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And the Beat Goes On: Popular *Billboard* Song Beats Per Minute and Key Signatures Vary with Social and Economic Conditions

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Abstract The beats per minute and key signatures of popular *Billboard* songs from 1955 to 2008 were investigated along with changes in the social and economic conditions of the USA, in accordance with the Environmental Security Hypothesis. Slower pop songs and songs in less common keys are generally more reflective and serious, whereas faster pop songs and songs in common keys are generally more celebratory and fun. Consistent with theory predictions, songs with more beats per minute and in common key signatures were most popular in social and economic good times and songs with less beats per minute and in less common key signatures were most popular during social and economic bad times. Environmental conditions appear to influence tempo and key preferences of popular music.

Keywords *Billboard* charts · Music preferences · Song tempo · Key signatures · Environmental Security Hypothesis

Music continues to be a poplar and increasingly studied topic in the field of social psychology. Previous research (Pettijohn and Sacco 2009) finds longer duration songs listeners rated to have more meaningful content, to be more comforting, more romantic, and slower songs were most popular when social and economic conditions were poor in the U.S. between 1955 and 2003. In addition, researchers (Pettijohn et al. 2010) also found seasonal variations in music category preferences such that energetic and rhythmic and upbeat and conventional music is preferred when participants are primed with spring/summer seasons. These studies suggest environment influences our desires for different varieties of music, however additional research on

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the relationship between social and economic environments and popular song tempo and tone preferences is necessary.

The *Environmental Security Hypothesis* (see Nelson et al. (2007); Pettijohn and Sacco (2009), for a review) proposes that our sense of environmental security impacts our social preferences within varying social and economic situations. Individuals should prefer more serious and significant social stimuli when environmental conditions are threatening. Threatening conditions lead people to focus on security and safety needs and therefore, social stimuli related to more meaningful and mature themes should be preferred to help reduce threat and uncertainty. Similarly, when conditions are less threatening and more certain, social stimuli related to fun and celebration would be preferred since the emphasis is no longer on reducing and managing environmental threats. These patterns of preferences can be related to the tempo and tone of popular songs.

Specifically related to popular music, slower pop songs generally have more reflective and serious themes while faster pop songs written for dance and celebration generally have less important messages and less serious themes. Listening to slow music often relaxes the listener whereas listening to fast music often excites the listener (Oakes 2003; Yamamoto et al. 2007). Music keys also affect the way listeners perceive songs. In western styles of composition, 12 notes divide the tones or octaves into seven standard pitches (do-re-mi-fa-so-la-ti) and five half steps or sharp/flats between most of these notes. Of the twelve, the seven standard pitches or tones serve as the most common root notes or key signature for songs, and thus listeners are conditioned to perceive these songs as the most familiar and comfortable (Deutsch 1992). Slower music is often in nonstandard keys to amplify the meaningful and mature themes. Dance and celebration themes typically combine standard keys with faster tempos to arouse the listener without instilling a sense of threat.

While Pettijohn and Sacco (2009) found people preferred *Billboard* songs judged to be slower during social and economic hard times, the researchers did not use objective music measures. The current research conceptually replicates and extends these original findings using measured beats per minute (BPM) as an indicator of song tempo and key signature to assess a song's familiarity and comfort. We predict songs with less BPM and in less common keys will be the most popular during poor social and economic conditions, whereas songs with more BPM and in standard keys will be the most popular during social and economic prosperous times.

Method

Billboard Number One Pop Songs The number one *Billboard* pop songs in the United States for each year from 1955 to 2008 were identified (Whitburn 2001; *Billboard* yearly reports) and mp3 files were collected. *Billboard* uses a formula of sales and radio airplay success to rank songs, both of which are indicators of preferences for popular music within the existing social and economic context.

