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Popularity, Mood, Energy, and Typicality in Music: A Computerized Analysis of 204,506 Pieces

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Several previous studies support the claim that liking for music can be predicted by its arousal-evoking qualities and typicality; and that emotional responses to music can be captured by two dimensions, namely sleepy-arousing and unpleasant-pleasant. The present research tests these ideas via all 204,506 pieces of music to have featured on sales and/or radio airplay charts in the United States, representing the entire commercial musical culture. Energy scores were related to popularity, although not always in the predicted direction. Atypical songs enjoyed more commercial success. Energy and beats per minute data were associated with seven mood scores for each piece, such that higher values were associated with the expression of moods toward the arousing pole of the sleepy-arousal dimension. Popularity was also associated with mood scores, demonstrating those moods associated most clearly with commercial success; and mood scores differed between genres, with implications for music therapy, research on music and mental health, and the uses of music in commerce.

Keywords: music, popularity, energy, typicality, mood

Much of the literature on aesthetic responses to music (see reviews by North & Hargreaves, 2008; Sloboda & Juslin, 2001) can be criticized for lacking ecological validity, as it has often used relatively small samples of (sometimes specially composed) music that are played to undergraduates under laboratory conditions who then respond via Likert scale ratings of the music or direct physiological measures. The experimental control associated with this typical methodology has allowed detailed theorizing but has precluded more ecologically valid responses to the music that is experienced in everyday life by members of the general public.

To address this, two recent articles (North, Krause, Sheridan, & Ritchie, 2017a, 2017b) considered all of the 143,353 pieces of music to have enjoyed any commercial success in the United Kingdom in terms of three well-known theories of psychoaesthetics. In addition to collecting data on the popularity of each, the pieces were computer-analyzed to determine their scores on measures of energy, typicality, and six different moods. North et al. (2017a) showed first that the relationship between the popularity and energy of the pieces was U-shaped, such that moderately energetic pieces were least popular and higher sales were associated instead with pieces that had lower or higher scores for energy. This analysis was based on arguments by Berlyne (1971) that music with moderately arousing properties (such as a moderate degree of energy) should instead be most popular because it produces maximal activity in areas of the brain responsible for pleasure but also minimal activity in areas responsible for displeasure. Although this physiological aspect of Berlyne's arguments is clearly contentious (see, e.g., Martindale, 2007), a number of laboratory-based studies using relatively small samples of music and student participants have provided some support for Berlyne's proposed inverted-U shaped relationship between liking for art works and their arousal-evoking properties (see review by North & Hargreaves, 2008). Nonetheless, North et al.'s (2017a) finding of a U-shaped relationship between energy and popularity across the entire commercial corpus of British music is discrepant with the theory, and instead indicates that, although pieces toward the very extreme poles of the energy dimension might well be disliked, of the music that people actually buy, it is the relatively calming and energizing pieces that are more popular. Given the discrepancy between this and the findings of several laboratory studies, there is merit in attempting to replicate the finding in another complete commercial musical culture.

A number of other researchers have also challenged Berlyne's theory. Perhaps the most notable of these challenges is a series of studies by Martindale which have shown that liking for pieces of music (and other artistic works) is related to the extent to which each is typical of the class it represents, and that this relationship is stronger than that between liking and the arousal-evoking aspects of the music (e.g., Martindale & Moore, 1989). Arguments

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such as these are often based on connectionist models, claiming that liking for music is driven by the extent of its meaningfulness to the listener or the ease with which it can be processed and categorized (e.g., Hekkert & van Wieringen, 1990; Martindale, Moore, & Borkum, 1990; Moore & Martindale, 1983; Whitfield, 1983; Whitfield & Slatter, 1979). North et al. (2017a) argued that although typicality might be related positively to liking for music, commercial factors could also distort the relationship such that atypical, distinctive pieces would stand out in a crowded commercial market place and perhaps gain popularity as a consequence. They operationalized typicality by calculating the mean score across their corpus of 143,353 songs for each of energy, beats per minute, and six mood scores, and then for each piece calculated the sum of differences between its own scores on those variables and the corpus means. These supported the typicality approach to some extent, as there was a negative relationship between these "difference scores" and two separate measures of popularity, such that music that was different from the corpus was less popular than music that was more similar to the corpus. There was also some indication, however, that within specifically pop music greater commercial success was attained by pieces that were neither highly innovative (as per the theory) or highly derivative (contrary to the theory), suggesting that in crowded music markets some degree of atypicality may be associated with sales. Again, there would be merit in attempting to replicate this finding in another commercial musical culture.

In addition to attempting to predict popularity, North, Krause, Sheridan, and Ritchie (2017b) tested the extent to which the mood scores assigned by the computer to the 143,353 pieces could be predicted on the basis of the energy and sales data. This was conducted in the context of the circumplex theory of emotion, which states that any particular emotion can be understood in terms of its location on two orthogonal dimensions, namely arousing–sleepy and pleasant–unpleasant. North et al. employed the energy scores assigned by the computer to each piece as a proxy for the location of each along the arousing–sleepy dimension of the circumplex, and the results were consistent with this. Specifically, energy scores were related negatively to the scores assigned by the computer to each piece concerning Mood 1 (clean, simple, and relaxing), Mood 4 (mystery, luxury, and comfort), and Mood 6 (calm, peace, and tranquility), and positively to scores concerning Mood 3 (passion, romance, and power) and Mood 5 (energetic, bold, and outgoing), such that higher energy scores were associated with moods indicative of greater arousal and lower energy scores were associated with moods indicative of lower arousal. North et al. also attempted to employ popularity as a proxy for the pleasantness dimension of the circumplex. Results were more mixed, and this was interpreted in terms of popularity data being a poor analogy for the pleasantness dimension of the circumplex (given, e.g., the numerous instances of music being liked and popular specifically because it represents negative moods such as sadness—see, e.g., Sachs, Damasio, & Habibi, 2015; Schubert, 2013). However, there were numerous associations between popularity and mood, and the pattern of these varied between genres such that commercial success in one genre was apparently related to one particular profile of moods that was often discrepant from the profile of moods associated with commercial success in another genre. This has obvious implications for the music industry, as well as those wishing to use music in therapy, marketing, and other contexts in which the ability to predict mood responses to music would be useful such that an attempt at replication in another commercial music culture would again be beneficial.

Two more general features of the North et al. (2017a,b) articles are also interesting. First, the predictor variables explained only a very small portion of the variance in the data. This is unsurprising given the number of variables that would reasonably be expected to relate to musical taste and sales, and it is interesting that the small number of variables employed were able to identify any relationships at all. It nonetheless also raises the question, however, of whether North et al.'s findings concerning relationships between popularity, energy, typicality, and mood can be replicated. This leads to a second feature of North et al.'s arguments, namely that the discrepancy between their findings and those of a number of laboratory studies indicates that music sales are undoubtedly influenced by cultural and commercial factors such as advertising, radio airplay, and a panoply of other marketing tactics, that likely mediate the relationships among the variables: This in turn again raises the issue of whether the relationships identified between popularity, energy, typicality, and mood in the United Kingdom can be replicated in another culture. These factors led to the present research which attempts to repeat North et al.'s work but instead using data concerning those 204,506 pieces to have enjoyed any commercial success in the United States (and adding scores for each piece concerning a seventh mood, namely "sad").

The United States obviously represents a different music market to the United Kingdom and is also the largest globally. The differences between the United Kingdom and United States in this respect are not trivial, and several deserve to be highlighted. First, although obviously overlapping, the United Kingdom and United States enjoy differing musical histories, which might alone be expected to mediate any relationships between for instance genre, mood, typicality, and popularity. Second, music sales charts in the United Kingdom until 2015 were based solely on sales (and thereafter incorporated Internet streaming), whereas the Billboard chart in the United States also utilizes a number of music industry variables such as radio airplay. The present research, and the earlier articles by North et al., both operationalize popularity via chart performance of the songs, but the latter is calculated on a different basis in the United States. Moreover, radio broadcasting of pop music in the United Kingdom has been dominated historically by BBC Radio 1, which has throughout its history been the country's most popular pop music station, and similarly, radio broadcasting of 'middle of the road' and high art music has been dominated by BBC Radios 2 and 3, respectively: this contrasts with the much more fragmented pop music radio market in the United States. Furthermore, since the BBC is publicly funded, in contrast to the predominantly private-sector music radio market in the United States, there is empirical evidence that it has employed a less conservative programming strategy (e.g., Hendy, 2000). Similarly, the sheer size of the U.S. music market (and country) means that relative to the United Kingdom we might well expect to find a different relationship between popularity and the extent to which a given song is typical or distinctive relative to others.

The following five hypotheses were tested:

> *Hypothesis 1 (H1):* Following Berlyne's theory, there should be an inverted-U relationship between energy (a proxy for arousal) and measures of popularity, such that moderately

arousing music enjoys greatest commercial success. Note that the relationship between these variables was not consistent with this pattern in North et al.'s (2017a) U.K. data, however.

Hypothesis 2 (H2): Following research on typicality, there should be a negative relationship between the difference scores for each piece relative to the corpus and each of the respective measures of popularity, indicating that typical music is most popular. However, there are intuitive grounds to suspect that commercial pressures would give rise to the reverse direction of findings, such that difference scores may be related positively to popularity, indicating that atypical music is able to achieve the degree of distinctiveness required to come to popular attention in a large market.

Hypothesis 3 (H3): There should be an association between both energy and beats per minute (BPM) and scores for the pieces on each of the seven moods: these associations should be positive in the case of moods indicative of highly aroused states, and negative in the case of those moods indicative of lower levels of arousal.

Hypothesis 4 (H4): Popularity scores should be associated with the scores on each of the seven moods.

Hypothesis 5 (H5): Following North et al.'s (2017a) U.K. findings, the seven mood scores should differ between genres.

Method

Data Set

The research was based on a master dataset of music employed by the music industry in radio programming and similar commercial ventures, and this information was supplemented by additional data on each piece of music provided by a private sector company. The master dataset contains over 38 million pieces of music obtained from over 400,000 record labels, and represents the canonical record of all music that been subject to commercial release in Europe, North America, and Australasia. The company that manages the database classifies each piece into one of 23 genres, based on an initial genre classification of the recording artist. The present research excluded pieces assigned to genres for which there were fewer than 100 tracks with associated data concerning popularity (see the following text); and the "comedy/spoken word" genre was excluded entirely since, if these tracks featured music at all, it was clearly not intended to be the focus of listeners' attention in the great majority of cases. The database was then filtered to include only those pieces that had popularity scores arising from United States (see the following text) that were greater than 0, so that the final dataset used for analysis contained all and only those 204,506 pieces of music to have achieved any degree of commercial success there.

Energy. Each piece was assigned an energy score based on its musical properties via a machine learning process detailed in Alcalde, Ricard, Bonet, Llopis, and Marcos (2010) and Alcalde, Ricard, Bonet, Llopis, and Marcos (2008). In summary, the machine ratings of energy were based on an initial set of 100 exemplar "calm" and 100 exemplar "energetic" pieces, that were selected as such on a collaborative basis by two music students, a musicologist, and an audio engineer. The computer analyzed 69 combinations of 11 sonic properties of the tracks (e.g., beats per minute, pitch, rhythm) to learn the common characteristics of energetic tracks, the common characteristics of calm tracks, and the factors that distinguish these two. The computer compared each individual track against the remaining exemplars via an algorithmic process. If within the 10 most acoustically similar tracks compared to the target track (again defined according to 11 computer-analyzed sound properties such as tempo, beat, pitch, and rhythm) the majority were from the same proposed class as the target track (i.e., calm vs. energetic), then the target piece was regarded as having been classified appropriately. The computer successfully classified 182 of the original tracks as energetic or calm, and the 18 tracks that were classified incorrectly were replaced in subsequent iterations until a 100% success rate was achieved. The computer then assigned an energy score to each track in the master database by analyzing the similarity between the target piece and the remainder of the pieces in terms of the same 69 combinations of the 11 sonic properties: the greater the sonic similarity between two pieces so the greater the similarity in energy scores. Finally, prior to the present analyses, 1,000 tracks were selected from the database on a quasi-random, informal basis to satisfy the researchers with regard to the face validity of energy scores from across the continuum.

BPM. Five algorithmic measures of BPM were initially tested, each of which was based on an industry-standard, open source C++ library (see http://essentia.upf.edu). The outputs of each were compared against human ratings of a subset of tracks drawn from across the genres, and the two best-performing algorithms were combined and employed here. Computer measurements of BPM for each track were taken every 30 s and averaged to produce a single score. The face validity of these scores was then assessed informally in the same manner as per energy scores.

