I Was) Born to Cry
1962	Dion	Love Came to Me
1962	Dion	Lovers Who Wander
1962	The Falcons	I Found a Love

1962	The Everly Brothers	That's Old Fashioned (That's the Way Love Should Be)
1962	Eddie Holland	Jamie
1962	Etta James	Stop the Wedding
1962	Gladys Knight & The Pips	Letter Full of Tears
1962	Brenda Lee	All Alone Am I
1962	Brenda Lee	Everybody Loves Me But You
1962	Brenda Lee	Heart in Hand
1962	Little Joey & The Flips	Bongo Stomp
1962	Jimmy Smith	Walk on the Wild Side (Part 1)
1962	Hank Snow	I've Been Everywhere
1962	Bertha Tillman	Oh My Angel
1962	Johnny Tillotson	It Keeps Right On A-Hurtin'
1962	Mel Torme	Comin' Home Baby
1962	Dinah Washington	Where Are You?
1963	LaVern Baker	See See Rider
1963	Bobby Bare	Detroit City
1963	The Beach Boys	In My Room
1963	Solomon Burke	If You Need Me
1963	The Chiffons	He's So Fine
1963	Nat "King" Cole	Those Lazy-Hazy-Crazy Days of Summer
1963	Dion	Ruby Baby
1963	Dion	This Little Girl
1963	The Drifters	On Broadway
1963	Dave Dudley	Six Days on the Road
1963	The Fireballs	Sugar Shack

1963	Etta James	Would It Make Any Difference to You?
1963	Chris Kenner	Land of the 1000 Dances
1963	Brenda Lee	Loosing You
1963	Barbara Lewis	Hello Stranger
1963	The Moments	Walk Right In
1963	The Ronettes	Be My Baby
1963	Johnny Tillotson	Out of My Mind
1963	Johnny Tillotson	Talk Back Trembling Lips
1963	Jackie Wilson	Baby Workout
1964	Louis Armstong	Hello Dolly!
1964	The Beach Boys	Wendy
1964	The Beatles	A Hard Day's Night
1964	The Beatles	Do You Want to Know a Secret?
1964	The Beatles	I Saw Her Standing There
1964	The Beatles	Love Me Do
1964	The Beatles	She's a Woman
1964	Jan & Dean	Sidewalk Surfin'
1964	Jan & Dean	The Anaheim, Azusa & Cucamonga Sewing Circle, Book Review And Timing Association
1964	Jan & Dean	The Little Old Lady (From Pasadena)
1964	Lesley Gore	You Don't Own Me
1964	B.B. King	How Blue Can You Get?
1964	Brenda Lee	As Usual
1964	Dean Martin	Everybody Loves Somebody

1964	Willie Mitchell	20-75
1964	Elvis Presley	Ask Me
1964	Ottis Redding	Chained and Bound
1964	The Rolling Stones	Not Fade Away
1964	The Rolling Stones	Time Is On My Side
1964	Barbara Streisand	Funny Girl
1964	Barbara Streisand	People
1964	Irma Thomas	Wish Someone Would Care
1964	Johnny Tillotson	I Rise, I Fall
1964	Johnny Tillotson	Worried Guy
1964	J. Frank Wilson & The Cavaliers	Last Kiss
1965	Joan Baez	There But For Fortune
1965	Fontella Bass	Rescue Me
1965	The Beatles	Eight Days a Week
1965	The Beatles	Help!
1965	The Beatles	I Don't Want to Spoil the Party
1965	James Brown	I Got You (I Feel Good)
1965	The Castaways	Liar, Liar
1965	Ray Charles	Crying Time
1965	Roy Head	Treat Her Right
1965	Brenda Lee	Too Many Rivers
1965	Martha & The Vandellas	Nowhere to Run
1965	Bobbi Martin	I Love You So
1965	Dean Martin	I Will
1965	Buck Owens	I've Got a Tiger by the Tail
1965	Wilson Pickett	In the Midnight Hour

