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Research Article

The power of repetition: repetitive lyrics in a song increase processing fluency and drive market success☆

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Abstract

The majority of music people listen to in their daily lives includes lyrics. This research documents how more repetitive songs lyrically are processed more fluently and thus adopted more broadly and quickly in the marketplace. Study 1 is a controlled laboratory experiment demonstrating how lexical repetition, a feature of the stimulus and *not* the consequence of repeated exposures, results in greater processing fluency. Study 2 replicates the effect utilizing custom-produced song excerpts holding everything constant except the lyrics. Utilizing data from *Billboard*'s Hot 100 singles chart from 1958–2012, Study 3 documents how more repetitive songs stand a greater chance of reaching #1 as opposed to lingering at the bottom of the chart. An analysis of #1 hits reveals increased repetition decreases the time it takes to reach #1 and increases the odds of debuting in the Top 40. This research chronicles the impact of processing fluency on consumer choice in the real world while demonstrating repetition as a stimulus feature matters. It also introduces a new variable to the processing fluency literature: lexical repetition.

Keywords: Processing fluency; Lexical fluency; Repetition; Music; Lyrics; Aesthetic goods

I guess a good song is a good song is a good song, ya know.George Thorogood American blues rock musician

Introduction

Music of one kind or another is ubiquitous in the modern world and plays an integral part in people's daily routines. Americans, for example, devote an average of 18 hours per week listening to recorded music and music on the radio (Rentfrow, Goldberg, & Zilca, 2011), and if background music is included, the time spent listening to music adds up to more than five hours per day (Levitin, 2006). The pervasive presence of music in people's lives is indicative of the pleasure it provides; listening to our preferred music induces the same euphoric response in the brain as food, sex, and drugs (Blood & Zatore, 2001). The question of why people prefer various types of music has attracted significant attention from researchers studying people's cognitive, emotional, physiological, and cultural responses to music, yet still relatively "little is known about the underlying principles on which individual musical preferences are based" (Rentfrow, Goldberg, & Levitin, 2011, p. 1139). Even less well understood is what drives consumers to prefer one specific piece of music to another (Lamont & Webb, 2010).

Generally speaking, three types of variables have been shown to impact people's preferences for music: (1) features of the musical stimulus, (2) characteristics of the listener, and (3) situational or environmental factors (Wapnick, 1976). Some features of the musical stimulus found to have significant relationship with musical preference include tempo, rhythm, pitch, melody, harmony, and timbre (Teo, 2003). This research

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focuses on an entirely different characteristic of a musical stimulus: the lyrics and their influence on a song's relative popularity. The majority of music that people listen to in their daily lives includes lyrics, and this is especially true for popular music (Mori & Iwanaga, 2013). Lyrics and music are often entwined, making it difficult to recite the words of a song without invoking its melody, and similarly challenging to sing a song's melody without invoking the words. Yet lyrics and music, the semantic and the melodic components of a song, have been found to be processed independently (Besson, Faita, Peretz, Bonnel, & Requin, 1998; Bonnel, Faita, Peretz, & Besson, 2001).

One striking feature of popular music is the use of repetition in lyrics as a rhetorical device. Historically, the Greek chorus was a group of actors who would punctuate a performance with commentary they sang or chanted in unison. These regularly repeated sections were easy for the audience to learn and join in and came to be known as "the chorus." In fact, the ethnomusicologist Bruno Nettl counts repetitiveness among the few musical universals known to characterize music across different cultures (Margulis, 2014). Little has changed in modern times. The chorus of a song is often used as a "hook" to catch the ear of the listener and is repeated regularly throughout a song. One benefit derived from having encountered a stimulus previously, or repetitive priming, is an ease of processing referred to as processing fluency. Fluency effects have been documented widely for language, including most often for individual words (Hutchins & Palmer, 2011). An ancillary benefit resulting from processing fluency, notably for aesthetic goods, is that the experience is typically more pleasant (Reber, Schwarz, & Winkielman, 2004). Consequently, we expect songs that are lyrically more repetitive (for instance, by repeating the chorus more often), and thus more fluent, to be generally preferred and adopted more quickly and broadly in the marketplace. This is exactly what we observe.

Our first contribution is to document the impact of lyrical repetitiveness on the relative success of popular music under ecologically valid conditions. Despite music's prominence in our lives, understanding the underlying drivers of consumers' musical preference is "an area in which empirical evidence lags well behind theoretical speculation" (Sluckin, Hargreaves, & Colman, 1983, p. 263). While some researchers have investigated the acoustic elements presumed to contribute to a song's becoming a chart-topping hit with mixed results (Dhanaraj & Logan, 2005; Pachet & Roy, 2008), our focus on the lyrical elements sets this research apart. The combination of real world data with the lab studies we present is the first research of which we are aware to document an effect of lyrical composition on a song's popularity.

In doing so, this work is also the first of which we are aware to demonstrate the impact of processing fluency generally – and linguistic fluency specifically – on consumer-driven market outcomes in the real world. Thus, our results address an important challenge facing contemporary consumer researchers, documenting meaningful effects of processing fluency, a metacognitive experience, in real-world markets. This challenge persists because it is not nearly as easy to find evidence of metacognitive experiences on choice as it is on judgment. Processing fluency's lack of applicability to consumer choice, relatively speaking, is likely due to the fact that "choice involves a selection among alternatives rather than the assessment of one of them" and "decision based cognitions may have no impact on choice probabilities if they affect all alternatives equally" (Huber, 2004, p. 358). It is more likely that difficulty associated with processing a variety of alternatives will impact whether or not the consumer ultimately makes a choice (Dhar, 1997) and not which alternative they choose. By demonstrating the impact of fluency on a song's relative popularity in a natural setting, we offer empirical evidence of the effects of processing fluency on actual market outcomes driven by consumer choice.

We also make a number of theoretical contributions to the literature on fluency. First, we present evidence showing how repetition, a linguistic strategy that shifts attention away from what is said to how it is said, increases processing fluency. Repetition is one of the most important variables utilized in lexicography, the study of the vocabulary of a language (Popescu & Altmann, 2006). Note that repetition in this research is not repetition in terms of recurring exposures *to the stimulus*. Instead, what we examine is the effect of repetition as an objective feature *of the stimulus*. To date, the literature on linguistic fluency has neglected the role repetition (within the stimulus, not of the stimulus) plays on influencing processing fluency.

In addition, our results extend the work on linguistic fluency from written to spoken text, or more precisely, sung text. Researchers have manipulated processing fluency in linguistics by altering the vocabulary (*lexical fluency*), pronounceability (*phonological fluency*), grammar (*syntactic fluency*), and use of rhyme (*phonemic fluency*) in written texts presented to respondents (for a review, see Alter & Oppenheimer, 2009). Yet consumers encounter myriad instantiations of vocalized text in their daily lives that vary in terms of their repetitiveness, from audio books to poetry readings, from comedy acts to song lyrics. In a marketing context, language used in commercial advertisements can also be more or less repetitive. This research contributes to our understanding of how vocalized repetition ultimately affects consumers.

