

Changes in Lyrical and Hit Diversity of Popular U.S. Songs 1956-2016

Peter Meindertsma <research_at_petermeindertsma_dot_com>, Department of Language Technology - Computational Linguistics, University of Groningen, Netherlands

Abstract

To examine changes in the diversity of popular songs over time, I have analyzed the lyrics of 99% of all songs sung in English that have appeared on the U.S. Billboard Hot 100 chart from 1956 up to and including 2016 (n=27.108). I have found the number of songs that reached the Hot 100 per year more than halved between 1966 and 2002, which indicates a loss in diversity. I have also found that the variation of valence (or level of *pleasantness*) in the songs' lyrics and the variation of a sampled Type Token ratio (an indicator for lexical complexity) decreases over time. This indicates that lyrics of popular songs become more similar and again signify a loss of diversity.

Introduction

In September 2012 the Universal Music Group completed the acquisition of EMI Music, reducing the number of worldwide music label conglomerates from four to three: Universal, Sony Music and Warner Music Group. This was another step in the concentration of media corporations that accelerated in the 1980s and 1990s [Bagdikian 2004] and gradually became a global media oligopoly, a form in which a market or industry is dominated by a small number of sellers. This oligopoly now not only controls music (e.g. 85% of the U.S. recording music industry [Lule 2012]) but also broadcasting, movies, publishing and advertising markets. This concentration of media ownership frequently raises concerns about the reduction of cultural diversity communicated through major media channels. Some argue that this concentration results in a shift away from serious news to infotainment [Owen 2012] and that it becomes harder for independent record companies to get airplay while large companies become more selective in the artists offered to radio stations [Lee 2004]. Even decades ago, Theodor Adorno warned about the eroding effects of the transition from autonomous works of art to profitable cultural products and the resulting impediment of the development of individual consciousness due to a strong cultural industry [Adorno and Rabinbach 1975]. Yet, despite all these concerns, the aforementioned acquisition of EMI clearly indicates that the process of media convergence has not been halted.

This creates an opportunity to investigate the diversity of cultural output over time to see if there is a homogenization of cultural meanings, values and tastes. To do so, I have chosen to examine the diversity of an important and omnipresent cultural product: popular music, by looking at changes in the number of hit songs (songs that appeared on a chart, ranked by sales or popularity) and lyrical variation over time.

Instead of stitching together lyrics of a few selected songs to represent popular music, which has been, until recently, the default method for lyric related studies, I will apply a macro analytic approach to grasp popular music as a whole. With the ever increasing capacity and speed of computers it becomes easier to create and quantitatively analyze large corpora of digitized texts and other media to study underlying phenomena. It has been applied successfully in many studies (e.g. Moretti, 2005; Jockers, 2011; Michel, 2011; Mauch, 2015). Note that challenges remain, such as adequately representing popular culture. Merely creating a large collection of song lyrics is not sufficient, for one can wonder if every included song qualifies to represent popular culture. And perhaps even more important: does the absence of all other similarly qualifying songs result in bias? Many studies of lyrics of popular songs tackle this issue by using charts, usually the U.S. Billboard Hot 100, to select songs that have earned a certain level of popularity. These

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charts remain a “crude but effective” means to measure the cultural impact of a song among the record buying public [Stewart 2012].

However studies that rely on hit song charts predominantly use subsets, e.g. top 10 songs for every tenth year, and are therefore limited in scope and detail. To contribute to the extensiveness of this study, I tried to collect lyrics of all songs that appeared on the Billboard Hot 100.

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Dataset and Methodology

The focus of this study is on lyrics from popular songs that charted in the USA, arguably the most important market in popular culture. To overcome limitations by scale, where only a few songs represent a much larger group, a major goal is to collect and analyze as much lyrics as possible of songs that have appeared on the Billboard Hot 100. Just by reaching a position on this chart, these songs have proven their popular cultural mass appeal.

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Despite its shortcomings, e.g. payola scandals and frequent changes in the balancing of digital and physical sales and airplay influence, the Billboard Hot 100 is still by far the leading song chart of the USA and for several decades it has been used for scientific research. By many it is regarded as the most appropriate source for songs that were most representative of general cultural preferences across time in the USA [Pettijohn and Sacco 2009].

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In order to have ample charting songs per year to be collected and analysed, the scope is restricted to the years from 1956 up to and including 2016. Billboard changed its weekly Top 40 chart of popular singles into a Top 100 in November 1955 and was renamed the Hot 100 in 1958. The year 1955 also roughly coincides with the dawn of the *rock age* when Rock ‘n’ Roll got a grip on the Billboard charts and quickly turned the focus of popular music primarily towards the youth and shaped popular music for at least the next forty years [Garofalo 2008, 2].

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The main source for the chart listings of songs, artists and years is Bullfrogs Pond’s Billboard database, an extensive collection of Billboard related chart data (1890-2017) maintained by an anonymous ‘avid music lover’ since 1999 (Bullfrog, 2016). Many randomly selected songs’ peak positions and years were double checked with official Billboard Chart data (at Billboard.com and Joel Whitburn’s “Top Pop Singles 1955-2012” (2013)) and chart data at Top40db.net to verify the reliability of this source. Based upon these sources I found that of all top 100 hits from 1956 up to and including 2016 (n=28.477), about 96% (n=27.387) of these songs have (predominantly) lyrics in English, when instrumental (3.5%, n=986) and non-English lyric songs (0.4%, n=104) are excluded.

