Abstract

The present research conducted a computerised analysis of the content of all lyrics from the United Kingdom's weekly top 5 singles sales charts (Study 1, 1962-2011), and considered their macroeconomic correlates (Study 2, 1960-2011). Study 1 showed that coverage of interpersonal relationships consistently reflected a self-centred and unsophisticated approach; coverage of violence featured predominantly anti-authoritarian denial rather than overt depictions; and more recent lyrics were more stimulating. Study 2 showed no evidence that variations in lyrical optimism predicted future variations in economic optimism and subsequently GDP; but, consistent with the environmental security hypothesis, economic turbulence (defined as volatility in the closing price of the London Stock Exchange) was associated with the later popularity of lyrics concerning certainty and succour. These findings are discussed in terms of the advantages and limitations of computerised coding of lyrics.

Running head: Pop music lyrics

Key words: music, lyrics, relationships, violence, optimism, certainty, economy

United Kingdom 'Top 5' Pop Music Lyrics

Each decade since the 1950s has witnessed strong public interest in, and often consternation with, the lyrical messages of the pop musicians concerned (see Christenson & Roberts, 1998; North & Hargreaves, 2008; Nuzum, 2001), and how these lyrics relate to broader factors in play in culture contemporaneously. Despite this cultural prevalence, there have been very few attempts to provide quantitative analyses of the vocabulary employed by lyricists from a psychological perspective, or to consider whether and how these lyrics reflect broader cultural factors. The present research redresses this imbalance by providing computerised quantitative content analysis of the lyrics of every song to have featured in the United Kingdom's top 5 weekly singles chart (Study 1), and considers whether these lyrics reflect macroeconomic data (Study 2). As such, Study 1 addresses the lyrics themselves, whereas Study 2 addresses how they relate to one particular aspect of contemporary culture, namely the success of the economy.

Study 1 involved a content analysis of the lyrics themselves in terms of notable psychological concepts, namely interpersonal relationships and violence; whether the lyrics are consistent with Martindale's (1990) theory that art forms should evolve so as to prevent audience habituation; and whether the lyrics of the 1960s, or any of the other decades concerned, represent a qualitatively-different stylistic period.

Interpersonal relationships and violence. Several studies highlight the predominance of interpersonal relationships in pop music lyrics and videos from the 1960s onwards (Christenson and Roberts, 1998; Cole, 1971; Dukes, Bisel, Borega, Lobato, and Owens, 2003); and related research has highlighted a clear sexist or misogynistic component to this (e.g., Gow, 1996; Hyden & McCandless, 1983; Ross & Coleman, 2011; Sommers-Flanagan, Sommers-Flanagan, & Davis, 1993; Vincent, 1989; Wilkinson, 1976). Moreover, numerous studies from

the 1980s onwards have shown that exposure to sexualised media is associated with young people holding detrimental attitudes towards sex (e.g., Ross & Coleman, 2011; ter Bogt, Engels, Bogers, & Kloosterman 2010; van Oosten, Peter, & Valkenburg, 2015; Ward, 2003). Similarly, Smith and Boyson's (2002) sample of 1962 videos showed violence in 15%, that 56% of the violence resulted in no injury, and that 88% of the violence was presented authentically (see also Baxter et al., 1985; DuRant et al., 1997; Kalis & Neuendorf, 1989; Plopper & Ness, 1993; and Sherman & Dominick, 1986); and several other studies indicate that exposure to violent music is associated with increased engagement in violent or delinquent behaviour (see review by North & Hargreaves, 2008).

However, these findings are based on small samples of lyrics and videos, and focus on incidence rather than detailed depiction via a more sophisticated range of variables. Hypothesis 1a therefore was that lyrics should demonstrate high incidence of vocabulary concerning interpersonal relationships and love (i.e., high levels of praise, self-reference, levelling, human interest, satisfaction, and rapport; and low levels of exclusion); and Hypothesis 1b was that there may be differences between years on the scores concerning these variables. Hypothesis 2a was that lyrics should demonstrate high incidence of vocabulary concerning violence (i.e., high levels of blame, aggression, and denial; and low levels of passivity); and Hypothesis 2b was that there may be differences between years on the scores concerning these variables.