Popularity. Two approaches to popularity were used in the present research representing the peak chart position reached by each song and the duration of its tenure on the charts, respectively, and these were termed hit popularity and hit appearance scores respectively. For both variables, general scores were based on chart data from the United Kingdom and United States, and U.S. scores were based on chart data from only the United States, giving rise to four variables in total (namely general hit popularity, general hit appearance, U.S. hit popularity, and U.S. hit appearance). The U.S. measures, therefore, use data from only that market, whereas the general measures provide an interesting complement to these, providing a broader measure of popularity. The measures incorporated general, genre-specific, and regional charts in a weighted manner. Weightings were based on the size of the geographical region covered by the chart (i.e., national vs. regional), whether the chart in question was genre-specific or not, and whether it measured data relating to individual songs or albums, such that national charts, non-genre-specific, and singles charts are weighted heavier than regional charts, genre-specific charts, and album charts, respectively. For each track per chart, the hit popularity score was calculated as 1 divided by (peak chart position multiplied by chart weighting). Hit appearance scores were determined by the number of weeks that each piece appeared on each of the charts (without reference to positioning), with the charts again weighted as per the hit popularity measures. Higher

scores reflect greater popularity, and full details are provided in North et al. (2017a,b).

Mood scores. Each track was assigned values for each of seven moods, namely Mood 1 = clean, simple, relaxing; Mood 2 = happy, hopeful, ambition; Mood 3 = passion, romance, power; Mood 4 = mystery, luxury, comfort; Mood 5 = energetic, bold, outgoing; Mood 6 = calm, peace, tranquility; and Mood 7 = sad, respectively. These mood labels were selected by the music industry body that developed the database at the time of inception on the basis of their commercial relevance (particularly to music radio programming). This notwithstanding, the moods represent a reasonable mix of those that might be expected to be associated with relatively low levels of arousal (represented by "clean, simple, relaxing"; "mystery, luxury, comfort"; and "calm, peace, tranquility") and relatively high levels of arousal (namely "happy, hopeful, ambition," "passion, romance, power," and "energetic, bold, outgoing").

The mood scores themselves were developed by a similar process to that outlined above concerning energy. Initial ratings of 300 seed tracks thought to represent a range of mood and genres were made by six musicians and sound engineers, and these were used to train the computerized scoring system which is detailed in Alcalde et al. (2010) and Alcalde et al. (2008). In summary, this AI process analyzed each piece via an algorithm addressing several musical characteristics (e.g., melody, harmony, tempo, pitch, octave, beat, rhythm, noise, brilliance, and chord progression). The AI then assessed the similarity between the pieces via an algorithm containing 69 different combinations of the musical characteristics. Finally, mood scores were assigned to each piece based on its degree of similarity to the others in the database and the mood scores assigned to the latter. The face validity of these scores was then assessed informally in the same manner as per energy scores.

Difference scores. A mean value for the corpus was calculated for each of energy, BPM, and the seven mood variables. This was then used to create a difference score for each piece, which was the sum of differences between a piece's own scores on each of the nine variables and the mean corpus values. If the summed value was negative, it was multiplied by −1 so that the difference score serves as a measure of typicality relative to the corpus (without direction). In addition to these corpus level scores, a separate set of difference scores was also calculated for each piece on a within-genre basis, and these were used for the genre-specific analyses reported in Table B2.

Results and Discussion

Energy and Popularity

According to H1, there should be an inverted-U relationship between energy and each of general hit popularity, general hit appearance, U.S. hit popularity, and U.S. hit appearance. Four separate curvilinear regression analyses were carried out to test each of these respectively across the corpus, and the results are reported in Table 1.

Table 1 indicates that, at the level of the corpus, these variables were related to each other significantly albeit weakly in each case. The standardized beta and squared beta values in Table 1 indicate that specifically inverted-U relationships between energy and popularity were identified in the case of both hit popularity measures, and this is consistent with Berlyne's theory and H1: Although the relationship was weak, moderately arousing pieces achieved the highest peak chart positions across all music of any commercial relevance in the United States.

However, in the case of the hit appearance measures, the weak standardized beta values indicate that the relationship with energy at corpus level, although significant, was U-shaped: moderately arousing music spends less time on the charts than do pieces that represent higher or lower levels of arousal. As such, the hit appearance data is only consistent with that aspect of Berlyne's theory that states that arousal is related to popularity, but not with that portion stating that the relationship should take the form of an inverted-U. There is nothing in the present data set that allows a concrete explanation of the difference in the results between the hit popularity and hit appearance measures. One speculative possibility concerns the role of radio airplay: perhaps radio programming favors songs with high and low energy scores, as the respectively arousing and calming properties of these would serve a clear function in the daily lives of listeners (see, e.g., Krause & North, 2014; Krause, North, & Hewitt, 2015), so that these songs remain on radio playlists for extended periods of time, leading to the present results concerning hit appearance. It would be extremely interesting if future research were able to obtain separate U.S. data for sales and radio airplay. In the meantime, these analyses suggest that although energy is implicated in popularity, the relationship between the two may not take the form predicted by Berlyne's theory.

The data in Table 1 also indicate the nature of the relationships between energy and measures of popularity within each of the genres separately. Given that the *N* sizes are inevitably smaller it is unsurprising that some of these were nonsignificant, and again these relationships when statistically significant were nonetheless weak. However, in the case of indie, significant U-shaped relationships were found between energy and both general hit popularity and U.S. hit popularity. In the case of Christian/Gospel, significant inverted-U relationships were found between energy and all four measures of popularity. In the case of classical/opera a significant inverted-U relationship was founded between energy and general hit appearance. In the case of country, a significant U-shaped relationship was found between energy and both general hit appearance and U.S. hit appearance. In the case of electronica/dance, a significant inverted-U relationship was found between energy and both general hit popularity and U.S. hit popularity, and a significant U-shaped relationship was found between energy and general hit appearance. In the case of folk, a significant inverted-U relationship was found between energy and general hit popularity, and a significant U-shaped relationship was found between energy and both general hit appearance and US hit appearance. In the case of jazz, there was a significant inverted-U relationship between energy and both general hit popularity and U.S. hit appearance. In the case of Latin, there was a significant U-shaped relationship between energy and both general hit appearance and U.S. hit appearance. In the case of pop, there were significant U-shaped relationships between energy and both general hit appearance and U.S. hit appearance. In the case of rap/hip hop, a significant U-shaped relationship was found between energy and general hit popularity, and a significant inverted-U relationship was found between energy and general hit appearance. In the case of ska, a significant inverted-U relationship was found between energy and

Table 1
Curvilinear Regression Results for the Analyses Testing Berlyne's Inverted-U Relationship

Popularity variable	Model	r^2	F	df_1	df_2	p	Energy β	t	p	Energy squared β	t	P
Overall corpus (N = 204,506)												
General hit popularity	Linear	.003	622.21	1	204,504	<.001	.06	24.94	<.001			
	Quadratic	.003	315.61	2	204,503	<.001	.08	9.65	<.001	−.02	−3.00	.003
General hit appearance	Linear	.009	1882.72	1	204,504	<.001	.10	43.39	<.001			
	Quadratic	.01	1023.3	2	204,503	<.001	.00	−.50	.617	.10	12.74	<.001
U.S. hit popularity	Linear	.002	313.71	1	204,504	<.001	.04	17.71	<.001			
	Quadratic	.002	166.11	2	204,503	<.001	.07	8.94	<.001	−.04	−4.30	<.001
U.S. hit appearance	Linear	.008	1556.49	1	204,504	<.001	.09	39.45	<.001			
	Quadratic	.009	945.32	2	204,503	<.001	−.06	−6.83	<.001	.15	18.21	<.001
Alternative/Indie (N = 652)												
General hit popularity	Linear	.009	6.18	1	650	.013	−.10	−2.49	.013			
	Quadratic	.025	8.33	2	649	<.001	−.77	−3.63	.000	.68	3.22	.001
General hit appearance	Linear	.003	1.67	1	650	.197	.05	1.29	.197			
	Quadratic	.004	1.20	2	649	.303	.23	1.07	.283	−.18	−.85	.395
U.S. hit popularity	Linear	.023	15.53	1	650	<.001	−.15	−3.94	.000			
	Quadratic	.040	13.44	2	649	<.001	−.84	−4.00	.000	.70	3.33	.001
U.S. hit appearance	Linear	.001	.89	1	650	.346	.04	.94	.346			
	Quadratic	.002	1.59	2	649	.204	.36	1.66	.097	−.32	−1.52	.130
Christian/Gospel (N = 607)												
General hit popularity	Linear	.012	7.38	1	605	.007	.11	2.72	.007			
	Quadratic	.059	18.86	2	604	<.001	.73	6.09	.000	−.66	−5.48	<.001
General hit appearance	Linear	.001	.72	1	605	.398	−.03	−.85	.398			
	Quadratic	.048	15.29	2	604	<.001	.59	4.87	.000	−.66	−5.46	<.001
U.S. hit popularity	Linear	.004	2.23	1	605	.136	.06	1.49	.136			
	Quadratic	.028	8.84	2	604	<.001	.51	4.20	.000	−.48	−3.93	<.001
U.S. hit appearance	Linear	.006	3.77	1	605	.053	−.08	−1.94	.053			
	Quadratic	.041	12.92	2	604	<.001	.46	3.77	.000	−.57	−4.68	<.001
Classical/Opera (N = 2,291)												
General hit popularity	Linear	.002	5.88	1	2,919	.015	.05	2.43	.015			
	Quadratic	.003	4.50	2	2,918	.011	.17	.32	.021	−.13	−1.76	.078
General hit appearance	Linear	.003	8.44	1	2,919	.004	.05	2.91	.004			
	Quadratic	.005	7.80	2	2,918	<.001	.25	3.32	.001	−.20	−2.67	.008
U.S. hit popularity	Linear	.001	2.94	1	2,919	.086	−.03	−1.72	.086			
	Quadratic	.001	1.82	2	2,918	.163	−.09	−1.23	.218	.06	.83	.407
U.S. hit appearance	Linear	.000	.01	1	2,919	.944	.00	−.07	.994			
	Quadratic	.000	.27	2	2,918	.761	.05	.70	.487	−.05	−.74	.464
Country (N = 14,707)												
General hit popularity	Linear	.000	4.11	1	14,705	.043	.02	2.03	.043			
	Quadratic	.000	2.13	2	14,704	.119	.03	1.07	.286	−.01	−.38	.702
General hit appearance	Linear	.002	29.55	1	14,705	<.001	−.05	−5.44	.000			
	Quadratic	.007	48.19	2	14,704	<.001	−.23	−9.56	.000	.19	8.17	<.001
U.S. hit popularity	Linear	.000	.97	1	14,705	.324	.01	.99	.324			
	Quadratic	.000	1.50	2	14,704	.223	−.02	−.99	.322	.03	1.43	.154
U.S. hit appearance	Linear	.004	56.85	1	14,705	<.001	−.06	−7.54	.000			
	Quadratic	.010	75.22	2	14,704	<.001	−.27	−11.69	.000	.23	9.66	<.001
Electronica/Dance (N = 5,692)												
General hit popularity	Linear	.012	69.95	1	5,690	<.001	.11	8.36	.000			
	Quadratic	.012	35.07	2	5,689	<.001	.14	2.20	.028	−.03	−.44	.661
General hit appearance	Linear	.004	23.20	1	5,690	<.001	.06	4.82	.000			
	Quadratic	.005	13.06	2	5,689	<.001	−.04	−.65	.519	.11	1.71	.088
U.S. hit popularity	Linear	.007	40.06	1	5,690	<.001	.08	6.33	.000			
	Quadratic	.007	20.17	2	5,689	<.001	.12	1.87	.061	−.03	−.54	.587
U.S. hit appearance	Linear	.000	2.54	1	5,690	.111	.02	1.59	.111			
	Quadratic	.001	2.00	2	5,689	.136	−.05	−.84	.400	.08	1.21	.228

(*table continues*)

Table 1 (*continued*)