In what follows, we begin by briefly reviewing the relevant literature on fluency, repetition, and repeated exposures. In Study 1, we demonstrate the negative effect of greater repetition in song lyrics on perceptions of novelty and thus the positive effect on processing fluency. Participants listened to and evaluated 30-second excerpts from unfamiliar songs in which the chorus was repeated more or less frequently. As expected, the more repetitious pieces were judged as significantly less novel. Worth pointing out is that repeated lyrical phrases are often accompanied by the same melody and rhythm. In the past, findings regarding any positive effect of melodic redundancy on attitude have been mixed; Getz (1966) found no effect, while McMullen (1974) found melodies containing low or intermediate levels of redundancy were generally preferred to highly redundant melodies.

In Study 2, we set out to insure the robustness of the effect of phrase repetition observed in Study 1while controlling for the melody and rhythm. Therefore, in Study 2, we replicate the effect from Study 1 utilizing custom-produced song excerpts that include the same music while the singer either did, or did not, sing the same phrase multiple times. The results add supporting evidence to the claim that increased repetition within lyrics leads to lower perceptions of novelty and thus greater fluency. In Study 3, we assess the impact of linguistic fluency on market outcomes under ecologically valid conditions utilizing a unique data set. The United States is the world's largest music market with industry revenues of $7 billion in 2013 (www.ifpi.org), and music is one of the country's foremost exports (Huron, 2001). The data for Study 3 come from 55 years of the country's most popular songs. The study consists of three parts.

First, we compare lyrics in terms of their linguistic fluency (i.e., repetitiveness) from two groups of songs that appeared on *Billboard*'s Hot 100 singles chart: those that reached #1 and those that never climbed above #90. While a chorus is typically an integrated, coherent message, we also test for the effect of simple word repetition. Greater repetition, both in terms of choruses and words, significantly increases the likelihood a song is a #1 hit as opposed to one that stagnates below #90, or at the proverbial "bottom" of the chart. Next, we look at the speed of adoption for the set of #1 hit songs by examining whether linguistic fluency impacts the time (in weeks) between when a song debuts in the charts and when it reaches the #1 position. We find that greater repetition in terms of choruses increases the velocity at which a #1 song climbs to the top of the chart. Finally, we ask whether lexical fluency impacts early adoption of a song. We find that more repetitive (fluent) songs are more likely to debut in the Top 40 and thus be embraced by consumers much faster, albeit with one caveat. If a song is too repetitive in terms of its words, the positive effect of chorus repetition is negated. In summary, across three studies, we find lexical repetition increases linguistic fluency, and fluency has significant positive downstream consequences on marketplace outcomes dependent on consumer choice. Fluency's influence on choice is reflected in our market data by broader and more rapid adoption of songs that are more repetitive.

Fluency, repetition, and repeated exposure

Fluency, the relative ease or difficulty associated with processing a stimulus, is an influential cue in a wide array of cognitive processes (e.g., physical perception, memory retrieval, etc.). Processing fluency isn't a process per se but rather describes how easy a process feels (Oppenheimer, 2008). It is the result of a metacognitive mechanism that signals the ease with which information is processed (Schwarz, 2004; Schwarz et al., 1991). The signal is "hedonically marked" such that greater fluency is indicative of a more positive state and elicits positive affect (Winkielman, Schwarz, Fazendeiro, & Reber, 2003). People have a "naïve theory" that the better something feels, the more they should like it and often form judgments in part by monitoring their feelings (Pham, Cohen, Pracejus, & Hughes, 2001; Schwarz, 1990). The feelings-as-information model implies people infer their evaluation from how they feel, and if something easier to process makes them feel good, they must like it (Schwarz, 2012; Schwarz & Clore, 1983).

Research has shown fluency has far reaching effects well beyond liking (Reber, Winkielman, & Schwarz, 1998). The literature on fluency effects has analyzed its role across a variety of measures (e.g., judgments, behavioral choices, and physiological responses) and its consequences across a variety of judgments, including familiarity (Reber & Zupanek, 2002; Tversky & Kahneman, 1973), confidence (Reder, 1987), truthfulness (Reber & Schwarz, 1999), intelligence (Oppenheimer, 2006), fame (Jacoby, Woloshyn, & Kelley, 1989), and perceived faultiness (Goodwin, 2006). Further, fluency effects have been documented using a wide variety of stimuli (e.g., peoples' faces, ideographs, words, and melodies). Two different stimulus variables known to facilitate fluency include: (1) objective features of the stimulus and (2) past experience with or repeated exposures to the stimulus.

Repetition as an objective feature of a stimulus

Objective
fluency is characterized by processing being faster, more accurate, and requiring fewer cognitive resources. A stimulus's objective fluency can be manipulated to affect judgments by changing the features of the stimulus (e.g., its visual clarity, the number of words with nine or more letters, etc.). S*ubjective* fluency is a conscious experience of processing ease associated with a stimulus. Processing fluency need not be reflected in conscious experience (Winkielman et al., 2003). We mention this distinction as it may help explain why someone likes a song the first time s/he hears it but cannot explain why. The song may be more fluent objectively (i.e., more repetitive) but not more fluent subjectively.

Fluency effects derived from the objective features of a stimulus would presumably have an effect within a single exposure. Among the sizable body of research examining these types of effects, the most relevant to the current research is that which addresses linguistic and, more specifically, lexical fluency. This stream of research depends primarily on variations in writing style, as simpler writing is easier to process than complex writing. In a number of experiments, Oppenheimer (2006) varied the fluency of various texts while holding the meaning constant by either utilizing simpler or more complex words. Fluency was manipulated in his experiments by including words with more letters in a text (experiments 1 and 3) and by utilizing texts rated as including more and less complex vocabulary (experiment 2). Experiment 1 involved role-playing whereby respondents judged a faux personal statement for graduate school admissions. Increased complexity negatively affected acceptance decisions. In experiments 2 and 3, Oppenheimer found needless complexity had a negative effect on respondents' judgment of the author's intelligence. Also related is work by Song and Schwarz (2009), which finds that word pronounceability is a source of fluency and hence increased difficulty in pronunciation increases perceptions of risk (in the case of made-up food additives). Finally, somewhat related is work by McGlone and Tofighbakhsh (2000). These authors find that obscure but rhyming aphorisms are judged "truer" than equivalent but non-rhyming versions (e.g., *woes unite foes* versus *woes unite enemies*). Worth noting for our purposes, rhyming phrases include many of the same sounds and are easier to process than non-rhyming phrases. Lexical repetition includes the exact same sounds. Taken together, past work supports the proposition that lexical repetition as a stylistic strategy and objective feature of the stimulus should increase fluency.