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The texts of these songs with lyrics in English were extracted automatically ^[1] from several online archives^[2]. Simultaneously, automatic and manual corrections were applied to restore song structures (e.g. replacing lines like “repeat chorus” with the fully transcribed chorus) and to remove mark-up, punctuation and metadata about performers or musical segments (e.g. phrases like “written by”, “intro” or “guitar solo”). Eventually I managed to obtain the lyrics of all but 1% (n=279) of all songs sung in English that charted on the Billboard top 100 charts from 1956 up to and including 2016. This resulted in a corpus of 7.727.622 words in 27.108 song files with an average of 444 examined songs per year, see Figure 1.

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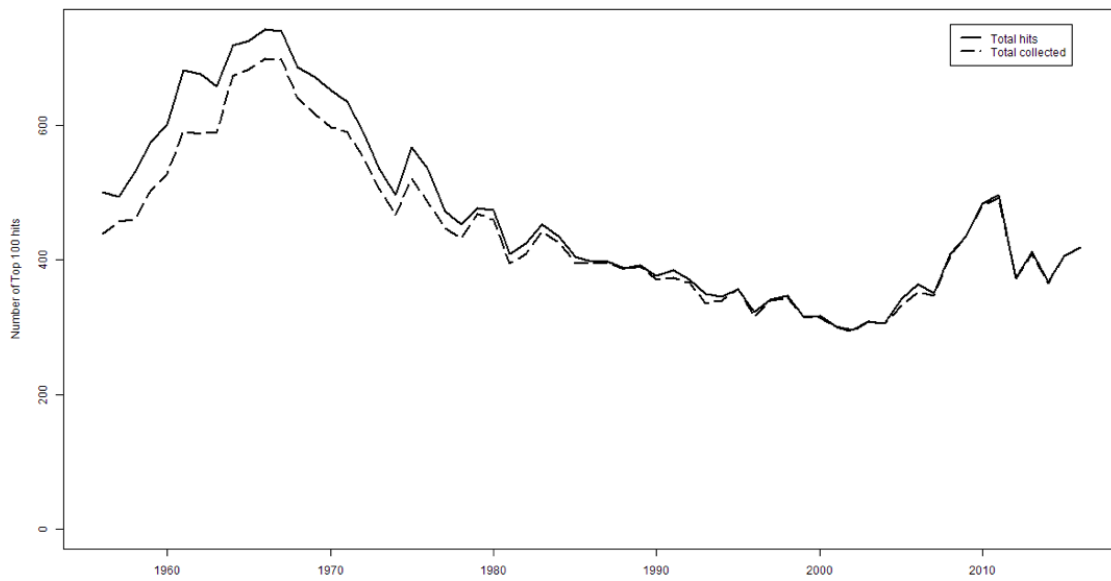


Figure 1. Total and collected number of Billboard Hot 100 hit song lyrics per year 1956-2016. Lyrics of instrumental (3.5%), non-English (0.4%), and unobtainable (1.0%) songs were not collected.

Results

1. Changes in hit diversity

Inspired by Lee’s research on the radio industry [Lee 2004], I first examined the frequency of charting songs per year and found a sharp decrease in the annual number of songs that obtained top 100, top 40, top 10 or number 1 positions (see Figure 2a, and 2b, a detailed version of 2a).