Popularity variable	Model	r^2	F	df_1	df_2	p	Energy β	t	p	Energy squared β	t	P
					Folk (N = 42,829)							
General hit popularity	Linear	.003	108.66	1	42,827	<.001	.05	10.42	.000			
	Quadratic	.003	55.01	2	42,826	<.001	.07	4.57	.000	−.02	−1.17	.243
General hit appearance	Linear	.002	102.24	1	42,827	<.001	.05	10.11	.000			
	Quadratic	.003	68.22	2	42,826	<.001	−.03	−2.14	.032	.09	5.84	<.001
U.S. hit popularity	Linear	.003	126.42	1	42,827	<.001	.05	1.24	.000			
	Quadratic	.003	63.30	2	42,826	<.001	.05	3.35	.001	.01	.42	.678
U.S. hit appearance	Linear	.002	66.86	1	42,827	<.001	.04	8.18	.000			
	Quadratic	.003	67.60	2	42,826	<.001	−.07	−5.07	.000	.12	8.26	<.001
					Jazz (N = 27,245)							
General hit popularity	Linear	.001	18.00	1	27,243	<.001	.03	4.24	.000			
	Quadratic	.001	13.31	2	27,242	<.001	.07	4.30	.000	−.05	−2.94	.003
General hit appearance	Linear	.000	.01	1	27,243	.923	.00	.10	.923			
	Quadratic	.000	1.08	2	27,242	.340	.02	1.40	.162	−.02	−1.47	.143
U.S. hit popularity	Linear	.000	1.86	1	27,243	.172	.01	1.37	.172			
	Quadratic	.000	3.16	2	27,242	.042	.04	2.47	.014	−.04	2.11	.035
U.S. hit appearance	Linear	.000	.35	1	27,243	.557	.00	−.59	.557			
	Quadratic	.001	10.89	2	27,242	<.001	.07	4.08	.000	−.08	−4.63	<.001
					Latin (N = 1,986)							
General hit popularity	Linear	.000	.00	1	1,984	.952	.00	−.06	.952			
	Quadratic	.000	.22	2	1,983	.806	.06	.62	.535	−.06	−.65	.513
General hit appearance	Linear	.007	13.81	1	1,984	<.001	.08	3.72	.000			
	Quadratic	.010	9.85	2	1,983	<.001	−.14	−1.46	.143	.23	2.42	.016
U.S. hit popularity	Linear	.000	.34	1	1,984	.861	−.01	−.58	.561			
	Quadratic	.003	2.60	2	1,983	.074	.19	2.00	45.000	−.21	−2.21	.027
U.S. hit appearance	Linear	.010	20.51	1	1,984	<.001	.10	4.53	.000			
	Quadratic	.020	19.97	2	1,983	<.001	−.30	−3.18	.002	.41	4.39	<.001
					Pop (N = 53,412)							
General hit popularity	Linear	.006	301.91	1	53,410	<.001	.08	17.38	.000			
	Quadratic	.006	153.30	2	53,409	<.001	.04	2.60	.009	.04	2.16	.031
General hit appearance	Linear	.007	366.77	1	53,410	<.001	.08	19.15	.000			
	Quadratic	.007	200.35	2	53,409	<.001	−.01	−.43	.666	.09	5.81	<.001
U.S. hit popularity	Linear	.003	185.34	1	53,410	<.001	.06	13.61	.000			
	Quadratic	.003	92.88	2	53,409	<.001	.05	3.05	.002	.01	.64	.520
U.S. hit appearance	Linear	.006	320.83	1	53,410	<.001	.08	17.91	.000			
	Quadratic	.007	191.65	2	53,409	<.001	−.04	−2.76	.006	.13	7.88	<.001
					Rap/Hip Hop (N = 8,884)							
General hit popularity	Linear	.004	36.39	1	8,882	<.001	.06	6.03	.000			
	Quadratic	.005	21.16	2	8,881	<.001	−.04	−.87	.387	.10	2.43	.015
General hit appearance	Linear	.001	12.95	1	8,882	<.001	.04	3.60	.000			
	Quadratic	.002	7.28	2	8,881	.001	.09	2.12	.034	−.05	−1.27	.205
U.S. hit popularity	Linear	.001	7.69	1	8,882	.006	.03	2.77	.006			
	Quadratic	.001	4.32	2	8,881	.013	−.01	−.26	.796	.04	.97	.331
U.S. hit appearance	Linear	.000	.43	1	8,882	.512	.01	.66	.512			
	Quadratic	.000	.50	2	8,881	.604	.04	.90	.369	−.03	−.76	.447
					Reggae/Ska (N = 605)							
General hit popularity	Linear	.000	.04	1	603	.838	.01	.20	.838			
	Quadratic	.003	.87	2	602	.421	.29	1.32	.189	−.28	−1.30	.194
General hit appearance	Linear	.000	.27	1	603	.607	.02	.51	.607			
	Quadratic	.006	1.77	2	602	.172	.41	1.87	.062	−.39	−1.81	.071
U.S. hit popularity	Linear	.000	.22	0	603	.641	−.02	−.47	.641			
	Quadratic	.019	5.81	2	602	.003	.70	3.23	.001	−.73	−3.38	.001
U.S. hit appearance	Linear	.000	.03	1	603	.855	−.01	−.18	.855			
	Quadratic	.023	7.02	2	602	.001	.79	3.64	.000	−.81	−3.74	<.001
					Rock (N = 38,885)							
General hit popularity	Linear	.000	.53	1	38,883	.465	.00	−.73	.465			
	Quadratic	.000	1.09	2	38,882	.336	.03	1.10	.269	−.03	−1.28	.199
General hit appearance	Linear	.005	211.56	1	38,883	<.001	.07	14.55	.000			

Table 1 (*continued*)

Popularity variable	Model	r^2	F	df_1	df_2	p	Energy β	t	p	Energy squared β	t	P
	Quadratic	.006	112.68	2	38,882	<.001	−.02	−.60	.546	.09	3.71	<.001
U.S. hit popularity	Linear	.000	19.01	1	38,883	<.001	−.02	−4.36	.000			
	Quadratic	.001	9.81	2	38,882	<.001	.00	−.14	.886	−.02	−.80	.436
U.S. hit appearance	Linear	.005	190.35	1	38,883	<.001	.07	13.80	.000			
	Quadratic	.006	119.27	2	38,882	<.001	−.10	−3.91	.000	.17	6.92	<.001
Soul/R&B (N = 337)												
General hit popularity	Linear	.010	3.48	1	335	.063	−.10	−1.87	.063			
	Quadratic	.013	2.16	2	334	.117	.08	.39	.700	−.19	−.92	.360
General hit appearance	Linear	.020	6.82	1	335	.009	−.14	−2.61	.009			
	Quadratic	.021	3.52	2	334	.031	−.05	−.23	.818	−.10	−.48	.629
U.S. hit popularity	Linear	.008	2.66	1	335	.104	−.09	−1.63	.104			
	Quadratic	.012	2.04	2	334	.132	.14	.71	.479	−.24	−1.19	.236
U.S. hit appearance	Linear	.007	2.21	1	335	.138	−.08	−1.49	.138			
	Quadratic	.008	1.30	2	334	.275	.04	.20	.838	−.13	−.62	.534
World (N = 5,744)												
General hit popularity	Linear	.009	54.90	1	5,742	<.001	.10	7.41	.000			
	Quadratic	.010	29.44	2	5,741	<.001	.01	.25	.801	.09	1.99	.047
General hit appearance	Linear	.003	17.18	1	5,742	<.001	.06	4.15	.000			
	Quadratic	.005	14.14	2	5,741	<.001	−.09	−1.98	.048	.15	3.33	.001
U.S. hit popularity	Linear	.021	121.55	1	5,742	<.001	.14	11.03	.000			
	Quadratic	.021	61.46	2	5,741	<.001	.09	2.10	.036	.05	1.16	.245
U.S. hit appearance	Linear	.001	7.93	1	5,742	.005	.04	2.82	.005			
	Quadratic	.005	14.02	2	5,741	<.001	−.16	−3.47	.001	.20	4.48	<.001

U.S. hit appearance. In the case of rock, a significant U-shaped relationship was found between energy and both general hit appearance and U.S. hit appearance. In the case of soul/R&B, no significant relationships were found between energy and popularity. In the case of world music, significant U-shaped relationships were found between energy and both general hit appearance and U.S. hit appearance.

Two aspects of these findings by genre stand out. First, there is considerable variability between genres in the nature of the relationship between energy and popularity. Second, notwithstanding the corpus level findings, in particular we note that pop and several other of the more culturally prevalent genres gave rise to U-shaped (rather than inverted-U) relationships. This is arguably consistent with the argument drawn concerning the corpus level data suggesting that these could reflect commercial marketing and the demands of radio airplay in favoring music that would stimulate listeners or help them to relax. A simpler (and perhaps complementary) conclusion is that the relationship between energy and popularity exists from a theoretical perspective, but that the nature of this relationship is better characterized at the level of the genre rather than the corpus. Such a conclusion is, of course, some way removed from Berlyne's theory which, given its psychobiological basis, implies that the relationship between popularity and energy should consistently follow an inverted-U function across genres and domains.

Typicality and Popularity

In accordance with H2, there should be a negative relationship between the difference scores and each measure of popularity, and the results of four correlations that were carried out to test this are reported in Table 2. Because it could be argued quite reasonably that typicality operates at the level of the genre rather than the overall corpus, difference scores were also calculated for each piece within each genre, and the same correlations were then repeated on a genre-by-genre basis. The results of these are again reported in Table 2.

Table 2 shows that, across the corpus, there was no relationship between typicality and either of the hit popularity measures, discrepant from the arguments of typicality theorists. There were significant, albeit weak associations between typicality and both measures of hit appearance. However, the coefficients presented in Table 2 show a positive relationship between difference scores and hit appearance: atypical music was associated with longer chart tenure. This direction of findings is intuitive when considered in the commercial context of chart data: it is arguable that in a large and crowded commercial music market, pieces will remain more prominent over time if they can be more easily distinguished from others against which they are competing. It is notable also that, given the difference in the pattern of results concerning hit appearance and hit popularity, the role of typicality in popularity is related more closely to the duration of a piece's tenure in the charts (measured by hit appearance) rather than its peak level of popularity (measured by hit popularity).

The genre-specific analyses in Table 2 present a similar pattern of findings to those obtained for the corpus. Fewer correlations achieved statistical significance, which might be expected given the smaller N sizes, and again the significant associations identified were weak. However, there were few instances of individual genres yielding significant results that were in a different direction to those obtained from the corpus. Several genres (such as Latin, reggae/ska, and soul/R&B) gave rise to positive relationships between difference scores and popularity, and these indicate those

Table 2
Correlation Coefficients Between the Total Difference Scores and Measures of Popularity

Total mean difference score	General hit popularity	U.S. hit popularity	General hit appearance	U.S. hit appearance
Overall corpus mean difference score (N = 204,506)	.004	.001	.034***	.038***
Alternative/Indie mean difference score (N = 652)	.061	.122**	−.068	−.050
Christian/Gospel mean difference score (N = 607)	−.082*	−.043	−.001	.029
Classical/Opera mean difference score (N = 2,921)	.014	.027	.038*	.030
Country mean difference score (N = 14,707)	−.033***	−.042***	−.003	−.009
Electronica/Dance mean difference score (N = 5,692)	−.017	−.012	−.028*	−.029*
Folk mean difference score (N = 42,829)	.018***	.009	−.002	−.008
Jazz mean difference score (N = 27,245)	.025***	.011	.021**	.001
Latin mean difference score (N = 1,986)	.029	.010	.079***	.098***
Pop mean difference score (N = 53,412)	−.001	.002	.014**	.023***
Rap/Hip hop mean difference score (N = 8,884)	.008	−.003	.000	.001
Reggae/Ska mean difference score (N = 605)	.132**	.111**	.143***	.012
Rock mean difference score (N = 38,885)	−.005	−.012*	−.003	.000
Soul/R&B mean difference score (N = 337)	.004	.064	.121*	.209***
World mean difference score (N = 5,744)	.033*	.039**	.009	−.011

* $p < .05$. ** $p < .01$. *** $p < .001$.

particular genres in which distinctiveness is associated with popularity. Those genres that yielded significant results in a different direction to the overall corpus, however, indicate that the relationship between typicality and popularity should instead be considered at the level of individual musical styles. The findings concerning electronica/dance are particularly interesting in this respect, indicating that within this genre there was a negative association between difference scores and the two hit appearance measures, so that typicality was related to greater popularity.

One other aspect of these findings is particularly notable. We noted earlier that there has been considerable debate in the experimental aesthetics literature concerning the relative predictive ability of Berlyne's theory versus approaches based on typicality. As North and Hargreaves (2000) detailed, the extent to which the two theories are truly contrasting is itself a complex issue. Nonetheless, it is interesting that the data here suggest that both theories may be moderated to some extent by market conditions and/or the uses to which people put music in everyday life. Both theories appear to identify variables of relevance to the popularity of musical pieces (since both energy and typicality were related to popularity) but market forces and aspects of the mundane uses of music might be mechanisms that moderate the precise relationship between these variables and popularity (since in neither case was the direction of findings wholly consistent with the predictions of the respective theories). Future research might well attempt to operationalize these market forces and mundane uses of music through big data variables such as record company marketing budgets and the time of day at which radio airplay (or Internet streaming of the music) occurs. For example, if commercial factors do distort the relationships between popularity and both energy and typicality then we would expect that the latter would be more consistent with laboratory-based research findings in the case of genres that are subject to relatively little marketing spend. A similar possibility is that radio airplay during the evening favors genres and tracks with relatively calming properties, but which nonetheless otherwise have less mainstream musical features: these market factors might increase the popularity of atypical music with low arousal potential beyond a level we would expect on the basis of earlier laboratory research.