Repeated exposures and the mere exposure effect

The mere exposure effect refers to the idea that increased exposures to a stimulus enhance liking (Zajonc, 1968). While there is no consensus as to what causes the mere exposure effect, a widely accepted explanation is that prior exposure allows a stimulus to be processed more easily when it is subsequently encountered. In other words, repeated exposure to the same stimulus is seen as enhancing fluency. As mentioned earlier, greater fluency results in greater positive affect (i.e., hedonic fluency), and the feelings-as-information model posits that greater positive affect leads to greater liking (see Winkielman & Cacioppo, 2001).

Numerous papers have explored the mere exposure effect as it applies to repeated exposures to musical pieces. For example, using student evaluations of songs on the radio, Ward, Goodman, and Irwin (2014) examine how familiarity is a driver of music choice. Similarly, Russell (1987) finds people's familiarity with a song on the charts increases over the course of its chart run, with repetitions being a function of chart performance (i.e., people are more familiar with higher ranked songs). Huron and Ollen (2004) estimates that more than 90 per cent of the time spent listening to music, people are actually listening to songs that they've heard before. Taking a different approach, Hargreaves (1984) looks at avant-garde jazz and easy listening (music without words) in the lab and finds an inverted-U for the effect of repeated exposure to musical stimuli on liking consistent with optimal complexity theory (Berlyne, 1974).

Other work on the mere exposure effect has employed repeated exposures of lexical content per se. In particular, the classic experimental paradigm proposed by Zajonc (1968) consists of varying the frequency of exposure to a meaningful or meaningless word and subsequently assessing respondents' attitudes. Still other work has focused on establishing a link between repeated exposures to lexical content and processing fluency. In a series of experiments, Whittlesea, Jacoby, and Girard (1990) presented participants the same series of words repeatedly. These authors find repeated exposure increases fluency of pronunciation and judgments of clarity. Topolinski and Strack (2009) show that the causal mechanism of the mere exposure effect in this type of study is the fluency of covert stimulus-specific motor-simulations (covert simulation of pronouncing a given word). If pronounceability is prevented, repeated exposure will not result in greater fluency (see also Topolinski, Lidner, & Freudenberg, 2013).

It is important to note that, up until this point, the effects of repetition on processing fluency and liking have been studied exclusively by focusing on repetition across repeated exposure occasions (for instance, listening to the same melody over and over). The literature has yet to look at the effect of repetition within a stimulus. We propose that repetition can be an objective feature of a stimulus that affects fluency, and, in turn, preference, linking together the two streams of research discussed above. We should be clear that the focus of this work is on lexical repetition and its impact on linguistic fluency. The first question we ask is whether lexical repetition, as an objective feature of a text, can increase processing fluency. We hypothesize that greater repetition in a text (e.g., song lyrics) will increase processing fluency. Second, we draw from the literature that links fluency and liking to hypothesize that greater repetition increases the likelihood of market success.

Study 1

In Study 1, we test the hypothesis that greater repetition, as an objective feature of the stimulus, increases processing fluency. We manipulate repetition by exposing participants to one of two different excerpts taken from the same song. We chose the excerpts such that they varied in terms of whether the chorus was heard once or twice (repeated). Respondents rated each excerpt in terms of novelty, an indicator of processing fluency in the literature (Song & Schwarz, 2009). More fluent stimuli tend to be judged as less novel (Cho & Schwarz, 2006; Fazendeiro, Winkielman, Luo, & Lorah, 2005; Unkelbach, 2006). Hence, our prediction is that increased chorus repetition (linguistic fluency) correlates negatively with participants' novelty ratings: if an excerpt is more (less) repetitive, it will be perceived as less (more) novel.

Participants and procedures

One hundred and twenty-six undergraduate business students from a major West Coast university participated in this study for partial course credit. Participants were told that they would be listening to excerpts from six different songs. The cover story stated that some songs had received airplay on the radio in the past few years while others were still waiting to be launched. In reality, we took care to ensure that the excerpts were taken from songs by unknown bands that had received little if any airplay (see Table 1). We did not provide participants with the songs' titles, the names of the performers, or any other information about the content that might influence their judgments.

Twelve unique excerpts were created (two for each song) by extracting 30-second excerpts such that one version (High Repetition) included the song's chorus twice while the other version (Low Repetition) included the chorus only once. Each participant was presented with a random selection of six of the 12 excerpts one-by-one that included either the low- or high-repetition version from each song. The excerpts were presented in a random order. To clarify, each respondent was exposed to excerpts from all six songs (3 in their High Repetition

Table 1
Songs utilized in study 1, part I.

Artist	Title
Lucy Spraggan	*Beer Fear*
Matt Toka	*666*
TryHardNinja	*Real Life*
Sin City	*Silver Bullet*
The Exies	*These Are The Days*
Chloe Dolandis	*Let's Make This Moment Come Alive*

version and 3 in their Low Repetition version). Which songs each respondent heard in a High Repetition and Low Repetition version was not counterbalanced but instead randomized in an attempt to avoid any effect of the presence of any one excerpt on another excerpt within the mix.

Given that the excerpts are from songs respondents have never heard before and were consequently exposed to only once, it was people's tacit knowledge of a correlation between previous exposures and processing ease that was expected to impact their perceptions. This attributional explanation for fluency effects posits that greater fluency triggers the sense a stimulus is less novel, even when it is new (Jacoby, Kelly, & Dywan, 1989). Therefore, novelty is our focal DV. Each of the 126 respondents rated each of six snippets in terms of its novelty on a 7-point scale [1 = not novel, 7 = novel], providing us with a total of 756 observations. In addition, consistent with the cover story, respondents also reported whether they had ever heard the song on the radio [1 = no, it certainly did not make it to radio play, 7 = yes, it certainly made it to radio play]. It is important to point out that had participants actually been familiar with these songs, we could expect no difference in terms of novelty across the two versions. This makes for an especially conservative test of lyrical repetition on novelty.

We did not expect recall for radio play to differ as the songs were all unknown. We did, however, expect participants' ratings of novelty to be significantly lower for High Repetition excerpts than for Low Repetition excerpts because we predicted the number of times a song's chorus is repeated increases linguistic fluency and thus processing fluency. As a means of testing whether respondents were aware of our manipulation, at the end of the study, participants rated the repetitiveness of each excerpt on a 7-point scale.