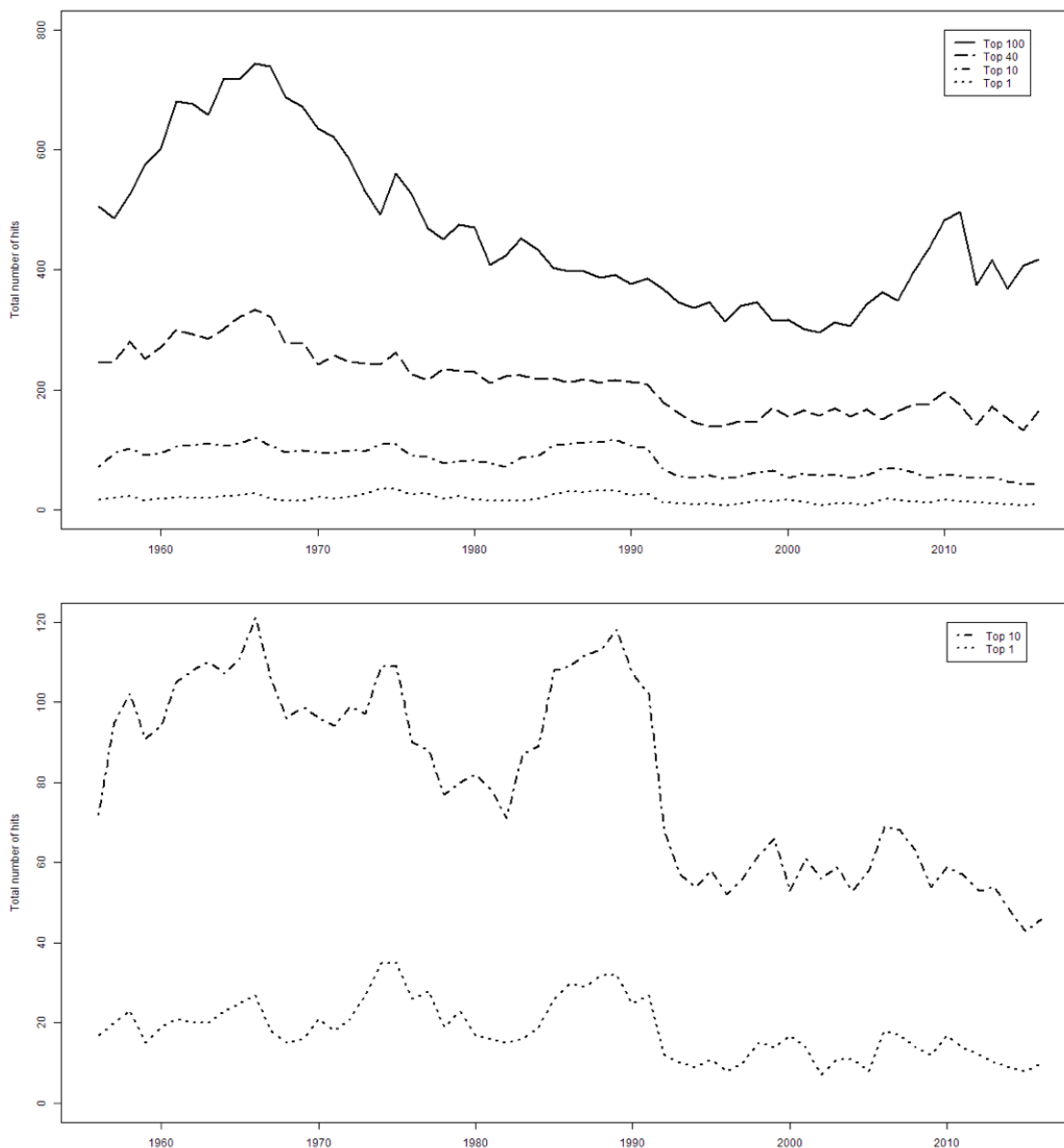


Figure 2. Total top 100, 40, 10 and number 1 hits in the Billboard Hot 100 per year (1956-2016).

The number of annual Hot 100 hits reached its low point in 2002 when 294 songs charted, which is less than 40% of its peak in 1966 when 743 songs appeared on the chart. Note that Figure 2b clearly shows a sharp decline in the total number of yearly top 10 and number 1 hits after 1991.

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It is very likely that these changes around the year 1991 were caused by an alteration in the way Billboard tracks sales. In that year the Billboard Hot 100 switched to Nielsen SoundScan, a digital and improved system for tracking sales, based upon data that represents over 90% of the U.S. music retail market [Billboard 2013]. It replaced a manual, error-prone and easy to manipulate system of calling selected stores about sales figures. Additionally, Billboard then also started to remove descending songs after twenty weeks that fell below position number 50, in order to make the charts more “current” [Billboard 2013]. In theory this could make more chart positions available for new and yet uncharted songs, but it apparently did not prevent the previously observed sharp decrease of annual charting songs, and led to an increase in the average time songs spent on the charts. Perhaps the previously used manual system caused an even greater removal of descending songs from the chart.

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Figure 2a and 2b also show that for the period prior to the introduction of SoundScan in 1991, the number of Top 100, 40 and 10 hits per year was, except for a peak in the number of Top 10 songs during the 1980s, steadily decreasing

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since 1966. In the latter year 743 songs charted on the Hot 100 and by 1990 this number was nearly halved to 376. Since several studies have shown a positive relation between the number of different recordings that reached the hit song charts and intensity of market competition [Peterson and Berger 1975] [Rothenbuhler and Dimmick 1982] [Burnett and Weber 1989], Figure 2a and 2b therefore indicate a loss of market competition and diversity.

2. Changes in word usage

Inspired by Google's Ngram Viewer [Michel et al. 2011], I arranged the lyric files by year and constructed a bigram viewer (see <http://www.petermeindersma.com/lyrics/>) to examine changes in the popularity of word and term usage. In order to limit the influence of duplicate terms in transcribed parts of the lyrics, e.g. in repeated choruses etc., I calculated the percentage of annual songs in which these words occur, so each song can only make one contribution to the popularity of a given word or term per year. This method enabled me to visualize the popularity of these words over time in order to signal trends, see Figure 3.

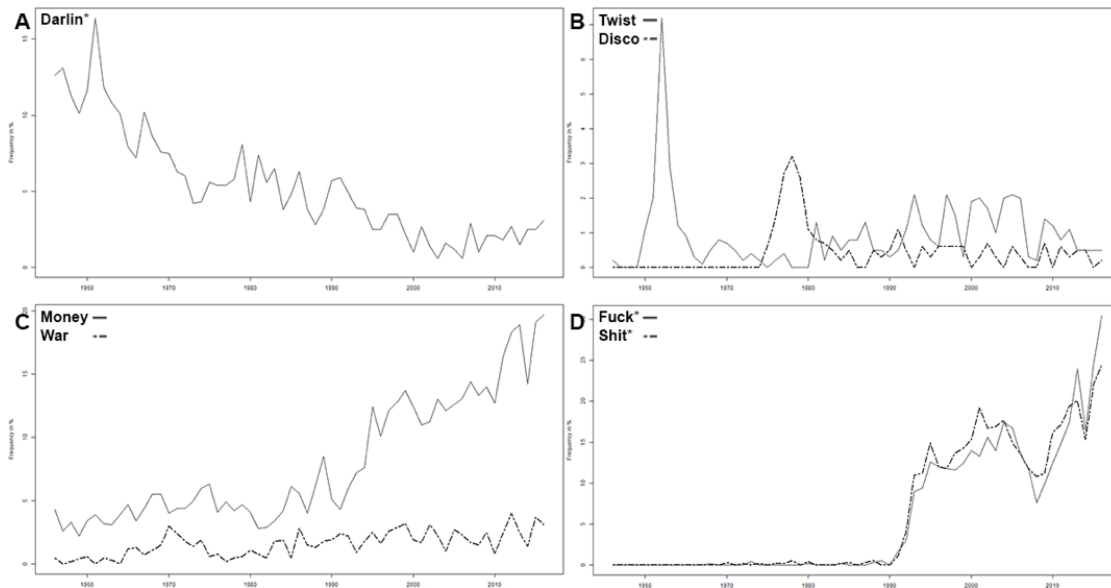


Figure 3. Relative frequencies of song lyrics that contain selected (case insensitive) terms on the Billboard Hot 100 (1956-2016). An * indicates that all suffixes are included, e.g. “darlin*” includes “darling” and “darlin”.