Energy, BPM, and Hit Popularity by Mood

Seven general linear mixed model (GLMM) analyses addressed whether each of the seven moods respectively was predicted by energy, BPM, and hit popularity ($\alpha < .001$, to allow for the multiple analyses performed) in the overall corpus and within each genre. Table 3 indicates that, of the three predictor variables, the largest effect sizes were almost always associated with energy, irrespective of the genre or mood in question, although again these associations were weak. Table 3 also reports corresponding analyses for each of the genres in turn ($\alpha < .001$), which again indicate that energy predicted the greatest amount of variance in the mood scores with only nine (out of 105 possible) exceptions, namely Mood 1 (clean, simple, relaxing) ratings for Christian/Gospel, electronica/dance, and pop; Mood 2 (happy, hopeful, ambition) ratings for Christian/Gospel, folk, and soul; Mood 3 (mood, passion, power) ratings for reggae/ska; and Mood 5 (energetic, bold, outgoing) ratings for rock; and Mood 6 (calm, peace, tranquillity) ratings for soul/R&B.

The results reported in Table 3 support H3, that energy and BPM scores would predict mood scores so that higher scores for the former would be found in the case of moods indicative of higher levels of arousal. This hypothesis is supported by the results reported in Table 3. Across the corpus as a whole, although the relationships were weak, energy scores were related negatively to scores for Mood 1 (clean, simple, relaxing), Mood 4 (mystery, luxury, comfort), Mood 6 (calm, peace, tranquillity), and Mood 7 (sad); and were related positively to scores for Mood 3 (passion, romance, power) and Mood 5 (energetic, bold, outgoing). The only result that was inconsistent with the hypothesis was the negative relationship within the corpus as a whole between energy and scores for Mood 2 (happy, hopeful, ambition), and the corresponding findings concerning individual genres show a positive relationship between scores for energy and Mood 2 for five of the genres and a negative relationship for seven of the genres. We note in this context, however, evidence (Mano, 1991; Russell & Mehrabian, 1977) that the Mood 2 adjectives are located around the midway

Table 3
GLMM Analyses Predicting Moods

Variable	*F*	*df*	df_{error}	*p*	β	*t*	95% CI		η^2
Mood 1: Clean, simple, relaxing									
Overall corpus (N = 204,506)									
Corrected model	3741.11	3	204,502	<.001					
Energy	7953.93	1	204,502	<.001	−.01	−89.19	−.02	−.02	.037
BPM	1938.65	1	204,502	<.001	.00	−44.03	−.01	−.01	.009
Hit popularity	15.60	1	204,502	<.001	−.60	−3.95	−.90	−.30	.000
Alternative/Indie (N = 652)									
Corrected model	186.33	3	648	<.001					
Energy	492.27	1	648	<.001	−.04	−22.19	−.05	−.04	.432
BPM	.01	1	648	.929	.00	−.09	.00	.00	.000
Hit popularity	23.78	1	648	<.001	8.28	4.88	4.95	11.62	.035
Christian/Gospel (N = 607)									
Corrected model	9.20	3	603	<.001					
Energy	.01	1	603	.928	.00	−.09	−.01	.01	.000
BPM	2.93	1	603	<.001	−.01	−3.60	−.02	−.01	.021
Hit popularity	16.14	1	603	<.001	−6.89	−4.02	−10.25	−3.52	.026
Classical/Opera (N = 2,921)									
Corrected model	330.77	3	2,917	<.001					
Energy	868.05	1	2,917	<.001	−.34	−29.46	−.36	−.31	.229
BPM	21.48	1	2,917	<.001	−.02	−4.64	−.03	−.01	.007
Hit popularity	.00	1	2,917	.998	.01	.00	−9.02	9.04	.000
Country (N = 14,707)									
Corrected model	350.98	3	14,703	<.001					
Energy	930.22	1	14,703	<.001	−.03	−30.50	−.03	−.03	.060
BPM	32.23	1	14,703	<.001	.00	−5.68	−.01	.00	.002
Hit popularity	11.11	1	14,703	.001	2.90	3.33	1.20	4.61	.001
Electronica/Dance (N = 5,692)									
Corrected model	10.15	3	5,688	<.001					
Energy	.20	1	5,688	.657	.00	−.44	.00	.00	.000
BPM	6.90	1	5,688	.009	.00	2.63	.00	.00	.001
Hit popularity	22.46	1	5,688	<.001	1.13	4.74	.66	1.59	.004
Folk (N = 42,829)									
Corrected model	1501.52	3	42,825	<.001					
Energy	3671.66	1	42,825	<.001	−.04	−60.59	−.04	−.04	.079
BPM	339.71	1	42,825	<.001	−.01	−18.43	−.01	−.01	.008
Hit popularity	59.33	1	42,825	<.001	−3.38	−7.70	−4.25	−2.52	.001
Jazz (N = 27,245)									
Corrected model	1900.51	3	27,241	<.001					
Energy	4804.83	1	27,241	<.001	−.09	−69.32	−.09	−.09	.150
BPM	185.59	1	27,241	<.001	−.01	−13.62	−.01	−.01	.007
Hit popularity	97.23	1	27,241	<.001	−7.32	−9.86	−8.78	−5.87	.004
Latin (N = 1,986)									
Corrected model	27.31	3	1,982	<.001					
Energy	38.90	1	1,982	<.001	.01	6.24	.01	.02	.019
BPM	8.60	1	1,982	.003	−.01	−2.93	−.01	.00	.004
Hit popularity	37.06	1	1,982	<.001	−6.64	−6.09	−8.78	−4.50	.018
Pop (N = 53,412)									
Corrected model	694.75	3	53,408	<.001					
Energy	804.81	1	53,408	<.001	−.01	−28.37	−.01	−.01	.015
BPM	1057.49	1	53,408	<.001	−.01	−32.52	−.01	−.01	.019
Hit popularity	.53	1	53,408	.466	−.19	−.73	−.70	.32	.000
Rap/Hip Hop (N = 8,884)									
Corrected model	15.74	3	8,880	<.001					
Energy	36.93	1	8,880	<.001	.00	−6.08	−.01	.00	.004
BPM	4.98	1	8,880	.026	.00	−2.23	.00	.00	.001
Hit popularity	2.85	1	8,880	.091	.32	1.69	−.05	.69	.000
Reggae/Ska (N = 605)									
Corrected model	18.68	3	601	<.001					
Energy	51.25	1	601	<.001	−.02	−7.16	−.03	−.01	.079
BPM	2.80	1	601	.095	.00	−1.67	−.01	.00	.005
Hit popularity	5.04	1	601	.025	−3.03	−2.24	−5.67	−.38	.008
Rock (N = 38,885)									
Corrected model	411.50	3	38,881	<.001					
Energy	949.89	1	38,881	<.001	−.01	−30.82	−.01	−.01	.024

(*table continues*)

Table 3 (*continued*)

Variable	*F*	*df*	df_{error}	*p*	β	*t*	95% CI		η^2
BPM	200.32	1	38,881	<.001	−.01	−14.15	−.01	−.01	.005
Hit popularity	2.84	1	38,881	.092	−.63	−1.68	−1.35	.10	.000
Soul/R&B (N = 337)									
Corrected model	3.70	3	333	.012					
Energy	6.33	1	333	.012	−.02	−2.52	−.03	.00	.019
BPM	1.22	1	333	.270	.00	−1.10	−.01	.00	.004
Hit popularity	2.58	1	333	.109	−3.35	−1.61	−7.46	.75	.008
World (N = 5,744)									
Corrected model	89.82	3	5,740	<.001					
Energy	244.56	1	5,740	<.001	−.02	−15.64	−.03	−.02	.041
BPM	9.26	1	5,740	.002	−.01	−3.04	−.01	.00	.002
Hit popularity	.80	1	5,740	.372	−1.00	−.89	−3.19	1.20	.000
Mood 2: Happy, hopeful, ambition									
Overall corpus (N = 204,506)									
Corrected model	2927.33	3	204,502	<.001					
Energy	8150.92	1	204,502	<.001	−.03	−90.28	−.03	−.03	.038
BPM	1322.22	1	204,502	<.001	.01	36.36	.01	.01	.006
Hit popularity	.23	1	204,502	.630	−.12	−.48	−.60	.37	.000
Alternative/Indie (N = 652)									
Corrected model	17.18	3	648	<.001					
Energy	23.20	1	648	<.001	−.02	−4.82	−.02	−.01	.035
BPM	17.87	1	648	<.001	−.02	−4.23	−.03	−.01	.027
Hit popularity	3.97	1	648	.047	−6.18	3.10	−12.26	−.09	.015
Christian/Gospel (N = 607)									
Corrected model	.87	3	603	.457					
Energy	.52	1	603	.472	−.01	−.72	−.02	.01	.001
BPM	1.50	1	603	.222	−.01	−1.22	−.02	.00	.002
Hit popularity	.46	1	603	.496	−2.39	−.68	−9.26	4.49	.001
Classical/Opera (N = 2,921)									
Corrected model	114.00	3	2,917	<.001					
Energy	233.08	1	2,917	<.001	.10	15.27	.09	.12	.074
BPM	47.62	1	2,917	<.001	.02	6.90	.01	.02	.016
Hit popularity	2.16	1	2,917	.142	−3.97	−1.47	−9.27	1.33	.001
Country (N = 14,707)									
Corrected model	154.73	3	14,703	<.001					
Energy	238.22	1	14,703	<.001	.03	15.44	.02	.03	.016
BPM	115.46	1	14,703	<.001	.01	10.75	.01	.02	.008
Hit popularity	46.88	1	14,703	<.001	10.22	6.85	7.29	13.14	.003
Electronica/Dance (N = 5,692)									
Corrected model	89.03	3	5,688	<.001					
Energy	211.94	1	5,688	<.001	−.03	−14.56	−.04	−.03	.036
BPM	.57	1	5,688	.450	.00	.76	.00	.01	.000
Hit popularity	32.41	1	5,688	<.001	−3.76	−5.69	−5.05	−2.46	.006
Folk (N = 42,829)									
Corrected model	140.21	3	42,825	<.001					
Energy	106.02	1	42,825	<.001	.01	10.30	.01	.01	.002
BPM	253.41	1	42,825	<.001	.01	15.92	.01	.01	.006
Hit popularity	7.83	1	42,825	.005	2.20	2.80	.66	3.74	.000
Jazz (N = 27,245)									
Corrected model	1202.81	3	27,241	<.001					
Energy	3050.50	1	27,241	<.001	.09	55.23	.09	.09	.101
BPM	107.98	1	27,241	<.001	.01	10.39	.01	.01	.004
Hit popularity	69.59	1	27,241	<.001	7.67	8.34	5.87	9.47	.003
Latin (N = 1,986)									
Corrected model	27.58	3	1,982	<.001					
Energy	62.23	1	1,982	<.001	−.04	−7.89	−.04	−.02	.030
BPM	12.29	1	1,982	<.001	.01	3.51	.01	.02	.006
Hit popularity	11.54	1	1,982	.001	8.50	3.40	3.60	13.41	.006
Pop (N = 53,412)									
Corrected model	408.52	3	53,408	<.001					
Energy	1017.59	1	53,408	<.001	−.02	−31.90	−.02	−.02	.019
BPM	232.13	1	53,408	<.001	.01	16.19	.01	.01	.005
Hit popularity	15.42	1	53,408	<.001	−1.68	−3.93	−2.51	−.84	.000
Rap/Hip Hop (N = 8,884)									
Corrected model	72.10	3	8,880	<.001					
Energy	139.11	1	8,880	<.001	−.02	−11.80	−.03	−.02	.015

Table 3 (*continued*)