Results

We do not have a repeated measures design because the song excerpts were randomized and different participants heard different combinations of excerpts; song excerpts and subjects are not perfectly paired. An ANOVA including a fixed effect for song and utilizing novelty as the dependent measure reveals a significant main effect of Chorus Repetition ($F(1,749) = 7.31$, $p < .01$), controlling for song. As expected, novelty scores were lower for High Repetition songs ($\mu_{HighRep} = 3.22$, $SD_{HighRep} = 1.61$) than Low Repetition songs ($\mu_{LowRep} = 3.54$, $SD_{LowRep} = 1.64$). Including a dummy variable for native English speakers, which was not significant ($F(1,748) = .65$, $p = .42$) did not change the results. With respect to the size of the effect – Cohen's d statistic is 0.185, with a confidence interval of 0.042 and 0.329 obtained through a Bootstrap estimation with 5,000 repetitions. These figures suggest the presence of a small yet stable effect size.

The model also indicates that different songs in our set varied in terms of perceived novelty ($F(5,749) = 5.40$, $p < .01$), supporting the inclusion of a fixed effect for song. As multiple observations came from the same participant, we re-estimated the model using regression techniques, controlling for potential error correlation at the participant level. The results of the repetition contrast hold if we regress novelty on repetition, clustering the errors at the participant level ($F(1,125) = 9.07$, $p < .01$). The same results are obtained if we, more formally, regress novelty on repetition including a fixed effect at the participant level ($F(1,125) = 9.07$, $p < .01$).

An ANOVA including a fixed effect for the song and utilizing radio recall as the dependent measure reveals no significant main effect of Chorus Repetition ($F(1,749) = 0.40$, $p = .53$), controlling for song. This confirms, as expected, that our songs were obscure, and respondents in both conditions believed they had not heard these songs on the radio before ($\mu_{HighRep} = 2.27$, $SD_{HighRep} = 1.57$ and $\mu_{LowRep} = 2.34$, $SD_{LowRep} = 1.60$). A separate ANOVA reveals respondents rated the High Repetition excerpts to be more repetitive compared to their Low Repetition versions ($\mu_{HighRep} = 4.76$, $SD_{HighRep} = 1.66$ vs $\mu_{LowRep} = 3.30$, $SD_{LowRep} = 1.51$; $F(1,749) = 165.41$, $p < .001$).

Discussion

The results from Study 1 provide initial support for the hypothesis that increasing lexical repetition, operationalized here as the number of times the chorus of a song is repeated, increases processing fluency. Processing fluency is measured in terms of novelty; the more novel something was perceived to be, the less ease with which it was processed. Our results also suggest that participants were aware of differences in repetitiveness across song snippets.

Study 2

In Study 1, we used snippets cut from songs that were selected intentionally to vary the number of times the chorus was repeated. The stimuli, therefore, included music that also differed across the two excerpts taken from each song. It is important that we document the impact of lyrical repetition on novelty while holding the music constant if we want to attribute our effects to lexical repetition alone, which would make our results more generalizable. This was our intention in Study 2 in which we utilized songs we were sure the respondents had never heard before.

To create the stimuli, we worked closely with music producer and sound engineer Lars Deutsche and singer-songwriter Adam Cullen. Excerpts from two different songs were created using tracks from Cullen's yet unreleased album "Paper Bag Dreams." The excerpts were mixed by Deutsche especially for our purposes. Pairs of excerpts of equal duration from each song were created utilizing the same music as a backing track but layering different vocal tracks on top. The vocal tracks included different lyrics that either repeated a phrase multiple times or did not. In this way, our manipulation of song features mirrors what we did in Study 1 in terms of lexical repetition while controlling for melodic repetition by holding the musical content constant.

Participants and procedures

One hundred and forty-one undergraduate business students from a major West Coast university participated in this study for partial course credit. Participants were exposed randomly to one of two 20-second excerpts from the song "Little Queen" or one of two 40-second excerpts from "I Need a Friend" and were asked to evaluate each excerpt in terms of novelty on a 7-point scale. Again, we expected participants' ratings of novelty to be lower when the phrase, essentially the chorus, was repeated multiple times (High Repetition) as compared to when it was not repeated at all (Low Repetition). As in Study 1, respondents also rated the repetitiveness of each excerpt on a 7-point scale [1 = not repetitive, 7 = highly repetitive].

Results

An ANOVA including a fixed effect for the song and utilizing novelty scores as the dependent measure reveals a marginally significant main effect of Chorus Repetition ($F(1,140) = 3.16$, $p < .08$). In line with our prediction, novelty scores were higher for Low Repetition songs ($\mu_{LowRep} = 3.37$, $SD_{LowRep} = 1.32$) than for High Repetition songs ($\mu_{HighRep} = 2.94$, $SD_{HighRep} = 1.48$), implying increased repetition reduced perceptions of novelty. Concerning the effect size for Chorus Repetition, Cohen's d statistic is 0.301, although the effect is marginal with $p < .10$. As in Study 1, we controlled for the song (and thus duration, which unlike Study 1 varied in Study 2 by song). In Study 2, there is no effect of song on novelty ($F(1,140) = 0.03$, p = NS). Just as in Study 1, respondents rated the High Repetition excerpts to be more repetitive compared to their Low Repetition counterparts ($\mu_{HighRep} = 5.49$, $SD_{HighRep} = 1.43$ vs $\mu_{LowRep} = 3.93$, $SD_{LowRep} = 1.431$; $F(1,140) = 46.08$, $p < .001$). Participants again appear to be sensitive to the increased repetitiveness of the High Repetition excerpts.

While the effect of Chorus Repetition was only marginal, it is worth noting that in Study 2 we employed a between-subjects design for chorus repetition. We did so because we utilize excerpts from songs by the same artist, and the concern was that novelty perceptions might have been affected by prior exposure in a within subjects design. This made for a particularly conservative test of our hypothesis as the discrepancy-account of processing fluency suggests that a more fluent experience needs to feel different from other experiences in order to be meaningful (Hansen, Dechêne, & Wänke, 2008; Hansen & Wänke, 2008; Whittlesea, 2004). In other words, consumers are more sensitive to changes in fluency as opposed to the absolute level of fluency, which makes fluency effects more likely to be detected in a within-subjects context, where respondents are presented with mixed lists of different stimuli that could be used as a point of reference for one another to inform subsequent evaluations (Dechêne, Stahl, Hansen, & Wänke, 2009).

Discussion

The results from Study 2 offer additional support for the proposition that lexical repetition – independent of the musical content – facilitates ease of processing. This implies the results from Study 1 are likely to generalize beyond sung text to the spoken word. Taken together, the results from Studies 1 and 2 support the hypothesis that repetition, commonly used as a stylistic device linguistically, increases fluency. While compelling, we acknowledge the effects detected in both studies are not especially strong. Part of the motivation for Study 3, in which we assess the real-world effects resulting from using repetition as a way to increase linguistic fluency, was to present even more substantial effects.

Study 3

Study 3 consists of multiple parts. In Part I, we examine the impact of repetition and thus linguistic fluency on a song's popularity in the marketplace. In Parts II and III, we focus on a particular subset of songs, those that eventually rose to #1 on *Billboard's* Hot 100 pop chart, in order to assess whether repetition has an effect on the number of weeks it takes a song to get to the top, as well as the position at which a song debuts when first appearing in the charts.