For example, a word like “darling” (or “darlin”) clearly lost its popularity (Figure 3A). In a similar way this tool can visualize the impact and duration of hypes in their times, e.g. dance crazes (*disco*, *twist*) (Figure 3B), and what was on our collective minds (e.g. *war* and *money*) (Figure 3C). This macro analytic approach demonstrates a major benefit: results become quantifiable: For example, the term *twist* is used in nearly twice as many songs in its peak year compared to the term *disco* (Figure 3B). It can also visualize trends like the rapid increase of profanity in lyrics since 1991 (Figure 3D), especially when compared to its gradual growth rate in books^[3]. This seems to signify an important change in American popular (music) culture and deserves more research.

Although this visualization method can signal changes in the popularity of word usage, it is too limited to examine changes in the homogeneity of popular lyrics. Therefore other methods are needed, like the analysis of sentiment and lexical complexity.

3. Changes in sentiment

To examine an aspect of changes in sentiment over time, I applied the Affective Norms for English Words (ANEW) list. This is a word list developed by Bradley and Lang to classify texts by valence (or “level of pleasantness”) [Bradley and Lang 1999] [Osgood et al. 1957]. This list contains 1034 words in English that have a score for emotional weight on a scale from 1 to 9. For example, “love” has a score of 8.72, “suicide” has 1.25. By adding these scores together for each of these ANEW words’ occurrences, the average emotional weight for each song is calculated. The resulting analysis is

consistent with Danforth and Dodds' findings [Danforth and Dodds 2010] that the average valence of lyrics from popular songs is decreasing over time and songs on average are less "happy" than ever before, see Figure 4.

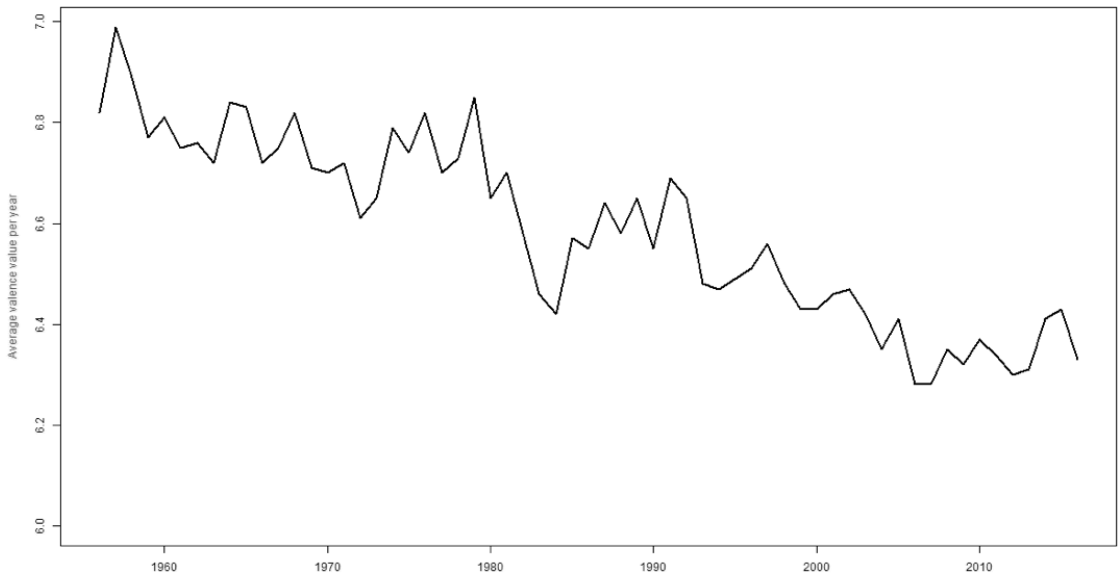


Figure 4. Average valence scores of songs on the Billboard Hot 100 per year (1956-2016).

Finally, I examined the variance (standard deviation) of the average valence of all songs per year, see Figure 5.