Variable	*F*	*df*	df_{error}	*p*	β	*t*	95% CI		η^2
BPM	1.43	1	8,880	.232	.00	1.20	.00	.01	.000
Hit popularity	64.43	1	8,880	<.001	−4.26	−8.03	−5.30	−3.22	.007
Reggae/Ska (*N* = 605)									
Corrected model	6.33	3	601	<.001					
Energy	12.99	1	601	<.001	−.04	−3.60	−.06	−.02	.021
BPM	2.72	1	601	.100	.01	1.65	.00	.02	.004
Hit popularity	.62	1	601	.432	−3.89	−.79	−13.61	5.82	.001
Rock (*N* = 38,885)									
Corrected model	2807.26	3	38,881	<.001					
Energy	8285.61	1	38,881	<.001	−.06	−91.03	−.06	−.06	.176
BPM	227.84	1	38,881	<.001	.01	15.09	.01	.01	.006
Hit popularity	79.52	1	38,881	<.001	6.39	8.92	4.99	7.80	.002
Soul/R&B (*N* = 337)									
Corrected model	6.44	3	333	<.001					
Energy	4.83	1	333	.029	−.05	−2.20	−.09	−.01	.014
BPM	1.52	1	333	.219	−.01	−1.23	−.03	.01	.005
Hit popularity	10.62	1	333	.001	24.39	3.26	9.66	39.12	.031
World (*N* = 5,744)									
Corrected model	57.65	3	5,740	<.001					
Energy	147.92	1	5,740	<.001	.02	12.16	.02	.03	.025
BPM	7.34	1	5,740	.007	.01	2.71	.00	.01	.001
Hit popularity	18.17	1	5,740	<.001	−6.40	−4.26	−9.35	−3.46	.003
Mood 3: Passion, romance, power									
Overall corpus (*N* = 204,506)									
Corrected model	24996.20	3	204502	<.001					
Energy	69240.77	1	204502	<.001	.14	263.14	.14	.14	.253
BPM	1531.35	1	204502	<.001	.02	39.13	.02	.02	.007
Hit popularity	591.32	1	204502	<.001	−9.33	−24.32	−10.08	−8.58	.003
Alternative/Indie (*N* = 652)									
Corrected model	521.06	3	648	<.001					
Energy	1487.55	1	648	<.001	.23	38.57	.22	.25	.697
BPM	.92	1	648	.337	−.01	−.96	−.02	.01	.001
Hit popularity	6.84	1	648	.009	−14.35	−2.62	−25.12	−3.58	.010
Christian/Gospel (*N* = 607)									
Corrected model	46.94	3	603	<.001					
Energy	134.14	1	603	<.001	.12	11.58	.10	.15	.182
BPM	1.30	1	603	.255	.01	1.14	−.01	.03	.002
Hit popularity	8.47	1	603	.004	−14.96	−2.91	−25.05	−4.86	.014
Classical/Opera (*N* = 2,921)									
Corrected model	525.64	3	2,917	<.001					
Energy	1333.15	1	2,917	<.001	.48	36.51	.45	.50	.314
BPM	46.17	1	2,917	<.001	.03	6.80	.02	.04	.016
Hit popularity	13.58	1	2,917	<.001	19.41	3.69	9.08	29.74	.005
Country (*N* = 14,707)									
Corrected model	1389.23	3	14,703	<.001					
Energy	3954.59	1	14,703	<.001	.14	62.89	.13	.14	.212
BPM	13.17	1	14,703	<.001	.01	3.63	.00	.01	.001
Hit popularity	31.83	1	14,703	<.001	−11.13	−5.64	−14.99	−7.26	.002
Electronica/Dance (*N* = 5,692)									
Corrected model	610.89	3	5,688	<.001					
Energy	1757.45	1	5,688	<.001	.10	41.92	.10	.10	.236
BPM	6.11	1	5,688	.013	.01	2.47	.00	.01	.001
Hit popularity	4.29	1	5,688	.038	−1.45	−2.07	−2.82	−.08	.001
Folk (*N* = 42,829)									
Corrected model	2037.55	3	42,825	<.001					
Energy	5595.04	1	42,825	<.001	.12	74.80	.12	.12	.116
BPM	111.68	1	42,825	<.001	.01	10.57	.01	.02	.003
Hit popularity	28.60	1	42,825	<.001	6.28	5.35	3.98	8.58	.001
Jazz (*N* = 27,245)									
Corrected model	2905.63	3	27,241	<.001					
Energy	7396.64	1	27,241	<.001	.17	86.00	.16	.17	.214
BPM	293.66	1	27,241	<.001	.02	17.14	.02	.02	.011
Hit popularity	85.30	1	27,241	<.001	10.36	9.24	8.16	12.56	.003
Latin (*N* = 1,986)									
Corrected model	85.57	3	1,982	<.001					

(*table continues*)

Table 3 (*continued*)

Variable	*F*	*df*	df_{error}	*p*	β	*t*	95% CI		η^2
Energy	238.88	1	1,982	<.001	.09	15.46	.08	.10	.108
BPM	7.30	1	1,982	.007	.01	2.70	.00	.02	.004
Hit popularity	4.77	1	1,982	.029	−7.88	−2.19	−14.94	−.81	.002
Pop (N = 53,412)									
Corrected model	3414.17	3	53,408	<.001					
Energy	8766.84	1	53,408	<.001	.11	93.63	.10	.11	.141
BPM	785.87	1	53,408	<.001	.03	28.03	.03	.04	.015
Hit popularity	170.94	1	53,408	<.001	−9.89	−13.07	−11.38	−8.41	.003
Rap/Hip Hop (N = 8,884)									
Corrected model	613.42	3	8,880	<.001					
Energy	1768.05	1	8,880	<.001	.05	42.05	.05	.06	.166
BPM	1.65	1	8,880	.199	.00	1.28	.00	.00	.000
Hit popularity	9.76	1	8,880	.002	.34	3.12	.39	1.72	.001
Reggae/Ska (N = 605)									
Corrected model	6.12	3	601	<.001					
Energy	1.39	1	601	.239	.01	1.18	−.01	.02	.002
BPM	.61	1	601	.436	.00	−.78	−.01	.01	.001
Hit popularity	14.89	1	601	<.001	14.67	3.86	7.20	22.13	.024
Rock (N = 38,885)									
Corrected model	10035.67	3	38,881	<.001					
Energy	29463.91	1	38,881	<.001	.17	171.65	.17	.18	.431
BPM	39.94	1	38,881	<.001	.01	6.32	.01	.01	.001
Hit popularity	185.39	1	38,881	<.001	−15.78	−13.62	−18.05	−13.51	.005
Soul/R&B (N = 337)									
Corrected model	13.36	3	333	<.001					
Energy	23.52	1	333	<.001	.12	4.85	.07	.17	.066
BPM	9.19	1	333	.003	.04	3.03	.01	.06	.027
Hit popularity	.36	1	333	.548	5.35	.60	−12.12	22.81	.001
World (N = 5,744)									
Corrected model	444.57	3	5,740	<.001					
Energy	1290.00	1	5,740	<.001	.09	35.92	.08	.09	.184
BPM	5.63	1	5,740	.018	.01	2.37	.00	.01	.001
Hit popularity	.02	1	5,740	.880	.28	.15	−3.39	3.96	.000
			Mood 4: Mystery, luxury, comfort						
Overall corpus (N = 204,506)									
Corrected model	9620.44	3	204,502	<.001					
Energy	23774.84	1	204,502	<.001	−.06	−154.19	−.06	−.06	.104
BPM	2392.31	1	204,502	<.001	−.02	−48.91	−.02	−.02	.012
Hit popularity	15.79	1	204,502	<.001	−1.09	−3.97	−1.63	−.55	.000
Alternative/Indie (N = 652)									
Corrected model	60.05	3	648	<.001					
Energy	164.20	1	648	<.001	−.04	−12.81	−.04	−.03	.202
BPM	2.55	1	648	.111	−.01	−1.60	−.01	.00	.004
Hit popularity	.23	1	648	.632	−1.22	−.48	−6.22	3.78	.000
Christian/Gospel (N = 607)									
Corrected model	6.73	3	603	<.001					
Energy	19.85	1	603	<.001	−.03	−4.46	−.05	−.02	.032
BPM	.11	1	603	.742	.00	.33	−.01	.01	.000
Hit popularity	1.17	1	603	.280	3.80	1.08	−3.10	10.70	.002
Classical/Opera (N = 2,921)									
Corrected model	321.74	3	2,917	<.001					
Energy	716.10	1	2,917	<.001	−.28	−26.76	−.30	−.26	.197
BPM	86.27	1	2,917	<.001	−.04	−9.29	−.05	−.03	.029
Hit popularity	11.60	1	2,917	.001	−14.43	−3.41	−22.74	−6.12	.004
Country (N = 14,707)									
Corrected model	339.53	3	14,703	<.001					
Energy	856.85	1	14,703	<.001	−.06	−29.27	−.06	−.05	.055
BPM	62.17	1	14,703	<.001	−.01	−7.88	−.02	−.01	.004
Hit popularity	.00	1	14,703	.994	−.01	−.01	−3.40	3.38	.000
Electronica/Dance (N = 5,692)									
Corrected model	324.50	3	5,688	<.001					
Energy	724.65	1	5,688	<.001	−.04	−26.919	−.047	−.04	.113
BPM	91.66	1	5,688	<.001	−.02	−9.574	−.019	−.01	.016
Hit popularity	23.94	1	5,688	<.001	−2.33	−4.892	−3.268	−1.40	.004

Table 3 (*continued*)

Variable	*F*	*df*	df_{error}	*p*	β	*t*	95% CI		η^2
Folk (*N* = 42,829)									
Corrected model	1901.64	3	42,825	<.001					
Energy	5045.93	1	42,825	<.001	−.08	−71.04	−.08	−.08	.105
BPM	208.51	1	42,825	<.001	−.01	−14.44	−.01	−.01	.005
Hit popularity	24.16	1	42,825	<.001	−4.18	−4.92	−5.85	−2.52	.001
Jazz (*N* = 27,245)									
Corrected model	2089.49	3	27,241	<.001					
Energy	5530.23	1	27,241	<.001	−.17	−74.37	−.18	−.17	.169
BPM	72.91	1	27,241	<.001	−.01	−8.54	−.02	−.01	.003
Hit popularity	140.45	1	27,241	<.001	−15.96	−11.85	−18.60	−13.32	.005
Latin (*N* = 1,986)									
Corrected model	77.42	3	1,982	<.001					
Energy	195.96	1	1,982	<.001	−.06	−14.00	−.07	−.05	.090
BPM	22.92	1	1,982	<.001	−.02	−4.79	−.03	−.01	.011
Hit popularity	4.70	1	1,982	.030	5.97	2.17	.57	11.36	.002
Pop (*N* = 53,412)									
Corrected model	876.64	3	53,408	<.001					
Energy	1244.09	1	53,408	<.001	−.02	−35.27	−.03	−.02	.023
BPM	1102.78	1	53,408	<.001	−.02	−33.21	−.03	−.02	.020
Hit popularity	.63	1	53,408	.428	−.36	−.79	−1.24	.53	.000
Rap/Hip Hop (*N* = 8,884)									
Corrected model	310.52	3	8,880	<.001					
Energy	904.85	1	8,880	<.001	−.04	−30.08	−.05	−.04	.092
BPM	2.21	1	8,880	.138	.00	1.49	.00	.01	.000
Hit popularity	8.14	1	8,880	.004	−1.10	−2.85	−1.85	−.34	.001
Reggae/Ska (*N* = 605)									
Corrected model	15.52	3	601	<.001					
Energy	39.68	1	601	<.001	−.07	−6.30	−.09	−.05	.062
BPM	6.21	1	601	.013	−.02	−2.49	−.03	.00	.010
Hit popularity	5.58	1	601	.018	−12.54	−2.36	−22.96	−2.11	.009
Rock (*N* = 38,885)									
Corrected model	836.18	3	38,881	<.001					
Energy	1922.46	1	38,881	<.001	−.02	−43.85	−.02	−.02	.047
BPM	412.37	1	38,881	<.001	−.01	−20.31	−.01	−.01	.010
Hit popularity	3.27	1	38,881	.071	1.00	1.81	−.09	2.09	.000
Soul/R&B (*N* = 337)									
Corrected model	22.37	3	333	<.001					
Energy	48.72	1	333	<.001	−.18	−6.98	−.23	−.13	.128
BPM	.77	1	333	.381	−.01	−.88	−.04	.01	.002
Hit popularity	17.92	1	333	<.001	−39.06	−4.23	−57.22	−20.91	.051
World (*N* = 5,744)									
Corrected model	142.36	3	5,740	<.001					
Energy	414.04	1	5,740	<.001	−.05	−20.35	−.05	−.05	.067
BPM	3.17	1	5,740	.075	−.01	−1.78	−.01	.00	.001
Hit popularity	4.73	1	5,740	.030	4.05	2.18	.40	7.71	.001
Mood 5: Energetic, bold, outgoing									
Overall corpus (*N* = 204,506)									
Corrected model	6439.88	3	204,502	<.001					
Energy	14466.20	1	204,502	<.001	.05	120.28	.05	.06	.066
BPM	2487.80	1	204,502	<.001	.03	49.88	.02	.03	.012
Hit popularity	193.70	1	204,502	<.001	4.54	13.92	3.90	5.18	.001
Alternative/Indie (*N* = 652)									
Corrected model	47.43	3	648	<.001					
Energy	139.86	1	648	<.001	.05	.00	.04	.06	.000
BPM	.30	1	648	.585	.00	.01	−.01	.01	.000
Hit popularity	1.67	1	648	.197	4.72	3.65	−2.45	11.89	.020
Christian/Gospel (*N* = 607)									
Corrected model	56.52	3	603	<.001					
Energy	149.90	1	603	<.001	.12	12.24	.10	.14	.199
BPM	5.18	1	603	.023	.02	2.28	.00	.03	.009
Hit popularity	3.80	1	603	.052	8.85	1.95	−.07	17.76	.006
Classical/Opera (*N* = 2,921)									
Corrected model	599.59	3	2,917	<.001					
Energy	1511.93	1	2,917	<.001	.25	38.88	.24	.26	.341
BPM	59.12	1	2,917	<.001	.02	7.69	.01	.02	.020
Hit popularity	12.30	1	2,917	<.001	9.15	3.51	4.03	14.26	.004