Part I

Data and measures

Billboard Magazine is the music industry's preeminent source for assessing a song's popularity. Since *Billboard's* Hot 100 singles chart's inception in 1958, a song's ranking on the chart is considered the "best benchmark we have to measure the bigness of hits" (Molanphy, 2013). We identified all 1,029 songs that reached #1 on *Billboard*'s Hot 100 singles chart between 1958 and the end of 2012, when our data collection ended. We also identified all 1,451 songs that made it onto the Hot 100 chart during the same time period but never climbed above the #90 ranking. While every song that makes it onto the Hot 100 chart could be considered a successful song, songs that climbed to #1 (41% of the sample, henceforth *Top Songs*) are significantly more successful commercially, in general, compared to those that lingered at the bottom of the chart (henceforth *Bottom Songs*). By drawing songs from the very top and the bottom of the chart, we help insure this difference. Our prediction is that lexical repetition increases the likelihood of a song being a Top Song as opposed to a Bottom Song.

We secured audio recordings of each of the 2,480 songs in our sample, being careful to obtain only the original version that actually made it onto the charts. We also collected the lyrics for each song in text form drawing from, and cross-checking through, a variety of online sources (e.g., www.lyricsfreak.com, www.oldielyrics.com). We employed a team of graduate students at one of the premier music schools in the USA to code a variety of features for each song. Each graduate student was trained and worked under the direction of a fourth-year Ph.D. student in Music Theory whose dissertation focused on American pop music. Lexical repetition was operationalized in two ways. First, each song was coded with respect to the number of times its chorus is repeated. *Chorus Repetition*, our primary variable of interest, ranges from 1 to 16 ($\mu = 3.8$, SD = 1.4).

Apart from chorus repetition, repetition of individual words is also an important feature of a song, and a text in general. Therefore, we calculated the Hirsch-Popescu-point (henceforth *H-P-point*) for each song. The H-P-point is a reliable indicator of word repetitiveness and is used widely in lexical analysis (Popescu & Altmann, 2006). For each song, the frequency distribution of words in the lyrics was calculated using text analysis software. The words were then ranked from the most common (highly repeated words) to the least common (unique words). The H-P-point is defined as the point in which the ranking of a word in the distribution matches its frequency, just like the h-index in academia (Hirsch, 2005). For example, the H-P-point is 10 if the 10th most repeated word recurs 10 times in the song. The smaller the H-P-point, the less repetition and the greater a song's lexical richness. Conversely, the greater the H-P-point, the greater a song's overall repetitiveness is in terms of words. The H-P-point scores in our sample range from 2 to 16 ($\mu = 7.19$, SD = 2.19). The correlation between Chorus Repetition and H-P-point is .10, so we could include both predictors without expecting multi-collinearity to be an issue.

We originally coded and included two other measures unrelated to repetition but related to the lexical characteristics of our songs because we suspected they might impact processing fluency and influence our results. The first was the number of words with more than six letters, a measure of complexity similar to that used by Oppenheimer (2006). The second was word density, or the average number of words sung per second. This measure was calculated by dividing the total number of words by the length of the song in seconds. Neither of these variables had any significant effect, so they will not be discussed further. Instead, in terms of linguistic fluency, we focus our attention exclusively on repetition, both in terms of phrases (choruses) and words.

Our analysis controls for several song-specific, artist-related qualities expected to impact a song's life in the Hot 100. Work by Frith (1983) and Hong (2013) suggests that demographic variables pertaining to a song's performers can impact listeners' responses to popular music. Therefore, key demographic features for each song's performer were coded and included in the analysis. The lead vocalist's age in years at the time the song was released was coded as *Age*. The *Gender* of the lead vocalist was coded as *Male*, *Female*, or *Both* (indicating the lead vocals were sung by both a man and woman). Each principal performer's race was classified in terms of being *Caucasian* or not based on assessments made by two independent judges (given the potential subjectivity in making this determination). Whenever necessary, the judges relied on contemporaneous photographs of the performers obtained online. Inter-judge reliability was extremely high (Cohen's $\kappa = 0.95$, 95% CI [0.923, 0.985]).

Finally, we collected measures for two technical features of each song that we felt could potentially exert influence on processing fluency (albeit non-linguistic): beats per minute and song length. Beats-per-minute (*BPM*) measures a song's tempo, its speed or pacing, and faster or slower songs could conceivably influence ease-of-processing. *Song Length* takes into account the duration of a song (measured in seconds). We suspected, a priori, that shorter (vs. longer) songs would be perceived as more fluent. It was not possible to collect information on every covariate for every song and, as a consequence, our analysis excluded 524 (21.4%) songs from the original sample of 2,480 songs (90 Top Songs and 434 Bottom Songs). Thus, the final data set used in our analysis includes 1,956 songs (939 Top Songs and 1,017 Bottom Songs).

Analysis and results

We utilize logit regression to test the relationship between lexical repetition and the likelihood of being a Top versus a Bottom Song. Some artists in our dataset entered the chart more than one time, with two or more Top or Bottom Songs, or some combination of both. Therefore, songs cannot be considered fully independent. We account for any within artist correlation by employing robust standard errors clustered at the artist level. Further, our dataset spans 55 years, and some omitted contextual variables that varied with time may have influenced the chance of rising up in the charts. We capture time dependence through a fixed time effect model that includes 54 yearly dummy variables. The output from the regression is presented in Table 2. The estimated model has good predictive capability (area under the ROC curve = .73) and goodness-of-fit (Hosmer-Lemenshow $\chi^2_{(8)} = 6.33$, $p = .610$). As the inclusion of covariates led to a loss of more than 20% of cases due to missing values, we re-estimated the model with the entire sample of 2,480 songs, yet without the covariates. The results are substantively the same (see Appendix A).

The results indicate that chorus repetition is a positive predictor of a song's likelihood of being a Top Song as opposed to being a Bottom Song. More specifically, looking at the Odds Ratio for Chorus Repetition (OR = 1.14, $p < .01$), for each additional repetition, a song's likelihood of making it to #1 as opposed to staying at the bottom of the *Billboard* chart increases by 14.5%, holding all other factors constant. At the

Table 2
Parameter estimates of the effects of selected independent variables on likelihood of being a top song (1958–2012).