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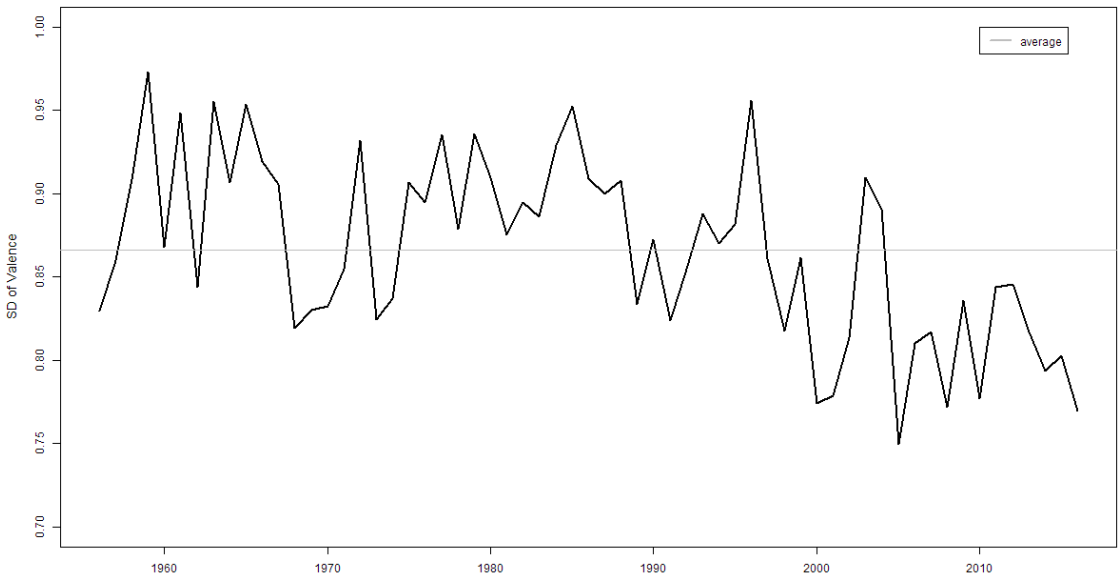


Figure 5. Standard deviation of average valence of Billboard Hot 100 songs per year (1956-2016).

Beside short-term fluctuations, the overall trend is a slow decrease in variance over time, which indicates a trend towards homogeneity in lyrics of popular songs.

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4. Changes in lexical complexity

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To examine changes in lexical complexity, I computed the average number of words per song per year (Figure 6) and used Bullfrogs Pond's data to find the average duration (length in seconds) per song over time (Figure 7).

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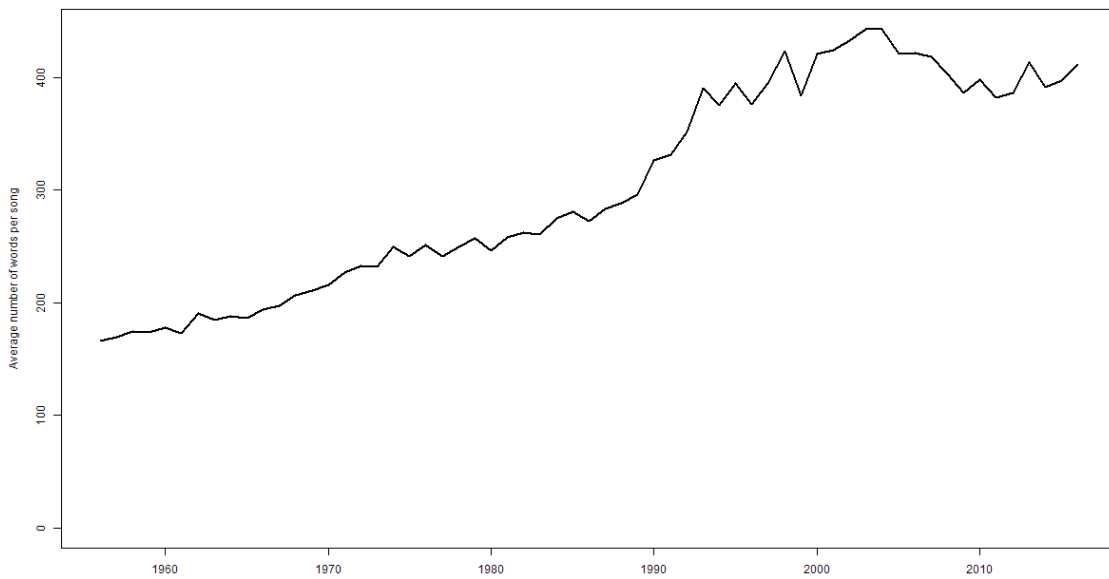


Figure 6. Average number of words per song on the Billboard Hot 100 per year (1956-2016).

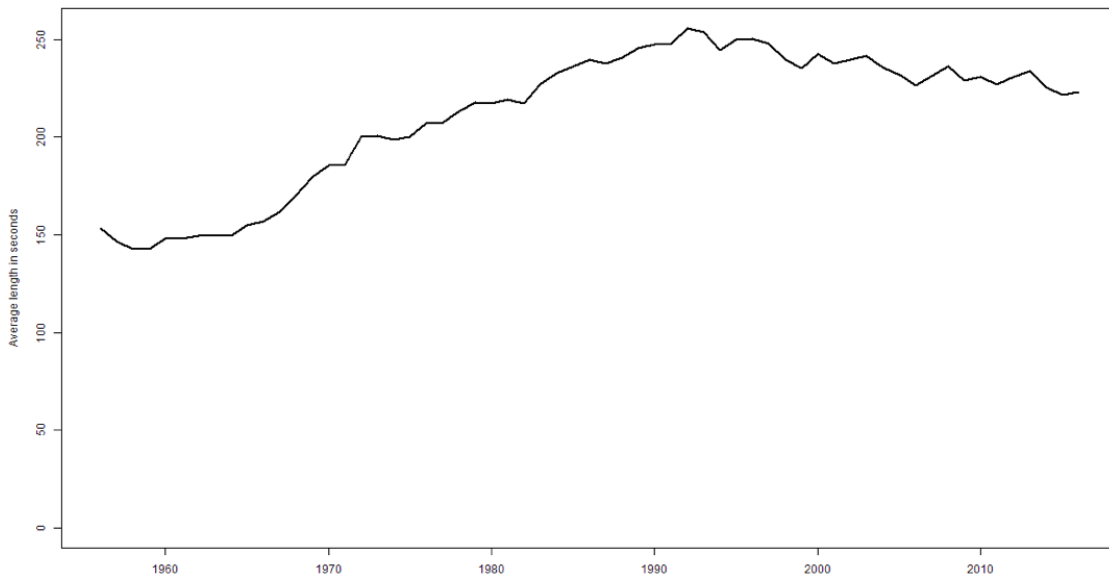


Figure 7. Average length in seconds of songs on the Billboard Hot 100 per year (1956-2016).