(*table continues*)

Table 3 (*continued*)

Variable	*F*	*df*	df_{error}	*p*	β	*t*	95% CI		η^2
Country (N = 14,707)									
Corrected model	1274.85	3	14,703	<.001					
Energy	3342.12	1	14,703	<.001	.12	57.81	.11	.12	.185
BPM	153.89	1	14,703	<.001	.02	12.41	.02	.02	.010
Hit popularity	5.43	1	14,703	.020	−4.32	−2.33	−7.96	−.69	.000
Electronica/Dance (N = 5,692)									
Corrected model	226.59	3	5,688	<.001					
Energy	625.69	1	5,688	<.001	.08	25.01	.08	.09	.099
BPM	14.96	1	5,688	<.001	.01	3.87	.01	.02	.003
Hit popularity	5.50	1	5,688	.019	−2.30	−2.35	−4.23	−.38	.001
Folk (N = 42,829)									
Corrected model	4493.22	3	42,825	<.001					
Energy	12459.04	1	42,825	<.001	.15	111.62	.15	.15	.225
BPM	166.01	1	42,825	<.001	.01	12.89	.01	.02	.004
Hit popularity	88.11	1	42,825	<.001	9.43	9.39	7.46	11.40	.002
Jazz (N = 27,245)									
Corrected model	5261.56	3	2,7241	<.001					
Energy	13381.86	1	2,7241	<.001	.23	115.68	.22	.23	.329
BPM	531.42	1	2,7241	<.001	.03	23.05	.03	.03	.019
Hit popularity	165.83	1	2,7241	<.001	14.63	12.88	12.40	16.85	.006
Latin (N = 1,986)									
Corrected model	45.49	3	1,982	<.001					
Energy	79.87	1	1,982	<.001	.06	8.94	.04	.07	.039
BPM	22.41	1	1,982	<.001	.03	4.73	.02	.04	.011
Hit popularity	30.67	1	1,982	<.001	21.08	5.54	13.62	28.55	.015
Pop (N = 53,412)									
Corrected model	1491.67	3	53,408	<.001					
Energy	3083.69	1	53,408	<.001	.05	55.53	.05	.05	.055
BPM	873.67	1	53,408	<.001	.03	29.56	.03	.03	.016
Hit popularity	51.76	1	53,408	<.001	4.16	7.19	3.02	5.29	.001
Rap/Hip Hop (N = 8,884)									
Corrected model	272.31	3	8,880	<.001					
Energy	771.85	1	8,880	<.001	.07	27.78	.06	.07	.080
BPM	9.76	1	8,880	.002	.01	3.12	.00	.01	.001
Hit popularity	15.96	1	8,880	<.001	−2.57	−4.00	−3.82	−1.31	.002
Reggae/Ska (N = 605)									
Corrected model	93.66	3	601	<.001					
Energy	270.65	1	601	<.001	.20	16.45	.18	.23	.311
BPM	30.12	1	601	<.001	.04	5.49	.03	.06	.048
Hit popularity	2.60	1	601	.107	9.87	1.61	−2.15	21.89	.004
Rock (N = 38,885)									
Corrected model	156.02	3	38,881	<.001					
Energy	43.63	1	38,881	<.001	.01	6.61	.00	.01	.001
BPM	350.49	1	38,881	<.001	.02	18.72	.02	.02	.009
Hit popularity	55.05	1	38,881	<.001	7.16	7.42	5.27	9.05	.001
Soul/R&B (N = 337)									
Corrected model	14.77	3	333	<.001					
Energy	29.48	1	333	<.001	.12	5.43	.08	.16	.081
BPM	6.65	1	333	.010	.03	2.58	.01	.05	.020
Hit popularity	1.86	1	333	.174	10.76	1.36	−4.76	26.27	.006
World (N = 5,744)									
Corrected model	490.94	3	5,740	<.001					
Energy	1297.16	1	5,740	<.001	.10	36.02	.09	.10	.184
BPM	23.04	1	5,740	<.001	.01	4.80	.01	.02	.004
Hit popularity	52.33	1	5,740	<.001	14.66	7.23	10.68	18.63	.009
			Mood 6: Calm, peace, tranquility						
Overall corpus (N = 204,506)									
Corrected model	29053.50	3	204,502	<.001					
Energy	77854.63	1	204,502	<.001	−.10	−279.02	−.11	−.10	.276
BPM	2849.54	1	204,502	<.001	−.02	−53.38	−.02	−.02	.014
Hit popularity	217.84	1	204,502	<.001	−3.96	−14.76	−4.49	−3.43	.001
Alternative/Indie (N = 652)									
Corrected model	575.37	3	648	<.001					
Energy	1599.03	1	648	<.001	−.14	−39.99	−.15	−.14	.712
BPM	7.82	1	648	.005	−.01	−2.80	−.02	.00	.012
Hit popularity	1.48	1	648	.225	3.90	1.22	−2.41	10.21	.002

Table 3 (*continued*)

Variable	*F*	*df*	df_{error}	*p*	β	*t*	95% CI		η^2
Christian/Gospel (N = 607)									
Corrected model	72.73	3	603	<.001					
Energy	191.69	1	603	<.001	−.10	−13.85	−.12	−.09	.241
BPM	9.30	1	603	.002	−.02	−3.05	−.03	−.01	.015
Hit popularity	3.67	1	603	.056	−6.93	−1.92	−14.03	.17	.006
Classical/Opera (N = 2,921)									
Corrected model	218.90	3	2,917	<.001					
Energy	439.58	1	2,917	<.001	−.18	−20.97	−.20	−.17	.131
BPM	87.01	1	2,917	<.001	−.03	−9.33	−.04	−.02	.029
Hit popularity	16.77	1	2,917	<.001	−14.43	−4.09	−21.34	−7.52	.006
Country (N = 14,707)									
Corrected model	1825.05	3	14,703	<.001					
Energy	4960.83	1	14,703	<.001	−.15	−70.43	−.15	−.14	.252
BPM	123.64	1	14,703	<.001	−.02	−11.12	−.02	−.02	.008
Hit popularity	.18	1	14,703	.674	−.79	−.42	−4.50	2.91	.000
Electronica/Dance (N = 5,692)									
Corrected model	532.20	3	5,688	<.001					
Energy	1473.30	1	5,688	<.001	−.06	−38.38	−.06	−.05	.206
BPM	5.62	1	5,688	.018	.00	−2.37	−.01	.00	.001
Hit popularity	13.08	1	5,688	<.001	−1.58	−3.62	−2.44	−.73	.002
Folk (N = 42,829)									
Corrected model	5577.88	3	42,825	<.001					
Energy	15262.55	1	42,825	<.001	−.14	−123.54	−.15	−.14	.263
BPM	311.31	1	42,825	<.001	−.02	−17.64	−.02	−.01	.007
Hit popularity	106.28	1	42,825	<.001	−8.93	−10.31	−10.63	−7.24	.002
Jazz (N = 27,245)									
Corrected model	2555.62	3	27,241	<.001					
Energy	5745.11	1	27,241	<.001	−.17	−75.80	−.18	−.17	.174
BPM	687.83	1	27,241	<.001	−.04	−26.23	−.04	−.04	.025
Hit popularity	135.19	1	27,241	<.001	−15.34	−11.63	−17.93	−12.75	.005
Latin (N = 1,986)									
Corrected model	204.29	3	1,982	<.001					
Energy	542.82	1	1,982	<.001	−.10	−23.30	−.10	−.09	.215
BPM	45.26	1	1,982	<.001	−.02	−6.73	−.03	−.02	.022
Hit popularity	6.77	1	1,982	.009	−6.53	−2.60	−11.46	−1.61	.003
Pop (N = 53,412)									
Corrected model	7310.38	3	53,408	<.001					
Energy	19722.73	1	53,408	<.001	−.10	−140.44	−.10	−.10	.270
BPM	917.17	1	53,408	<.001	−.02	−30.29	−.02	−.02	.017
Hit popularity	6.87	1	53,408	.009	−1.21	−2.62	−2.11	−.30	.000
Rap/Hip Hop (N = 8,884)									
Corrected model	593.70	3	8,880	<.001					
Energy	1704.46	1	8,880	<.001	−.07	−41.29	−.07	−.07	.161
BPM	.78	1	8,880	.378	.00	−.88	−.01	.00	.000
Hit popularity	15.97	1	8,880	<.001	−1.83	−4.00	−2.73	−.93	.002
Reggae/Ska (N = 605)									
Corrected model	47.04	3	601	<.001					
Energy	124.17	1	601	<.001	−.10	−11.14	−.12	−.08	.171
BPM	8.68	1	601	.003	−.02	−2.95	−.03	−.01	.014
Hit popularity	17.39	1	601	<.001	−19.14	−4.17	−28.16	−10.13	.028
Rock (N = 38,885)									
Corrected model	5490.51	3	38,881	<.001					
Energy	15334.99	1	38,881	<.001	−.07	−123.84	−.07	−.07	.283
BPM	534.63	1	38,881	<.001	−.02	−23.12	−.02	−.01	.014
Hit popularity	2.22	1	38,881	.136	−.97	−1.49	−2.23	.30	.000
Soul/R&B (N = 337)									
Corrected model	9.04	3	333	<.001					
Energy	8.23	1	333	.004	−.06	−2.87	−.10	−.02	.024
BPM	10.71	1	333	.001	−.03	−3.27	−.05	−.01	.031
Hit popularity	3.57	1	333	.060	−13.68	−1.89	−27.92	.57	.011
World (N = 5,744)									
Corrected model	871.60	3	5,740	<.001					
Energy	2460.42	1	5,740	<.001	−.15	−49.60	−.15	−.14	.300
BPM	27.03	1	5,740	<.001	−.02	−5.20	−.02	−.01	.005
Hit popularity	10.54	1	5,740	.001	−7.32	−3.25	−11.74	−2.90	.002

(*table continues*)

Table 3 (*continued*)