1965	Otis Redding	I've Been Loving You Too Long (To Stop Now)
1965	The Righteous Brothers	Unchained Melody
1965	Simon & Garfunkel	The Sounds of Silence
1965	Sonny & Cher	Baby Don't Go
1965	The Yardbirds	Heart Full of Soul
1966	The Byrds	Eight Miles High
1966	Ray Charles	Let's Go Get Stoned
1966	The Chiffons	Sweet Talkin' Guy
1966	Bobby Darin	If I Were a Carpenter
1966	Donovan	Sunshine Superman
1966	The Kinks	'Till the End of the Day
1966	Brenda Lee	Coming On Strong
1966	Roger Miller	You Can't Roller Skate in a Buffalo Herd
1966	Aaron Neville	Tell It Like It Is
1966	Buck Owens	Think of Me
1966	Paul Revere & The Raiders	Kicks
1966	The Righteous Brothers	(You're My) Soul and Inspiration
1966	The Rolling Stones	Have You Seen Your Mother, Baby, Standing In The Shadow?
1966	Simon & Garfunkel	A Hazy Shade of Winter
1966	Nancy Sinatra	These Boots Are Made For Walkin'
1966	Swingin' Medallions	Double Shot (Of My Baby's Love)
1966	The Temptations	Ain't Too Proud to Beg

1966	The Yardbirds	Shape of Things
1967	James Brown	Cold Sweat – Part 1
1967	The 5th Dimension	Go Where You Wanna Go
1967	The Animals	San Franciscan Nights
1967	The Buckinghams	Kind of a Drag
1967	The Byrds	Goin' Back
1967	Arthur Conley	Sweet Soul Musi
1967	The Electric Prunes	I Had Too Much to Dream (Last Night)
1967	The Four Tops	Standing in the Shadows of Love
1967	Aretha Franklin	Chain of Fools
1967	Aretha Franklin	I Never Loved a Man (The Way I Love You)
1967	Marvin Gaye & Tami Terrell	If I Could Build My Whole World Around You
1967	Marvin Gaye & Kim Weston	It Takes Two
1967	Lesley Gore	California Nights
1967	The Hollies	Carrie-Ann
1967	The Music Explosion	Little Bit O' Soul
1967	The Music Machine	The People in Me
1967	Nitty Gritty Dirt Band	Buy For Me the Rain
1967	Roy Orbison	Cry Softly Lonely One
1967	Wilson Pickett	I'm in Love
1967	Wilson Pickett	Soul Dance Number Three
1967	Elvis Presley	Judy
1967	The Rolling Stones	Dandelion

1967	Jimmy Ruffin	I've Passed This Way Before
1967	Sagittarius	My World Fell
1967	Simon & Garfunkel	Fakin' It
1967	Sopwith Camel	Hello Hello
1967	The Turtles	Happy Together
1967	The Who	Happy Jack
1968	The Amboy Dukes	Journey to the Center of the Mind
1968	Blue Cheer	Summertime Blues
1968	The Box Tops	Cry Like a Baby
1968	Canned Heat	On the Road Again
1968	Clarence Carter	Too Weak to Fight
1968	Ray Charles	Eleanor Rigby
1968	Joe Cocker	With a Little Help From My Friend
1968	Cream	Sunshine of Your Love
1968	Creedence Clearwater Revival	I Put a Spell on You
1968	Dion	Abraham, Martin and John
1968	Flatt & Scruggs	Foggy Mountain Breakdown
1968	Max Frost & The Troopers	Shape of Things to Come
1968	Iron Butterfly	In-A-Gadda-Da-Vida
1968	Tommy James	Mony Mony
1968	The Miracles	I Second That Emotion
1968	Wilson Pickett	I Found a True Love
1968	Elvis Presley	Guitar Man
1968	Elvis Presley	If I Can Dream
1968	The Rascals	People Got to Be Free