Both graphs show a gradual increase over time. By 1994 the average number of words per song has nearly doubled since 1960, while the average duration of songs has increased by about 60% between 1960 and 1991. 25

With this data, I also calculated the average number of words per second, which remained fairly stable at about 1.2 words per second until around 1991 when it started to increase rapidly and reached its (preliminary) peak in 2004 with 1.87 words per second, see Figure 8. 26

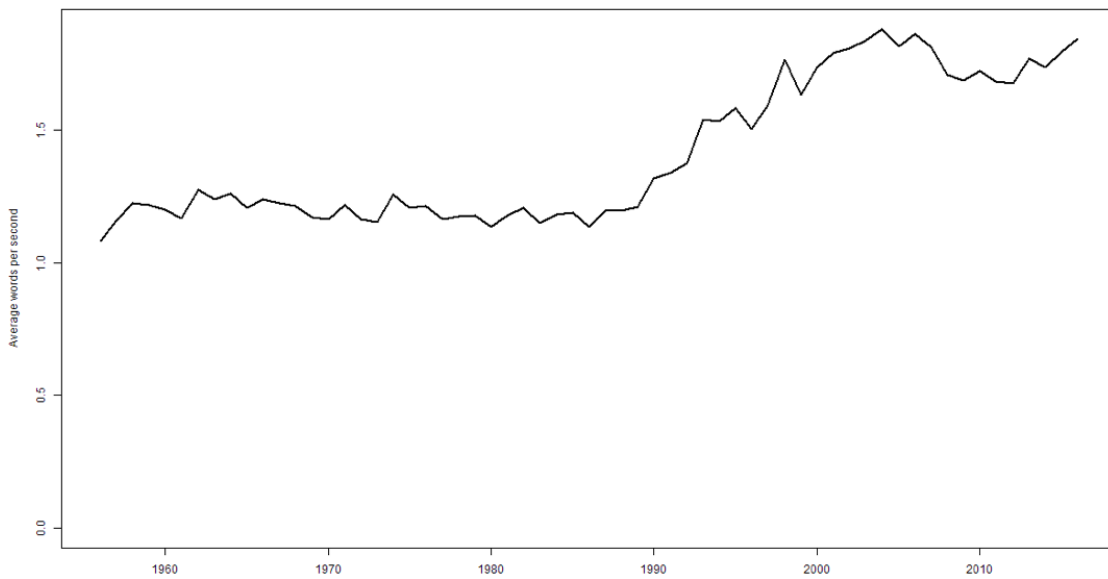


Figure 8. Average words per second of songs on the Billboard Hot 100 per year (1956-2016).

This increase of the average of number of words per second in songs hints at an increase in lyrical complexity. It also suggests, like my previous findings, that a big change has occurred in popular music around 1991. 27

To further examine this likely increase in lexical complexity, I computed the percentage of unique words per text or Type Token ratio. This is a frequently used method to provide an estimate of lexical complexity where a higher percentage indicates a higher level of complexity. However, this ratio is affected by varying lengths of texts. Since I have previously demonstrated that the average number of words per song has roughly doubled between 1960 and 1994 (see Figure 6), I have used a sampling method to compensate for the changes in average length of lyrics over time. From each song's lyrics, 75 words (sample size) were selected randomly to calculate the song's Type Token ratio. To reduce the influence of potential unintended effects of this random selection, I repeated this process fifty times (!) per song in order to achieve an average sampled Type Token Ratio. For different sample sizes (50, 75 and 100 words), I found an increase in this sampled Type Token ratio which indicates an increase in lyrical complexity, see Figure 9. 28