Variable	*F*	*df*	df_{error}	*p*	β	*t*	95% CI		η^2
				Mood 7: Sad					
Overall corpus (N = 204,506)									
Corrected model	52744.45	3	204,502	<.001					
Energy	145538.49	1	204,502	<.001	−.28	−381.50	−.28	−.28	.416
BPM	2903.89	1	204,502	<.001	−.04	−53.89	−.05	−.04	.014
Hit popularity	289.56	1	204,502	<.001	−8.92	−17.02	−9.94	−7.89	.001
Alternative/Indie (N = 652)									
Corrected model	894.21	3	648	<.001					
Energy	2528.44	1	648	<.001	−.33	−50.28	−.35	−.32	.796
BPM	7.68	1	648	.006	.02	−2.77	−.04	−.01	.012
Hit popularity	1.18	1	648	.277	−6.53	−1.09	−18.31	5.26	.002
Christian/Gospel (N = 607)									
Corrected model	115.29	3	603	<.001					
Energy	290.68	1	603	<.001	−.31	−17.05	−.35	−.28	.325
BPM	23.20	1	603	<.001	−.07	−4.82	−.10	−.04	.037
Hit popularity	8.05	1	603	.005	−25.06	−2.84	−42.40	−7.71	.013
Classical/Opera (N = 2,921)									
Corrected model	786.58	3	2,917	<.001					
Energy	2045.96	1	2,917	<.001	−.64	−45.23	−.67	−.61	.412
BPM	54.82	1	2,917	<.001	−.04	−7.40	−.05	−.03	.018
Hit popularity	4.36	1	2,917	.037	−11.94	−2.09	−23.15	−.73	.001
Country (N = 14,707)									
Corrected model	4477.13	3	14,703	<.001					
Energy	12394.03	1	14,703	<.001	−.40	−111.33	−.40	−.39	.457
BPM	196.04	1	14,703	<.001	−.04	−14.00	−.05	−.04	.013
Hit popularity	.03	1	14,703	.874	−.52	−.16	−6.89	5.86	.000
Electronica/Dance (N = 5,692)									
Corrected model	1166.80	3	5,688	<.001					
Energy	3337.42	1	5,688	<.001	−.24	−57.77	−.25	−.23	.370
BPM	1.20	1	5,688	.273	−.01	−1.10	−.01	.00	.000
Hit popularity	6.28	1	5,688	.012	−3.06	−2.51	−5.45	−.67	.001
Folk (N = 42,829)									
Corrected model	10593.47	3	42,825	<.001					
Energy	29873.19	1	42,825	<.001	−.39	−172.84	−.04	−.39	.411
BPM	262.42	1	42,825	<.001	−.03	−16.20	−.03	−.02	.006
Hit popularity	80.46	1	42,825	<.001	−15.14	−8.97	−18.45	−11.83	.002
Jazz (N = 27,245)									
Corrected model	7562.39	3	27,241	<.001					
Energy	19584.29	1	27,241	<.001	−.53	−139.94	−.54	−.52	.418
BPM	621.91	1	27,241	<.001	−.06	−24.94	−.06	−.06	.022
Hit popularity	172.70	1	27,241	<.001	−28.50	−13.14	−32.75	−24.25	.006
Latin (N = 1,986)									
Corrected model	181.81	3	1,982	<.001					
Energy	442.79	1	1,982	<.001	−.17	−21.04	−.19	−.16	.183
BPM	21.88	1	1,982	<.001	−.03	.01	−.05	−.02	.000
Hit popularity	70.95	1	1,982	<.001	−42.18	−8.42	−52.00	−32.36	.035
Pop (N = 53,412)									
Corrected model	15302.06	3	53,408	<.001					
Energy	42186.19	1	53,408	<.001	−.27	−205.39	−.28	−.27	.441
BPM	1274.88	1	53,408	<.001	−.05	−35.71	−.05	−.05	.023
Hit popularity	28.39	1	53,408	<.001	−4.71	−5.33	−6.44	−2.98	.001
Rap/Hip Hop (N = 8,884)									
Corrected model	1238.77	3	8,880	<.001					
Energy	3517.65	1	8,880	<.001	−.20	−59.31	−.21	−.20	.284
BPM	40.61	1	8,880	<.001	−.02	−6.37	−.03	−.02	.005
Hit popularity	.68	1	8,880	.409	−.76	−.83	−2.56	1.04	.000
Reggae/Ska (N = 605)									
Corrected model	73.86	3	601	<.001					
Energy	212.55	1	601	<.001	−.24	−14.58	−.27	−.21	.261
BPM	.35	1	601	.556	−.01	−.59	−.03	.01	.001
Hit popularity	6.05	1	601	.014	−20.21	−2.46	−36.36	−4.07	.010
Rock (N = 38,885)									
Corrected model	10930.92	3	38,881	<.001					
Energy	31380.73	1	38,881	<.001	−.22	−177.15	−.22	−.22	.447

Table 3 (*continued*)

Variable	*F*	*df*	df_{error}	*p*	β	*t*	95% CI		η^2
BPM	505.07	1	38,881	<.001	−.03	−22.47	−.04	−.03	.013
Hit popularity	1.23	1	38,881	.268	−1.58	−1.11	−4.37	1.22	.000
Soul/R&B (N = 337)									
Corrected model	30.03	3	333	<.001					
Energy	82.79	1	333	<.001	−.29	−9.10	−.35	−.22	.199
BPM	.27	1	333	.605	−.01	−.52	−.04	.02	.001
Hit popularity	.22	1	333	.639	5.23	.47	−16.66	27.11	.001
World (N = 5,744)									
Corrected model	1968.91	3	5,740	<.001					
Energy	5647.30	1	5,740	<.001	−.35	−75.15	−.36	−.34	.496
BPM	25.76	1	5,740	<.001	−.03	−5.08	−.04	−.02	.004
Hit popularity	14.91	1	5,740	<.001	−13.61	−3.86	−20.53	−6.70	.003

Note. BPM = beats per minute.

point of the arousing–sleepy dimension of the circumplex so that this result is not particularly surprising.

The results concerning BPM were typically similar to those concerning energy, but were less consistently in the predicted direction within each specific genre, and typically gave rise to weaker associations with each of the moods than did energy. Across the corpus there was a negative association between BPM and scores on Mood 4 (mystery, luxury, comfort), Mood 6 (calm, peace, tranquillity), and Mood 7 (sad); and positive associations between BPM and scores on Mood 3 (passion, romance, power) and Mood 5 (energetic, bold, outgoing). Given that BPM captures only one specific aspect of the arousing qualities of music, it is pleasing that the results are on the whole consistent with expectations.

According to H4, hit popularity scores would be associated with mood scores. Table 3 indicates that, across the corpus, the relationships were weak but hit popularity scores were associated positively with scores for Mood 5 (energetic, bold, outgoing), and were associated negatively with scores for Mood 1 (clean, simple, relaxing), Mood 3 (passion, romance, power), Mood 4 (mystery, luxury, comfort), and Mood 6 (calm, peace, tranquillity) and also Mood 7 (sad song score)*;* and were not associated at all with scores on Mood 2 (happy, hopeful, ambition). Rather than dwell on the possible implications of this for circumplex approaches to mood (which are detailed in North et al., 2017b), we would instead highlight that these data provide extremely interesting insight into the moods embodied by the most popular music in the largest market for such globally. Specifically, for the sake of being explicit, Table 3 indicates that commercial success (i.e., higher popularity scores) is associated with music that scores higher on Mood 5 (energetic, bold, outgoing), and lower on Mood 1 (clean, simple, relaxing), Mood 3 (passion, romance, power), Mood 4 (mystery, luxury, comfort), Mood 6 (calm, peace, tranquillity), and Mood 7 (sad). The strongest association with hit popularity was for music with (lower levels of) Mood 3 (passion, romance, power).

Greater insight into this issue is provided by data in the lower portions of Table 3 concerning the relationship between hit popularity and mood scores within genres. These show that, although the relationships are weak, within genres there are differing relationships between popularity and mood, such that each genre has a 'mood profile' indicative of greater popularity that in many cases differs from that identified for other genres. Specifically, Mood 1 (clean, simple, relaxing) was associated positively with hit popularity for alternative/indie and electronic/dance; was associated negatively with hit popularity for Christian/Gospel, folk, jazz, and Latin; and was not associated at all with hit popularity for classical/opera, country, pop, rap/hip hop, reggae/ska, rock, soul/R&B, and world music. Mood 2 (happy, hopeful, ambition) was associated positively with hit popularity for country, jazz, Latin, and rock; was associated negatively with hit popularity for electronic/dance, pop, rap/hip hop, and world music; and was not associated at all with hit popularity for alternative/indie, Christian/Gospel, classical/opera, folk, and reggae/ska. Mood 3 (passion, romance, power) was associated positively with hit popularity for classical/opera, folk, jazz, and reggae/ska; was associated negatively with hit popularity for alternative/indie, country, pop, and rock; and was not associated at all with hit popularity for Christian/Gospel, electronica/dance, Latin, rap/hip hop, soul/R&B, and world music. Mood 4 (mystery, luxury, comfort) was associated positively with hit popularity for none of the styles; was associated negatively with hit popularity for classical/opera, electronica/dance, folk, jazz, and soul/R&B; and was not associated at all with hit popularity for alternative/indie, Christian/Gospel, country, Latin, pop, rap/hip hop, reggae/ska, rock, and world music. Mood 5 (energetic, bold, outgoing) was associated positively with hit popularity for classical/opera, folk, jazz, Latin, pop, rock, and world music; was associated negatively with hit popularity for rap/hip hop; and was not associated at all with hit popularity for alternative/indie, Christian/Gospel, country, electronica/dance, reggae/ska, and soul/R&B. Mood 6 (calm, peace, tranquillity) was associated positively with hit popularity for none of the styles; was associated negatively with hit popularity for classical/opera, electronica/dance, folk, jazz. rap/hip hop, reggae/ska, and world music; and was not associated at all with hit popularity for alternative/indie, Christian/Gospel, country, Latin, pop, rock, and soul/R&B. Mood 7 (sad) was associated positively with hit popularity for none of the styles; was associated negatively with hit popularity for folk, jazz, Latin, pop, and world music; and was not associated at all with hit popularity for alternative/indie, Christian/Gospel, classical/opera, country, electronica/dance, pop, rap/hip hop, reggae/ska, and rock. It is particularly interesting that for none of the genres was hit popularity associated positively with Mood 4 (mystery, luxury, comfort), Mood 6 (calm, peace, tranquillity), or Mood 7 (sad), indicating that composers hoping for commercial success in the United States should eschew particularly these characteristics, irrespective of the genre in which they are working.

Mood by Genre

Seven further GLMM analyses (one per mood respectively, $\alpha < .001$, to allow for the multiple analyses) were carried out to investigate H5, namely that there should be differences between genres in mood scores. Table 4 indicates that each analysis was significant, albeit with low effect sizes, such that mood scores differed between genres, and the deviation contrasts show the mood scores for each genre relative to the overall corpus mean score for each mood.

Table 4 illustrates the numerous differences between the mood scores associated with particular genres. We will refrain from commenting in detail on these, although the data in Table 4, and the size of the dataset on which these data are based, provide clear evidence concerning the normative mood-based profile of each genre. This in turn provides specific guidance for those wishing to elicit certain moods during their everyday music listening (e.g., Krause & North, 2014; Krause et al., 2015), during music therapy (e.g., Standley, 1995), or in specific commercial contexts (e.g., North & Hargreaves, 2008). These findings also speak to the literature in public health, criminology, and media studies that has attempted to identify associations between liking for both rock and rap and elevated incidence of mental health problems, aggression, and criminality (North & Hargreaves, 2008). Specifically, the data in Table 4 indicates that rock and rap/hip hop produced means lower than the corpus on Mood 1 (clean, simple, relaxing), Mood 2 (happy, hopeful, ambition), and Mood 6 (calm, peace, tranquility), although there were several instances of other genres with comparable scores on these moods.

General Discussion

It is difficult to compare the present data from the United States with those reported earlier concerning the United Kingdom (North et al., 2017a,b) without risking some degree of overgeneralization, although a few points can be made with relative safety. At the corpus level, whereas the U.K. data provided some evidence that the relationship between energy and popularity may be U-shaped, the U.S. data provide a much more equivocal conclusion with regard to the direction of the relationship between the two variables. Similarly, whereas the U.K. data provided some support for the notion that popularity scores there were associated positively with typicality, the U.S. data provide more support for the notion that popularity in that country may be associated more clearly with a degree of distinctiveness from competing music. With regard to mood, both the U.K. and U.S. data were consistent with the notion that energy scores map meaningfully on to moods, such that in both countries more "aroused" moods were found within tracks that had higher energy scores, and calmer moods were found within tracks that had lower energy scores. However, there were also numerous associations between popularity and mood in both countries, indicative of national proclivities toward music with certain emotional traits that to some extent may quantify the musical cultures of the two respective countries. Moreover, both countries gave rise to notable differences between genres in the moods that the latter evoked most commonly.

This leads to one final point of comparison between the U.S. and U.K. data. There were numerous instances within both countries where findings at the corpus level were not replicated at the level of specific genres. Energy and typicality appear to be relevant variables in the moods evoked by music and the popularity of that music, consistent with previous theories developed in neutral laboratory settings. However, the differences between the United Kingdom and the United States in the nature of these relationships and between the nature of these relationships within individual genres, indicates that culture plays an important role in modifying theories of music aesthetics developed in neutral laboratory settings. We note also that an approach based upon typicality is better able to cope with these cultural factors than an approach based upon Berlyne's theory. Arguments based upon typicality by definition refer to the broader culture in which a given musical piece exists, whereas the biological basis of arguments involving arousal inevitably implies that there should be a degree of universality to responses that is not supported by the present findings.

There are also at least three notable limitations of the present research. First, the number of statistically significant results reported here is itself pleasing, given that the energy and difference scores capture only a fraction of the broader concepts (namely arousal and typicality, respectively) that they purport to embody. However, the strength of associations was nonetheless typically very weak, with one variable regularly explaining less than 1% of the variance in another. This is arguably unsurprising, since in addition to the inherent limitations of energy and difference scores as operationalizations of arousal and typicality, the popularity data are subject to a number of considerable commercial distortions that are not present in the controlled lab settings in which the theories in question were developed. Moreover, there are undoubtedly a very large number of other variables that also mediate popularity and mood in relation to music, and so it is interesting that it was possible to detect relationships involving popularity, mood, energy, and typicality.

Second, the present findings are limited to the United States and may not apply in other music markets. Although the same criticism might be applied to a large portion of the published research in psychology, it is particularly pertinent here for two reasons. Most obviously, music is a cultural product, so that attempts to extrapolate findings across cultures are particularly risky. Moreover, the size of the market means that the United States is anything but a "typical" musical culture.