Variable	Odds Ratio	Std. Err.	z-stat	p	Confidence Interval	
Chorus repetition	1.145**	0.047	3.32	.001	1.057	1.240
H-P-Point	1.124**	0.034	3.91	.000	1.060	1.912
Age	0.939**	0.008	−7.26	.000	0.923	0.955
Both	1.082	0.204	0.42	.676	0.748	1.565
Female	0.919	0.155	−0.50	.616	0.660	1.279
Caucasian	1.286+	0.180	1.80	.071	0.978	1.691
Song length	1.006**	0.001	4.49	.000	1.003	1.009
BPM	0.998	0.002	−0.94	.349	0.994	1.002
Year dummies	Omitted from table					

Note: + p < .10, * p < .05, ** p < .01.

same time, as the H-P-point of a song becomes larger (i.e., more repetitive), a song's likelihood of hitting the #1 position on the Hot 100 also increases. An increase of one point in the H-P-point of a song increases its odds of becoming a Top Song by 12.4% (OR = 1.12, $p < .01$), again holding all other factors constant.

The results also show a song's likelihood of climbing to #1 in the chart is influenced by the demographic characteristics of the lead performer and by technical features of the song. In particular, a song's likelihood of becoming a Top Song *decreases* by 6.1% with each additional year in the age of its principal performer (OR = .94, $p < .01$) while it *increases* by 28.6% if the lead performer is Caucasian (OR = 1.29, $p < .0.7$), once again holding all other factors constant. In other words, mass market appeal appears to have favored young, white performers. The gender of the lead performer, on the other hand, does not appear to influence a song's likelihood of being a Top versus a Bottom song. With respect to technical features, our results indicate that consumers favor longer songs, as a song's likelihood of becoming a Top Song is positively affected by its length (OR = 1.01, $p < .01$). This is in contrast to our expectations that shorter songs would be more fluent and thus favored. Tempo does not appear to matter.

Discussion

In the first part of Study 3, we establish that both chorus repetition and word repetition each play an important role in determining a song's chances of becoming more successful in the marketplace. Our model indicates that increasing Chorus Repetition as well as increasing word repetition (the H-P-point) each increases the odds of becoming a Top Song relative to becoming a Bottom Song. In short, more repetitive (fluent) pop songs are more successful in terms of popularity among the mass market. We should highlight the fact that our variables are expressed in different units of measurement and vary considerably in their range. To facilitate a comparison of their order of magnitude, we standardized our measures of chorus repetition, H-P-point, song length, and age (the remaining variables were categorical, and tempo was not significant), and repeated the analysis. The results (see Appendix B) show that, when expressed using the same unit of measurement, the effect of chorus repetition and that of H-P-point are substantially the same in terms of magnitude (OR = 1.21 and OR = 1.29, respectively). Moreover, if we compare the effect of chorus repetition with that of song length (which appears to be the largest one), the difference between the two parameters is not significantly different from zero ($\chi^2_{(1)} = 3.62$; $p = 0.06$). Therefore, we can conclude that repetition affects the chance of becoming a #1 song more or less within the same order of magnitude as that of the other covariates.

A natural follow-up question is whether lexical repetition has any influence in terms of speed with which a Top Song rises to the #1 position. We hypothesize that, just as listeners appear to favor more fluent songs, they will also be attracted to more fluent songs faster. In other words, fewer exposures to a highly-fluent song should be necessary for consumers to grow fond of it. At the aggregate level, this implies more repetitive songs should achieve faster success and thus climb to #1 faster. We test this hypothesis in the second part of Study 3.

Part II

In the second part of Study 3, we focus only on the 939 Top Songs (songs reaching #1 for which we have control variables) in our data set as we investigate whether lexical repetition predicts the speed with which these songs climbed the charts. Due to greater fluency, we expect more repetitive songs to be faster in reaching #1.

Data and measures

To test the hypothesis that more repetitive songs are faster in climbing the chart, we employ a survival analysis approach considering the time (i.e., number of weeks) a song took to reach the #1 spot once it entered the chart as our time-at-risk period. The variable *Time To #1* was created for each Top Song, indicating the number of weeks it took the song to reach #1 from the week it first debuted on the chart. The number of weeks spent climbing to #1 is used as the dependent variable in this analysis. The main predictors of interest are once again *Chorus Repetition* and *H-P-point*. We include the same set of control variables used in Study 3, Part I.

In addition, we include two new control variables we anticipated might play an important role in determining the speed of adoption for a newly released song. The first new covariate, *Prior Top10s*, denotes the total number of previous Top 10 songs attributable to the performer at the time the focal song was released. Highly successful artists have a well-established fan base, and their new releases could be expected to have faster success. The second, *Soundtrack*, is a dummy variable indicating whether the song appeared on a major motion picture soundtrack. Songs from films often have exceptionally high visibility at the time of release, which could affect the speed at which they climbed the chart. We expected both of these control variables to be positively associated with the rate at which a song accrues fans and therefore its pace in climbing to #1.

Analysis and results

For the survival analysis, we use a general-to-specific modeling strategy starting with a parametric model that characterizes the hazard in a relatively flexible way (i.e., the generalized Gamma model) and subsequently testing whether the specifications nested within this are appropriate using likelihood ratio tests (Cleves, Gould, Gutierrez, & Marchenko, 2010). The test for $k = 1$ was the only case for which the result was non-significant ($\chi^2_{(1)} = 3.45$; p = .06), suggesting the Weibull distribution as the appropriate functional form for the hazard function. Given our interest is in estimating survival time (i.e., climbing period) and not hazard rates, we show the estimated coefficients in the Accelerated-Time Form (ATF) rather than the commonly reported proportional hazard metric. To avoid left-censoring issues, songs that were already present in the chart in the first week of 1958 were excluded from the analysis. As all songs in the analysis already peaked at #1, right-censoring was not a concern in our analysis.

The model thus predicts the median Time to #1 for Top Songs as a function of our focal IVs of *Chorus Repetition* and *H-P-point* as well as the various covariates. In this model, as in Part I, we employed robust standard errors clustered at the artist level and captured time dependence with a fixed time effect model that includes 54 yearly dummy variables. The results are presented in Table 3 and, in general, support the hypothesis that a song's lexical repetition decreases the number of weeks it takes a song to reach #1. More specifically, we find a song's *Time To #1* decreases with additional repetitions of the chorus, holding other factors constant ($\beta = -.012$, $p = .03$). The *H-P-point* coefficient, however, failed to reach statistical significance ($\beta = -.005$, $p = .46$). As a robustness check, we note that the same results hold even if we use a Cox non-parametric survival analysis (Hazard Ratio of Chorus Repetition = 1.037; $p = .043$). It seems repetition involving phrases – but not necessarily words – are what matters with respect to speed of adoption.

Also, as expected, both *Prior Top10s* and *Soundtrack* decrease the *Time To #1* of a song ($\beta_{PriorTop10s} = -.02$, $p < .00$ and $\beta_{Sountrack} = -.08$, $p < .01$). While somewhat interesting anecdotally, these were control variables in our model. One could speculate, though, as to whether other factors such as previous exposures to a song within a film or familiarity with an artist's style of music don't also affect the charts by way of increasing fluency. Another factor that reduced a song's *Time To #1* was the *Age* of the performer ($\beta = .01$, $p < .01$).