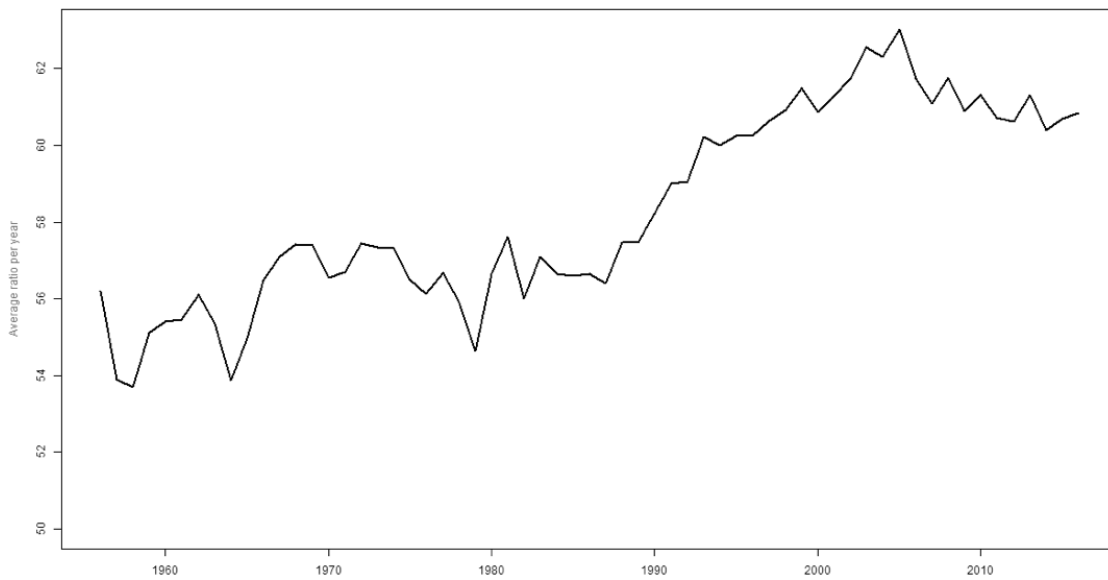


Figure 9. Average Type Token ratio of songs on the Billboard Hot 100 per year (1956-2016), based upon a sample size of 75 words per song.

Note that the average Type Token ratio starts to increase considerably around 1990. This coincides with the rapidly 29

increasing popularity of hip hop on the Billboard Hot 100 around that time. For example, Katznelson et al. have found a higher type token ratio for hip hop songs compared to rock and pop songs between 1989 and 2009 [Katznelson et al. 2011].

As for changes in lexical diversity, I have also examined the variance (standard deviation) of this sampled Type Token ratio and it clearly fluctuates over time, see Figure 10.

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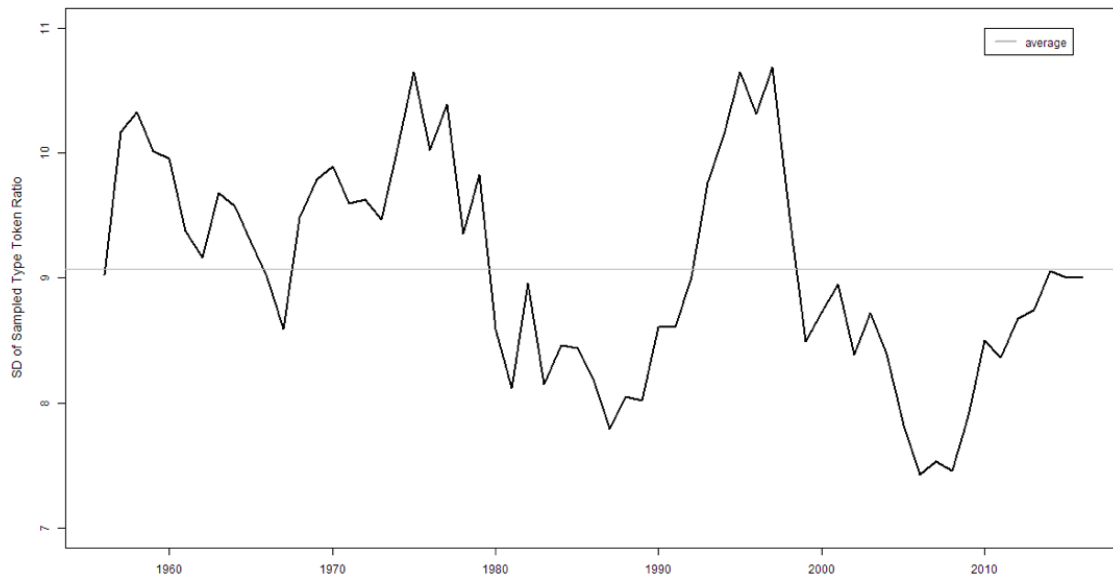


Figure 10.

This variance roughly seems to behave like a sine wave cycle, repeating nearly every twenty years. The global trend, however, is a slowly decreasing variance, which means that lyrics become more similar and again indicates a loss of diversity.

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Limitations

The results of this study support the argument that the lyrics of popular songs reveal a trend toward homogeneity over time. However, this work has several limitations and acknowledging these can provide a better understanding of the scope of these results and might improve further related research.

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A first limitation is the restriction of using only lyrics of songs that charted in the USA. Since this country currently accounts for about 4.5% of the world's population, these results cannot be applied internationally [Arnett 2008] [DeWall et al. 2011] and require further research into other cultures. Also note that this study focuses solely on the pop singles charts, which relate strongly to youth culture. Other aspects of popular culture, e.g. more adult oriented pop albums, radio station playlists, music venue owners, movie scripts, popular fiction novels or special interest magazine articles, may yield different results.

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A second restriction is the potential imperfection of the examined lyrics. Due to the lack of access to or absence of official sources, the lyrics were collected from several Internet websites, and were, unfortunately, subject to errors. These lyrics were most likely transcribed by individuals and could potentially not always accurately reflect the official spelling of the words used. For example, lyrics by British musicians could have been transcribed by American individuals choosing the word "color" over "colour" and vice versa. Additionally, since there were basically no online lyric archives before the 1990s, it is safe to assume that most of the transcriptions of songs from previous decades were made long afterwards. Since language and peoples' preferences gradually change over time, it seems likely that these lyrics do not necessarily reflect the preferred spelling (fashions) of its original times, e.g. words like "kissing" and "love" could have been replaced by "kissin'" and "luv" respectively. For further analysis, stemming and lemmatization techniques are recommended to improve some of these issues.