1968	Otis Redding	(Sittin' On) The Dock of the Bay
1968	Marty Robbins	I Walk Alone
1968	Simon & Garfunkel	Mrs. Robinson
1968	Steppenwolf	Born to be Wild
1968	The Temptations	I Wish It Would Rain
1968	B.J. Thomas	Hooked On a Feeling
1968	Jerry Jeff Walker	Mr. Bojangles
1969	Badfinger	Maybe Tomorrow
1969	The Beach Boys	Bluebirds Over the Mountain
1969	The Beatles	Come Together
1969	Brother Jack McDuff	Them From Electric Surfboard
1969	Glen Campbell	Galveston
1969	Glen Campbell	Wichita Lineman
1969	Jimmy Cliff	Wonderful World, Beautiful People
1969	The Cowsills	Hair
1969	The Cowsills	Silver Threads and Golden Needles
1969	Creedence Clearwater Revival	Bad Moon Rising
1969	Crosby, Stills & Nash	Judy Blue Eyes
1969	The Isley Brothers	It's Your Thing
1969	The Jacksons	I Want You Back
1969	Tommy James	Crystal Blue Persuasion
1969	Janis Joplin	Kozmic Blues
1969	Little Anthony & The Imperials	Out of Sight, Out of Mind
1969	Peggy Lee	Is That All There Is?

1969	The Miracles	Baby, Baby Don't Cry
1969	Oliver	Good Morning Starshine
1969	The Rolling Stones	Honky Tonk Women
1969	Sly & The Family Stone	Hot Fun In the Summertime
1969	Sly & The Family Stone	I Want to Take You Higher
1969	The Who	Pinball Wizard
1969	The Youngbloods	Get Together
1970	James Brown	Get Up (I Feel Like a) Sex Machine – Part 1
1970	Glen Campbell	It's Only Make Believe
1970	Canned Heat	Let's Work Together
1970	Clarence Carter	Patches
1970	Chicago	25 or 6 to 4
1970	Chicago	Does Anybody Really Know What Time It Is?
1970	Chicago	Make Me Smile
1970	Crosby, Stills & Nash	Teach Your Children
1970	B.B. King	The Thrill Is Gone
1970	The Meters	Look-Ka Py Py
1970	Elvis Presley	I Really Don't Want to Know
1970	Ray Price	For the Good Times
1970	Rare Earth	Get Ready
1970	Jimmy & David Ruffin	Stand By Me
1970	Santana	Evil Ways
1970	Simon & Garfunkel	Cecilia
1970	Simon & Garfunkel	El Condor Pasa
1970	Edwin Starr	War

1970	The Supremes	Stoned Love
1970	R. Dean Taylor	Indiana Wants Me
1970	The Tee Set	Ma Belle Amie
1970	Ike & Tina Turner	I Want to Take You Higher
1971	The 5th Dimension	Never My Love
1971	The 5th Dimension	One Less Bell to Answer
1971	The Band	Life Is a Carnival
1971	Bread	If
1971	Cornelius Brothers & Sister Rose	Treat Her Like a Lady
1971	The Doors	Riders of the Storm
1971	Emerson, Lake & Palmer	Lucky Man
1971	Five Man Electric Band	Absolutely Right
1971	Isaac Hayes	The Look of Love
1971	Jimi Hendrix	Freedom
1971	Elton John	Levon
1971	Tom Jones	She's a Lady
1971	Roberta Flack & Donny Hathaway	You've Got a Friend
1971	Marvin Gaye	Mercy Mercy me (The Ecology)
1971	Tom T. Hall	The Year That Clayton Delaney Died
1971	Gladys Knight & The Pips	If I Were Your Woman
1971	Kris Kristofferson	Loving Her Was Easier
1971	The Miracles	I Don't Blame You at All
1971	Graham Nash	Chicago
1971	Ocean	Put Your Hand in the Hand
1971	The Osmonds	One Bad Apple

1971	Wilson Pickett	Don't Knock My Love – Part 1
1971	Elvis Presley	There Goes My Everything
1971	Jerry Reed	Ko-Ko Joe
1971	The Rolling Stones	Wild Horses
1971	Sonny & Cher	All I Ever Need Is You
1971	Rod Stewart	Maggie May
1971	James Taylor	Country Road
1971	Ten Years After	I'd Love to Change the World
1971	Bill Withers	Ain't No Sunshine
1971	Bobby Womack	That's the Way I Feel About Cha
1971	Stevie Wonder	If You Really Love Me