Beats per Minute Ratings Beats per minute were assessed using both a professional musician and a computer software package (MixMeister 2010). The professional musician determined the beats per minute (BPM) by counting "the pulse" within two,

randomly selected, 30 second samples of every song. The computer program also analyzed the BPM of each mp3 file, but we found errors in how the program measured certain songs. Within a song, a baseline beat can be relative (a 120 BPM count of "one and," "two and …" can also be musically noted as a 240 BPM counted as one, two, three, four ….). Thus, the software sometimes measures slower songs at twice the BPM than they actually are, and faster songs at half the rate they actually are. While the majority of songs were rated similarly for BPM between our two rating sources, we used the musician ratings for analyses since it more accurately captures the overall feel of some songs. BPM ranged from 50 to 194 (M=103.19, SD=34.18).

Key Signature A professional musician transcribed the chords of every song to identify key signatures. A dummy variable was created, with all songs in standard keys (C, D, E, F, G, A, B) assigned a score of 1 while those in sharp/flat keys were assigned 0. As expected, the majority of songs (36 of the 54 songs) were composed in the standard keys.

General Hard Times Measure The General Hard Times Measure (GHTM; see Pettijohn and Sacco (2009), updated for current study years) has been used in several previous investigations. The GHTM is a standardized measure of global social and economic threat created from U.S. unemployment rate, change in disposable personal income, change in consumer price index, death rate, birth rate, marriage rate, divorce rate, suicide rate, and homicide rate. Larger values indicate relatively greater hard times. While relationships between song tempo, tone, and specific social and economic statistics could be explored, we were most interested in an aggregate measure of social and economic threat.

Results

Beats per minute for each *Billboard* number one pop song and the GHTM were correlated and a negative relationship was found, r (52)=−0.43, p<0.001. The point biserial correlation coefficient between the GHTM and standard key signatures was also negative, r (52)=−0.32, p<0.01.

Discussion

As predicted, *Billboard* number one pop songs with more beats per minute and songs in standard keys were most popular during social and economic good times whereas songs with less beats per minute and songs in sharp/flat keys were most popular during difficult social and economic conditions. For example, upbeat, dance songs in standard keys, such as "I'm a Believer" (BPM=162) or Elvis Presley's "All Shook Up" (BPM=154), were popular in relatively good times compared to slow, reflective music in nonstandard keys, such as Lionel Richie's "Say You, Say Me" (BPM=66) or Brian Adam's "I Do it for You" (BPM=61), which were popular when times were relatively bad.

The music industry and the everyday music fan may be interested in these results. Artists could consciously choose the BPM and key signatures of their music based on the corresponding social and economic conditions to be more appealing to consumers. Music fans could make better use of their listening habits by understanding how their preferences are influenced by their feelings of safety and security in their social and economic environment. To celebrate, listeners want dance music with more BPM in standard keys and to contemplate love and other serious matters, listeners want slower, more thoughtful songs with lower BPM.

We recognize the results of the current study are based on correlational outcomes only and constrained to pop music, thereby limiting causal conclusions and music genre generalizability. Future experimental research may find that individuals experiencing environmental threats prefer to listen to more serious, contemplative music in nonstandard keys with less beats per minute in a controlled lab setting. Furthermore, future research may examine different genres of music to determine if the preferences that correspond with environmental threat are specific to pop music. For example, country music may not follow the same pattern since themes of struggle and loss are often more common in this genre (Eastman 2010).

Another limitation of the current work includes our selection of the GHTM to reflect social and economic hard times. While we are confident the GHTM provides a single, global measure of environmental threat, individual circumstances should also be considered. For example, even within an economic recession certain individuals may feel financially and socially stable and therefore their musical preferences will not reflect societal circumstances in general. Again, additional experimental research could address these personal variations. How well the ordinary listener can differentiate between songs with more or less beats per minute may also be a concern. Fortunately, research has concluded that even people without music education are capable of accurately interpreting tones as beats per minute (Duke et al. 1991), suggesting that music listeners can accurately discern the difference between slow and fast songs.

In summary, the current research extends previous work by Pettijohn and Sacco (2009), providing an objective measure of song tempo (beats per minute) and adding key signatures to show that pop music preferences are influenced by social and economic factors.

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