Stimulation and time. Other research has considered whether changes over time in artworks can be predicted on the basis of fundamental motivational principles. Martindale's (1990) arguments concerning this are most notable, arguing that the nature of an artist's outputs is influenced by the audience's ongoing desire to avoid habituation but also excessive stimulation. As such, lyricists are incentivised to employ vocabulary that would produce gradual but continual increases in stimulation in the audience. We might also or instead

expect to see sudden peaks and troughs between years in this content: Martindale argues that artworks can only become so stimulating before they cannot be comprehended, and in these cases artists instead employ associative and irrational thought processes (so-called 'primordial processing') to produce new ideas which are themselves stimulating.

Martindale (1990) supported this via human ratings of specifically music from 1490 to 1909; and Simonton (1980) showed that, over the span of their respective careers, 1479 classical music composers generally employed increasing levels of melodic originality in specifically their music. Hypothesis 3 therefore addressed whether this could be extrapolated to lyrics, and proposed that more recent years should give rise to higher scores than should more distant years on factors that would stimulate the audience (i.e., the number of words, the number of different words, complexity, aggression, motion, collectives, ambivalence, cognitive terms and variety; and low levels of passivity, familiarity, and concreteness); and there may be individual years with scores representing particular peaks or troughs relative to the corpus.

Decades. Finally, the pop music of the 1960s, in particular, has been the subject of extensive commentary in terms of the extent to which it was supposedly ground-breaking and representative of a cultural revolution concerning humanism and a variety of other ideals (e.g., Miller, 1999); and similar arguments have been made in terms of the supposed 'return to realism' of the 1970s, materialism in the 1980s, and 'lad culture' in the 1990s. Quantitative evidence is at best limited, however, and we are not aware of previous research that has attempted to apply this reasoning to lyrics (rather than music per se). Hypothesis 4, therefore, was that there may be distinguishable decades in pop music lyrics within which are common lyrical themes that differ from those prevalent in other decades, and the 1960s may represent one such period.

Study 1 therefore provides a detailed overview of the content of the lyrics in the light of previous findings concerning the content if pop music over the past several decades. Study 2 then goes on to consider how these aspects of the lyrics relate to one particular aspect of the broader culture in which they were produced by considering their macroeconomic correlates. There is a dearth of music research at what Doise (1986) characterised as the ideological level of social influence, which considers relationships between music and society in terms of entire cultures and populations. Quantitative evidence is very scant indeed, limited predominantly to Simonton's (e.g., 1998a; 1998b) very well-known work on classical music composition and eminence. This second part of the manuscript concerns a possible population-level relationship between popular music lyrics and the prevailing economic zeitgeist, by considering whether changes in lyrics can predict subsequent changes in the economy and/or vice versa.

Zullow (1991) found evidence for the former of these two possibilities. He asked human raters to consider the prevalence of pessimistic rumination and a stable, global, and internal explanatory style in the lyrics of the Billboard annual top 40 songs in the USA for 1955-1989, and also weekly covers of Time magazine over the same period, and subsequent analyses showed that changes in these cultural products predicted future changes in consumer optimism, and subsequently future personal spending and Gross National Product with a one- to two-year time lead. Pettijohn and Sacco (2009) found evidence for the reverse relationship, namely that macroeconomic factors predict the future popularity of certain lyrical themes. Their environmental security hypothesis states that perceived threats in the environment drive social preferences, so that in the aftermath of perceived threat, people consider their security and prefer items and themes that are mature and meaningful. These assertions are supported by previous research showing that uncertain macroeconomic conditions are associated with subsequent preference for mature facial features (Pettijohn &