With respect to an artist's use of repetition, we were curious as to whether the lyrics a given artist utilized in hit songs varied across time with respect to repetition. In other words, did an artist's songs change systematically over time, increasing or decreasing in terms of either chorus or word repetition from song to song? One might imagine an artist beginning with simpler songs that get more complex, or vice versa. To investigate this question, we coded each song in terms of what number hit it was for an artist (1st, 2nd, 3rd, etc.) and looked at whether hit number had any effect on repetition. It did not; artists neither increased nor decreased the amount of repetition over time. This null result is of course limited by the fact we are only looking at songs popular enough to have made it onto the chart.

Table 3
Survival analysis of the effects of selected independent variables on the median time to #1 (1958–2012).

Variable	Coefficient^	Std. Err.	z-stat	p	Confidence Interval	
Chorus repetition	−0.012*	0.006	−2.15	.032	−0.023	−0.001
H-P-Point	−0.005	0.006	−0.74	.461	−0.017	0.008
Age	0.006**	0.002	3.23	.001	0.002	0.009
Both	−0.059	0.037	−1.59	.112	−0.131	0.014
Female	−0.012	0.027	−0.05	.962	−0.054	0.051
Caucasian	−0.032	0.025	−1.24	.216	−0.083	0.019
Song length	−0.000+	0.000	−1.93	.054	−0.001	0.000
BPM	−0.000	0.000	−0.37	.710	−0.001	0.000
Prior top 10s	−0.020**	0.002	−8.14	.000	−0.025	−0.015
Soundtrack	−0.080**	0.029	−2.76	.006	−0.137	−.0023
Year dummies	Omitted from table					

Note: + p < .10, * p < .05, ** p < .01.
^Parameters in AFT form.

Discussion

The second part of Study 3 supports the notion that more fluent songs are adopted more quickly. We observe in our data that more repetitive songs reach the pinnacle of their success more rapidly, represented here by more linguistically fluent songs climbing *Billboard*'s Hot 100 faster. Overall, Study 3 shows important real-world consequences of lexical repetition in a song, reflected by broader (Part I) and more rapid (Part II) market adoption.

Part III

In Part III of Study 3, we take a slightly different and more extreme perspective on speed of adoption. Instead of looking at the time it takes for a #1 song to reach its peak, we focus on a song's ranking when it first enters the chart. We accomplished this by coding whether or not the song made its chart debut in the Top 40, an exalted achievement in the music industry and a measure of extraordinary early success. Here, we look at the effect of lexical repetition on early adoption, somewhat different than the overall speed of adoption investigated in Part II operationalized as the weeks to reach #1. A total of 149 #1 songs (14.5% of Top Songs) entered the chart directly in the Top 40. The term "Top 40" dates back to the 1950s when it was used as a term for a radio format that plays current, popular music, but today it generally refers to the first 40 songs on the Hot 100 (Molanphy, 2013). The Top 40 is thus a more discriminating metric of speed of adoption yet not too restrictive a criterion. Part III also allows us to identify a boundary condition to the effect of increasing repetition.

Data and measures

A second logit model is used to predict whether or not a song debuted in the Top 40 as a function of our focal IVs of *Chorus Repetition* and *H-P-point* as well as the same covariates as Part II. In this model, as in Parts I and II, we employed robust standard errors clustered at the artist level and captured time dependence with a fixed time effect model that includes 54 yearly dummy variables.

Analysis and results

The results are presented in Table 4. Because there were years when no songs debuted in the Top 40, all songs in those years were excluded from the analysis due to complete separation issues. Hence, the results are based on a sample of 704 songs.

In our original specification, the coefficient Chorus Repetition was significant and greater than one, indicating more repetitions increased the chances of entering the chart in the Top 40. However, the coefficient H-P-point was less than one and significant as well, suggesting that word repetition reduced the odds of entering the chart in the Top 40. The opposing effects were unexpected and consequently led us to explore the interaction effect between Chorus Repetition and H-P-point.

Table 4
Parameter estimates of the effects of selected independent variables on likelihood of debuting in the top 40 (1958–2012).

Variable	Odds Ratio	Std. Err.	z-stat	p	Confidence Interval	
Chorus repetition	2.613**	0.756	3.32	.001	1.482	4.609
H-P-Point	1.308	0.239	1.47	.141	0.915	1.871
Chorus Rep × H-P Point	0.889**	0.039	−2.71	.007	0.817	0.968
Age	0.994	0.024	−0.26	.793	0.949	1.041
Both	1.748	0.727	1.34	.179	0.773	3.951
Female	0.919+	0.495	1.73	.084	0.934	2.985
Caucasian	1.006	0.292	0.02	.983	0.569	1.778
Song length	1.002	0.003	0.74	.458	0.996	1.008
BPM	1.004	0.005	0.85	.393	0.994	1.015
Prior top 10s	1.149**	0.037	4.33	.000	1.079	1.223
Soundtrack	0.889	0.380	−0.28	.782	0.385	2.053
Year dummies	Omitted from table					

Note: + p < .10, * p < .05, ** p < .01.

This interaction is negative and significant (Chorus Repetition × H-P-point OR = 0.989, $p < .01$). The model presented in Table 4 includes the interaction. In order not to lose any data due to complete separation issues, we replicated the analysis incorporating a cubic polynomial specification for the time effect instead of yearly time dummies (Carter & Signorino, 2010). The results are substantively the same (Chorus Repetition x H-P-point OR = 0.913, $p < .05$).

The negative interaction implies that the positive effect of Chorus Repetition on debuting in the Top 40 is attenuated as the H-P-point increases and vanishes altogether at very high levels of word repetition. This pattern is shown in Fig. 1 in a plot of the effect of Chorus Repetition (margins) on predicted probability of debuting in the Top 40 across the various levels of H-P-point.

Discussion

Complementing Parts I and II of Study 3, Part III reveals how fluency, in terms of repetition, facilitates a song experiencing faster success. Entering into the Top 40 straightaway is an explicit indicator of how quickly a song catches on or its speed of adoption. More repetitive (fluent) songs are adopted more quickly, albeit with one caveat. If a song is too repetitive in terms of words, the positive effect of Chorus Repetition is nullified. This is reminiscent of Berlyne's (1974) two-factor theory of wear-in and wear-out, whereby a highly repetitive song chorus-wise has a positive effect, but too much word repetition has a countervailing negative effect. In other words, the benefit in terms of entering the charts at an especially high ranking that comes from increasing the repetition of the chorus is moderated by word repetition.