Third, by focusing on population-level data, the present findings ignore individual differences. These of course are particularly relevant to responses to music, which are notoriously idiosyncratic. For instance, the present findings concerning popularity and energy or between-genre differences in mood scores do not necessarily reflect the reaction of any given "bellwether" individual, and the wide variety of moods represented by the pieces within a genre means that responses to a given piece of music do not necessarily map well onto genre-level data.

These issues notwithstanding, the present data indicate that, among a data set of 204,506 pieces of music, representing the entirety of the United States' commercial musical culture, it is possible to explain variations in nationwide commercial popularity in terms of arousal- and typicality-based approaches that draw on fundamental principles of human motivation, and to explain the moods portrayed by genres in terms of their energy scores. In some cases, there were associations

Table 4
Means, Standard Errors, 95% Confidence Intervals, and Deviation Contrast Details for the GLMM Analysis Concerning Genre Predicting Moods

Genre	*M*	*SE*	95% CI		*t*	*p*	95% CI		η^2
				Mood 1: Clean, simple, relaxing[a]					
Alternative/Indie	3.31	.18	2.97	3.66	−2.38	.017	−.72	−.07	.000
Christian/Gospel	4.38	.18	4.02	4.74	3.94	<.001	.34	1.01	.000
Classical/Opera	12.12	.08	11.96	12.29	101.65	<.001	8.26	8.58	.048
Country	3.53	.04	3.46	3.60	−3.84	<.001	−.27	−.09	.000
Electronica/Dance	2.89	.06	2.77	3.00	−12.98	<.001	−.94	−.70	.001
Folk	2.52	.02	2.48	2.56	−32.21	<.001	−1.26	−1.11	.005
Jazz	4.78	.03	4.73	4.84	27.08	<.001	1.00	1.16	.004
Latin	1.85	.10	1.65	2.05	−18.88	<.001	−2.05	−1.66	.002
Pop	3.50	.02	3.46	3.54	−5.69	<.001	−.27	−.13	.000
Rap/Hip Hop	3.00	.05	2.90	3.09	−13.20	<.001	−.82	−.61	.001
Reggae/Ska	.84	.18	.48	1.19	−16.72	<.001	−3.21	−2.53	.001
Rock	3.07	.02	3.03	3.11	−17.00	<.001	−.71	−.56	.001
Soul/R&B	.87	.24	.39	1.35	−12.41	<.001	−3.28	−2.39	.001
World	5.21	.06	5.10	5.33	23.99	<.001	1.39	1.63	.003
				Mood 2: Happy, hopeful, ambition[b]					
Alternative/Indie	7.19	.28	6.65	7.74	−38.90	<.001	−10.75	−9.71	.007
Christian/Gospel	15.67	.29	15.10	16.23	−6.49	<.001	−2.29	−1.22	.000
Classical/Opera	12.81	.13	12.55	13.07	−35.03	<.001	−4.87	−4.35	.006
Country	18.15	.06	18.03	18.26	9.92	<.001	.58	.87	.000
Electronica/Dance	13.57	.09	13.39	13.76	−38.39	<.001	−4.05	−3.65	.007
Folk	20.37	.03	20.27	20.40	49.84	<.001	2.80	3.03	.012
Jazz	17.11	.04	17.02	17.19	−4.98	<.001	−.44	−.19	.000
Latin	21.97	.16	21.66	22.29	29.19	<.001	4.25	4.86	.004
Pop	16.84	.03	16.78	16.91	−10.17	<.001	−.69	−.47	.001
Rap/Hip Hop	16.77	.08	16.62	16.91	−7.67	<.001	−.82	−.49	.000
Reggae/Ska	24.88	.29	24.31	25.45	27.36	<.001	6.93	7.99	.004
Rock	14.14	.04	14.07	14.21	−55.34	<.001	−3.40	−3.17	.015
Soul/R&B	26.46	.39	25.70	27.23	24.93	<.001	8.33	9.75	.003
World	18.00	.09	17.82	18.18	5.79	<.001	.38	.77	.000
				Mood 3: Passion, romance, power[c]					
Alternative/Indie	32.88	.47	31.95	33.80	43.95	<.001	18.58	20.31	.009
Christian/Gospel	7.93	.49	6.98	8.88	−12.02	<.001	−6.40	−4.61	.001
Classical/Opera	16.29	.22	15.85	16.72	12.90	<.001	2.42	3.29	.001
Country	13.00	.10	12.81	13.17	−3.50	<.001	−.67	−.19	.000
Electronica/Dance	8.13	.16	7.82	8.44	−31.46	<.001	−5.64	−4.97	.005
Folk	15.47	.06	15.36	15.58	20.73	<.001	1.85	2.23	.002
Jazz	8.20	.07	8.05	8.34	−49.21	<.001	−5.45	−5.03	.012
Latin	12.01	.27	11.48	12.53	−5.43	<.001	−1.94	−.91	.000
Pop	17.79	.05	17.69	17.89	45.68	<.001	4.17	4.55	.010
Rap/Hip Hop	4.75	.13	4.50	5.00	−60.42	<.001	−8.97	−8.40	.018
Reggae/Ska	7.97	.49	7.01	8.92	−11.92	<.001	−6.37	−4.57	.001
Rock	24.90	.06	24.78	25.02	114.85	<.001	11.27	11.66	.061
Soul/R&B	8.95	.65	7.67	10.23	−7.35	<.001	−5.68	−3.29	.000
World	9.80	.16	9.49	10.11	−21.59	<.001	−3.96	−3.30	.002
				Mood 4: Mystery, luxury, comfort[d]					
Alternative/Indie	12.18	.31	11.58	12.78	−4.43	<.001	−1.85	−.71	.000
Christian/Gospel	13.60	.32	12.98	14.23	.48	.635	−.45	.73	.000
Classical/Opera	12.33	.15	12.04	12.61	−7.81	<.001	−1.41	−.85	.000
Country	13.03	.07	12.90	13.15	−5.36	<.001	−.59	−.27	.000
Electronica/Dance	11.68	.10	11.48	11.88	−16.13	<.001	−2.00	−1.56	.001
Folk	11.98	.04	11.90	12.05	−23.01	<.001	−1.61	−1.36	.003
Jazz	21.50	.05	21.41	21.60	115.54	<.001	7.91	8.18	.061
Latin	12.60	.18	12.25	12.94	−5.01	<.001	−1.20	−.52	.000
Pop	11.11	.03	11.05	11.18	−37.58	<.001	−2.47	−2.22	.007
Rap/Hip Hop	14.62	.08	14.45	14.78	12.31	<.001	.97	1.34	.001

(*table continues*)

Table 4 (*continued*)

Genre	*M*	*SE*	95% CI		*t*	*p*	95% CI		η^2
Reggae/Ska	13.93	.32	13.30	14.55	1.56	.118	−.12	1.06	.000
Rock	8.87	.04	8.79	8.95	−70.29	<.001	−4.72	−4.46	.024
Soul/R&B	15.35	.43	14.51	16.18	4.73	<.001	1.11	2.67	.000
World	15.66	.10	15.46	15.86	20.04	<.001	1.99	2.42	.002
Mood 5: Energetic, bold, outgoing[e]									
Alternative/Indie	14.15	.39	13.39	14.90	−17.75	<.001	−7.15	−5.73	.002
Christian/Gospel	18.33	.40	17.55	19.11	−6.01	<.001	−2.99	−1.52	.000
Classical/Opera	10.56	.18	10.21	10.92	−55.23	<.001	−10.38	−9.67	.015
Country	20.23	.08	20.07	20.39	−3.51	<.001	−.55	−.16	.000
Electronica/Dance	23.94	.13	23.68	24.20	24.26	<.001	3.08	3.63	.003
Folk	22.93	.07	22.84	23.02	29.08	<.001	2.19	2.50	.004
Jazz	16.51	.06	16.39	16.62	−46.73	<.001	−4.25	−3.91	.011
Latin	27.20	.22	26.77	27.63	30.75	<.001	6.19	7.04	.005
Pop	19.90	.04	19.82	19.99	−8.71	<.001	−.84	−.53	.000
Rap/Hip Hop	21.24	.10	2.04	21.45	5.57	<.001	.43	.89	.000
Reggae/Ska	31.20	.40	30.42	31.99	28.23	<.001	9.88	11.35	.004
Rock	20.03	.05	19.93	20.13	−6.78	<.001	−.72	−.39	.000
Soul/R&B	24.62	.54	23.57	2.67	8.06	<.001	3.05	5.01	.000
World	17.35	.13	17.09	17.60	−23.48	<.001	−3.51	−2.97	.003
Mood 6: Calm, peace, tranquility[f]									
Alternative/Indie	8.67	.35	7.98	9.36	−7.60	<.001	−3.16	−1.87	.000
Christian/Gospel	12.54	.36	11.83	13.26	3.97	<.001	.69	2.03	.000
Classical/Opera	16.01	.17	15.68	16.33	29.17	<.001	4.50	5.15	.004
Country	14.54	.07	14.40	14.69	36.44	<.001	3.18	3.54	.006
Electronica/Dance	5.28	.12	5.05	5.52	−46.79	<.001	−6.15	−5.65	.011
Folk	11.06	.04	10.97	11.14	−1.72	.085	−.27	.02	.000
Jazz	17.62	.05	17.51	17.72	80.82	<.001	6.28	6.59	.031
Latin	8.92	.20	8.53	9.32	−11.53	<.001	−2.65	−1.88	.001
Pop	10.63	.04	10.55	10.70	−7.82	<.001	−.70	−.42	.000
Rap/Hip Hop	7.49	.10	7.30	7.67	−34.38	<.001	−3.91	−3.49	.006
Reggae/Ska	9.22	.36	8.51	9.94	−5.71	<.001	−2.63	−1.29	.000
Rock	8.52	.05	8.44	8.61	−35.61	<.001	−2.81	−2.51	.006
Soul/R&B	9.29	.49	8.33	10.24	−4.16	<.001	−2.79	−1.00	.000
World	16.78	.12	16.55	17.01	44.53	<.001	5.35	5.84	.010
Mood 7: Sad[g]									
Alternative/Indie	35.41	.76	33.91	36.90	−8.01	<.001	−7.16	−4.35	.000
Christian/Gospel	53.33	.79	51.78	54.96	16.37	<.001	10.71	13.62	.001
Classical/Opera	65.25	.36	64.54	65.96	67.07	<.001	23.38	24.79	.022
Country	50.11	.16	49.80	50.42	44.75	<.001	8.56	9.34	.010
Electronica/Dance	26.54	.26	26.04	27.05	−53.41	<.001	−15.16	−14.08	.014
Folk	41.35	.09	41.17	41.54	1.20	.232	−.12	.50	.000
Jazz	53.61	.12	53.38	53.84	72.06	<.001	12.11	12.79	.025
Latin	30.50	.44	29.65	31.36	−25.04	<.001	−11.50	−9.83	.003
Pop	42.83	.08	42.67	43.00	10.80	<.001	1.37	1.98	.001
Rap/Hip Hop	29.97	.21	29.57	30.38	−47.95	<.001	−11.65	−10.73	.011
Reggae/Ska	23.39	.79	21.84	24.94	−23.88	<.001	−19.23	−16.32	.003
Rock	37.38	.10	37.19	37.57	−23.32	<.001	−4.10	−3.46	.003
Soul/R&B	34.63	1.06	32.55	36.70	−6.60	<.001	−8.48	−4.59	.000
World	51.96	.26	51.46	52.46	39.59	<.001	10.27	11.33	.008

[a] $F(13, 204{,}492) = 1316.03$, $p < .001$, $\eta_p^2 = .077$. [b] $F(13, 204{,}492) = 1694.14$, $p < .001$, $\eta_p^2 = .097$. [c] $F(13, 204{,}492) = 3781.73$, $p < .001$, $\eta_p^2 = .194$. [d] $F(13, 204{,}492) = 3670.11$, $p < .001$, $\eta_p^2 = .189$. [e] $F(13, 204{,}492) = 1040.65$, $p < .001$, $\eta_p^2 = .062$. [f] $F(13, 204{,}492) = 2062.87$, $p < .001$, $\eta_p^2 = .116$. [g] $F(13, 204{,}492) = 2189.42$, $p < .001$, $\eta_p^2 = .122$.

between the variables that corresponded with the direct predictions of earlier lab-based research. However, there were several instances in which the relationships between the variables were discrepant from the predictions of these theories, varied between genres, and were subject to weak effect sizes. As such, the findings provide broad support for earlier research carried out in neutral laboratory settings, but also highlight the importance of subsequently testing these theories in real musical cultures.

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