Jungeberg, 2004; Pettijohn & Tesser, 1999, 2005). Pettijohn and Sacco (2009) considered the Billboard number 1 songs for each year from 1955 to 2003 in terms of both the music and lyrics, showing that, at times of socioeconomic threat, the songs were longer; and were considered by human raters to be comforting; slower; addressing complex, serious, and socially-significant issues; and placing more emphasis on close relationships and love. These arguments lead us to expect that harsh socioeconomic conditions should also be associated with the future success of lyrics that are longer; which address complex, serious, and socially-significant issues; which place more emphasis on close relationships and love; and which are more comforting: more generally, we would expect similar relationships involving other aspects of the lyrics indicative of maturity, meaningfulness, and other manifestations of reassurance and comfort.

The arguments of Zullow and Pettijohn and Sacco are not mutually-exclusive, and can be tested within a single research design, using a much larger quantity of songs. Study 2, therefore, employed the same lyrics as Study 1, and considered two hypotheses concerning their relationship with economic variables. Following Zullow, hypothesis 5 was that we would expect that levels of optimism and certainty in lyrics should predict future economic optimism and that that in turn should predict future economic output. Following Pettijohn and Sacco, hypothesis 6 was that we would expect economic turbulence (operationalised as higher volatility in the closing price of the London Stock Exchange) to predict the future popularity of lyrics expressing maturity, comfort, and certainty, operationalised as lyrics which (a) contain more words; (b) address complex issues; (c) emphasise close relationships; (d) emphasise love and happiness via the concepts of praise, togetherness, and satisfaction; (e) are meaningful through the expression of concrete terms and numerical concepts, and the avoidance of ambivalence; and (f) express certainty overtly. Given the emphasis of Zullow (1991) on optimism, we also considered (g) whether volatility on the London Stock Exchange

could predict subsequent reductions in optimism within the lyrics. We might also expect (h) that changes in economic optimism relate to future changes in lyrics in a manner consistent with hypotheses 6a-g. An alternate possibility concerning hypothesis 6, corresponding to a weaker form of Pettijohn and Sacco's arguments, is that stock market volatility would relate to the subsequent popularity of lyrics expressing less maturity, comfort, and certainty: this weaker hypothesis still allows for lyrics reflecting earlier economic turbulence, but instead the difference in direction compared to the main hypothesis conceptualises the role of the lyrics as merely mirroring rather than ameliorating this turbulence.

Study 1

Method

Lyrics. The top five songs from sales charts in the United Kingdom were identified for each week from January 1962 through to the end of December 2011, providing 50 complete years worth of data. This gave rise to a total of 4351 observations representing 4121 unique songs. The chart information employed was that used in broadcasts by the British Broadcasting Corporation, thus representing the most widely-recognised chart in the country, and was derived from Gambaccini, Rice, and Rice (1996) for the period January 1962 to December 1995 and www.officialcharts.com for the period thereafter. One particularly notable feature of this chart is that, unlike corresponding charts in several other countries, it was based entirely on sales of physical music media throughout the period in question (although it now includes digital downloads and streaming), and did not include radio airplay or any other measure of popularity. Moreover, for the entirety of the period in question, the United Kingdom's radio broadcasting was dominated by the provision of a small number of stations from the BBC, most notably BBC Radio 1: these employed frequent repetition of top-

selling singles (rather than albums or more niche recordings), such that each was played approximately once every three hours during the day, thus ensuring wide exposure to the songs in question at national level.