The interaction effect reveals that increasing repetition in not a surefire method for increasing success; there is a ceiling effect to the benefit of repetitiveness that is reflected in Part III by the simultaneous increase of both choruses and word repetition. As far as rapid adoption is concerned, more repetition is not always better. By focusing on an extreme phenomenon, whereby only 14.5% of songs debuted in the Top 40, we are able to observe ceiling effects that we did not see in Parts I and II. In addition,

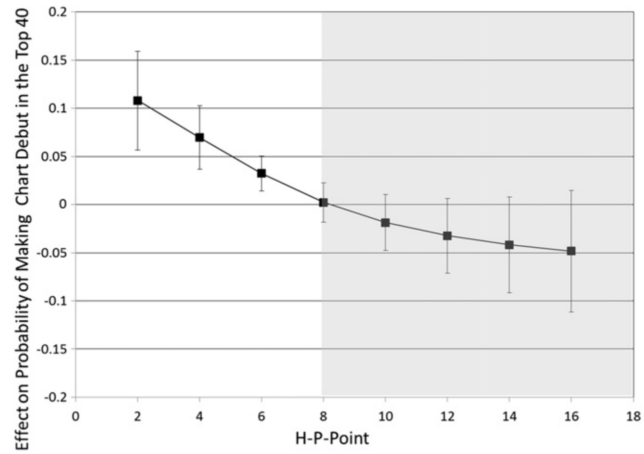

Fig. 1. Average marginal effect of one additional chorus repetition across H-P-points. Note: Effect of chorus repetition is nullified when H-P-Point exceeds six (shaded area).

we should point out that we returned to our analyses for Parts I and II to investigate potential interaction effects between Chorus Repetition and H-P point. Although the same directionally, neither interaction was significant.

General discussion

This research documents the effect of processing fluency on real world consumer-related outcomes including the overall popularity of a song and its speed of adoption. In doing so, we introduce a new variable, lexical repetition, to the fluency literature and show how increased repetition increases processing fluency. Repetition here acts like repeated exposure to a stimulus but is, in fact, a feature of the stimulus itself. Our results also show that linguistic fluency applies to vocalized text as well as to written text and that it can have an effect on preference (i.e., liking) as a form of judgment.

We believe these results have important implications for consumer research involving information goods and diffusion as they suggest fluency helps accelerate adoption. If one were to look at social contagion with respect to urban legends, rumors, and other forms of word-of-mouth communication, it would be reasonable to expect repetitive messages to spread faster, as they would be expected to be easier to process and therefore more fluent. These results may also have strategic implications for marketers, especially when it comes to advertising text and product jingles (or even the use of songs in advertising). Ads that use repetition should be judged more positively, which may ultimately impact people's attitudes toward the products and services being promoted. We know of no work that looks at repetition within an ad, although work on repetition of an ad is abundant (see for instance Campbell & Keller, 2003).

This research also merits attention from those who are interested in what makes certain music so popular. Just like the Greek Chorus, or its antecedent, the African tribes that practiced chanting in rhythmic fashion, there appears to be a long history of human's affinity for the repetition of words in music. From earliest childhood (consider "Row, Row, Row Your Boat") through adolescence (consider "Louie Louie" by the Kingsmen) to contemporary times (consider "It's All About That Bass" by Meghan Trainor), for many of us the songs that stand out in our minds are those in which we can easily hear the same words repeating themselves over and over again in our heads. While every artist strives to create a catchy *hook*, they may also consider striving to write a coherent song in which the chorus is repeated frequently while utilizing a limited vocabulary. This prescriptive is speculative, as what makes a song successful in the charts is relative; still, it would seem that if a songwriter can increase lyrical fluency without sacrificing their artistic integrity, it would seem like a good idea. Of course, one has to beware of being seen as formulaic and unimaginative. Consider "Weird Al" Yankovic's satirical "(This Song's Just) Six Words Long," a parody referring to the repetitiveness of George Harrison's "Got My Mind Set on You." Worth noting is Harrison's "Got My Mind Set on You," alluded to in the title, was a #1 hit that spent 22 weeks on Billboard's *Hot 100* in 1987.

Our research is not without its limitations, and some of these may provide fruitful avenues for future research. For example, our studies look at text that is sung as opposed to spoken. Singing increases the emphasis on phonation relative to articulation (Nair, 1999), technically sophisticated topics with respect to linguistics that fall outside of the scope of our research. Future research could attempt to replicate our results using the spoken word and further explore the effects of language production and transmission.

In Studies 1 and 2, we utilized song snippets exclusively, while in Study 3 our full songs were all popular enough to have made it onto *Billboard*'s Hot 100 chart. By default, this limited the extent of repetition in our data. It may very well be that all songs that make it onto the chart are both complex enough (i.e., not too much repetition) and simple enough (i.e., enough repetition) to secure mass market appeal. Work on optimal complexity theory (Berlyne, 1974) might suggest that, compared to songs that never make it onto the chart, those unpopular songs are either too simple (too much repetition) or too complex (too little repetition) lyrically. Looking at full songs that never made it onto the charts may reveal a richer story and be worthy of further study. Researchers may also look at lyrics based on song genre and extend the analysis to songs outside the realm of what is considered "pop music" (the focus of the current work).

We should mention that while conducting this research, we looked at other song variables that could be reliably coded and might have implications for our findings. An interesting result that emerged from this analysis refers to the impact of song form on how many times a chorus is repeated within a song. Song form describes the layout of a composition and how it is divided into sections. Songs in our data were coded by the aforementioned Ph.D. student in music theory according to its song form in one of three ways: AABA form, verse-chorus form, and everything else. In the AABA form, the A section is the dominant section, while the B section is the contrasting "bridge." The Verse-Chorus form describes a song that is built on a verse that leads to a chorus, with the chorus being the primary focus of the song. Songs that did not fit into either of these standard forms were coded as "other." We find that song form was correlated with how many times the chorus was repeated ($F(2,2339) = 38.38$, $p < .01$). Songs of the AABA format included more chorus repetition, on average ($\mu_{AABA} = 4.27$ vs. $\mu_{VerseChorus} = 3.60$ vs. $\mu_{Other} = 4.06$). Professional musicians may not find this result surprising, but it may help explain the popularity of this particular song form throughout the history of pop music.

What this finding illustrates is the interdependency of various elements of a song's composition; song form is linked to chorus repetition just as tempo and instrumentation are often inextricably intertwined. There are other elements that one might imagine impact the fluency of a song. These could include factors related to orchestration. Consider the repetitiveness of guitar riffs. Simpler chords and chord combinations as well as more familiar instrument sounds (timbres or timbre mixtures) may all have an impact on a song's ease of processing (and ultimately, market success). Among artist-types, a song is often viewed as the unique assembly of components that resist decomposition. Yet music psychologists have recently begun documenting what causes someone to like a song more or less. Despite the many factors that go into creating a hit song, we identify linguistic fluency – vis-à-vis lexical repetitiveness – as one that has important real-world implications for artists, producers, record labels, and others in the music industry.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jcps.2014.12.004.

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