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A further challenge is related to the increasing average number of words used per song over time. As I have shown previously in Figure 6, the average number of words per song has doubled between 1960 and 1994. This means that, regarding my method of visualizing term usage over time (see Figure 3), songs from 1994 can, in theory, contribute to the popularity of twice as many different terms compared to that of songs from 1960. A word-weighting formula might be considered to compensate for this. 35

Finally, the used method of measuring *valence* has its limitations. It is based upon only 1034 words that constitute the ANEW list and this in general works better for longer texts. Also, the method of counting specific words or phrases does not necessarily overlap with intended meaning, e.g. sarcasm, hidden messages or context, like changes in time and space [Danforth and Dodds 2010]. For example, some words with a low *valence* value are from time to time used as words of approval like “wicked” and “sick” and should therefore deserve a distinct and higher value. 36

Unfortunately, this study’s focus on extensiveness comes with a price, as most of the limitations mentioned above illustrate less paid attention to detail. Ideally, for an all encompassing and thorough study, this macro analytic approach can therefore not replace the traditional method of close reading, but rather supplement it. For similar or larger sized corpora, this combination can become very labor intensive. Nevertheless, for examining underlying phenomena less focus on detail is required, as Bernoulli’s law of large numbers should prove. The methods and results of this study therefore should only be applied to improve our understanding of the big picture. 37

Conclusion and Discussion

In this study I have devised and applied a macro analytic approach for re-evaluating our understanding of popular music’s last sixty years, especially to examine if changes occurred in its homogeneity over time. Using this method, I have analyzed the diversity of hit songs and their lyrics over time and found that the number of annual charting songs on the Billboard Hot 100 has gradually, but steadily been decreasing since the 1960s until 2005^[4]. I have also demonstrated that the variances of valence (a level of pleasantness) and the variances of sampled Type Token ratio (an indicator for lexical complexity) have decreased over time. 38

These findings all indicate a loss of diversity of popular songs and will hopefully inspire further research to take the next step: examine if this observed trend toward homogenization is a symptom of the aforementioned media convergence, e.g. by analyzing differences in output diversity of large vs. independent record labels over time. 39

Additionally, this study’s findings also demonstrate remarkable changes around the year 1991. It is very likely that Billboard’s switch to SoundScan in 1991 influenced these changes, but the findings suggest other causes as well. The rapid increase in the average number of words per song (see Figure 6), words per second (see Figure 8) and sampled Type Token Ratio (see Figure 9), the further decrease in valence (see Figure 5) and the remarkable increase of profanity in song’s lyrics (see Figure 3D) indicate that popular music in the USA has changed considerably at that time. This coincides with the time when hip hop became a dominant music genre on the charts, at the expense of others, e.g. music by British musicians and especially (classic, alternative and hard-) rock music. This shift is arguably the most important event that shaped the Billboard charts in the last sixty years [Mauch et al. 2015]. 40

As Figure 10 points out, I have also found that the variance of the sampled Type Token Ratio roughly behaves like a sine wave cycle over time. Further research can hopefully specify if periods of rapid increases (e.g. 1989-1994) correspond with transitional periods in popular music (e.g. increased market competition and changes of dominating genres), while the rapid decreases (e.g. 1977-1981) are years of stabilization. This method can then facilitate predictions of coming changes in the development in popular music and add to the debate whether cultural products go through cycles [Peterson and Berger 1975]. 41

Finally, the remarkable increase in the number of annual charting songs that peak between position 40 and 100 since 2005 (see Figure 2a), indicates new changes in chart diversity, especially in the lower chart regions, for the number of yearly Top 40, Top 10 and Number 1 songs has not changed that much since 2005. This increase of annual charting songs is likely due to Billboard’s inclusion of digital sales from online retail stores such as iTunes for compiling the weekly Hot 100 charts since 2005 [Billboard 2013]. These stores are in general not depending on the physical 42

availability and storage of singles and can offer a much larger and more diverse and quickly accessible stock compared to offline retailers. Songs are also no longer required to have a physical single release in order to chart, which is exemplified by the simultaneous charting of many album tracks when current popular artists like Taylor Swift and Eminem release much anticipated new albums. It also enables short chart runs for (in general) short-lived televised song performances, e.g. by American Idol artists (since 2002) and the cast of the TV series Glee (since 2009). This increase in annually charting songs could in theory indicate a new period of increased song diversity on the charts, although the variances of valence (see Figure 5) and Type Token ratio (see Figure 10) are still (slightly) below average.

It is nevertheless very likely that the composition of the Billboard Hot 100 chart will continue to change. For example, in February 2013 it started to include YouTube (Vivo) streams, making it more susceptible for songs that suddenly become a hit on the Internet (e.g. *Harlem Shake* by Baauer). This change could lead to a further increase in the number of annual charting songs and future research should reveal how this affects the diversity of popular songs.

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Notes

[1] To obtain lyrics from online archives, a parser was written in Perl. It included instructions to retrieve the lyrics at random delay times to avoid bot detection (i.e. non-human behaviour) and potential blacklisting.

[2] The lyrics were predominantly retrieved from Lyrics.com. Additional lyrics were acquired from Top40db.net, metrolyrics.com, lyricsfreak.com and, to a lesser extent from lyrics.wikia.com, releaselyrics.com, lyricsmode.com, azlyrics.com, lyricsdomain.com, lyricstime.com, lyricsmania.com, and musicsonglyrics.com.

[3] See Google Books Ngram Viewer: https://books.google.com/ngrams/graph?content=fuck,shit&year_start=1956&year_end=2014&corpus=15&smoothing=0&share=&direct_url=t1;fuck;:c0;t1;shit;:c0

[4] The number of annual charting songs began to increase again in 2005, especially in the lower chart regions.

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