Texts of lyrics for each song were obtained from a number of (typically web-based) sources (e.g., www.azlyrics.com). The lyrics for each song were corroborated against either a second text-based source or an audio recording of the song in question, depending on availability, to ensure that the two corresponded. In the small number of cases in which these two versions did not correspond a third version was identified and the version of the lyrics that could be matched was the one employed in analysis. Where multiple versions of songs existed, the lyrics were selected for specifically the version intended for United Kingdom radio airplay (such as the 'radio edit', the English rather than other language version, or the lyrics of the 7" rather than the 12" single). The lyrics went through two screening processes before analysis. First, in the instances where redundancy had been removed (through, for example, use of text such as, "Repeat chorus", or "x2"), the full text was reintroduced so that the text file employed contained a verbatim account of the lyrics as recorded. Second, a number of batch 'find and replace' operations was carried out on the lyrics to ensure consistent use of language: for example, all instances of, "It's" (and similar abbreviations) were replaced with "It is"; instances of, "Wanna" (and similar mis-spellings such as, "Gonna") were corrected (e.g., to "Want to"); and instances of "Lovin'" (and similar mis-spellings, such as "Goin'") were corrected (e.g. to "Loving").

Coding of lyrics. Lyrics from each song were analysed via Diction 7.0 software (Hart, Carroll, & Spiars, 2013), which is designed for analysis of the content of texts of varying lengths (Sydserff & Weetman, 2002). The advantages of using computerized content analysis include the nature and amount of text that research can consider, impartiality, and a potentially richer analysis of the data than practically achievable by a human (Amernic, Craig,

& Tourish, 2010; Bligh, Merolla, Schroedel, & Gonzalez, 2010; Ober, Zhao, Davis, & Alexander, 1999; Sydserff & Weetman, 2002). Diction, specifically, examines text using a set of 10,000 search words organised into lists, so that each list represents a separate variable or 'dictionary' (Ober et al., 1999) and none of the individual words is duplicated between the dictionaries. The dictionaries were constructed through analysis of more than 20,000 texts (Sydserff & Weetman, 2002), and were designed with reference to linguistic theory such that these dictionaries consist of the (types of) words frequently encountered in public discourse (Abelman, 2014). Diction lends itself to analysing the content of a wide variety of social discourse (Bligh, et al., 2010), and has previously been used in a diverse range of research areas, including media (Hart, 2014). In particular, the sample texts included with the software, which indicate its intended range of uses, include specifically song lyrics; and Cook and Krupar (2010) used Diction successfully to consider popular song lyrics during the Great Depression period. Diction has been used in over 300 pieces of published research (detailed at http://www.dictionsoftware.com/published-studies/).

The software measures 35 variables, with each dictionary on which these are respectively based containing between 10 and 745 words. The application calculates the frequency with which the words within each of the dictionaries occur within a given text. This then leads to a score for the text in question for each of the 35 dictionaries. For example, the 'self-reference' dictionary contains, among others, the word 'me', and so each instance of the word 'me' in a given set of lyrics adds 1 to the 'self-reference' score for those lyrics. A small number of other variables calculate values based on the characteristics of the words themselves (e.g., total number of different words, or mean characters per word) or composites of other variables. The variables and descriptions of these (taken from Hart, 1997) are shown in Table 1. Diction also produces a word count for each text, so that this can be used as a covariate in comparison of texts of varying lengths.

- Table 1 about here -

Data analysis. We used a '*between*-song' design in which a *different* set of songs was evaluated at each time point. This was because each song had only one record in the data set (except for those occasions (N = 228) where a song straddled a year boundary), and we were interested in how the lyrics of one particular year compared with the overall average. These effects were analysed with a generalised linear mixed model (GLMM) which allows investigation of specific years which give rise to scores that differ from the mean, and which allows direct comparison of the prevalence of the themes addressed by the Diction variables. In order to consider the semantic content of the lyrics using Diction's individual dictionaries, a separate GLMM analysis was conducted for each of the Diction variables of interest (α = .001). For each GLMM, 'song' was the unit of analysis and 'year' (1962 – 2011) was analysed as an ordinal fixed effect. Because each of the variables was significantly - albeit weakly - correlated with the number of words contained in the lyrics, the latter was included as a covariate in the statistical model. The GLMM 'robust statistics' option was invoked to accommodate the negative skew that was apparent to varying extents in all of the lyric variables. The GLMM analyses were implemented through the SPSS (Version 22) GENLINMIXED procedure.

Results

Overview of the lyrics. A one-way ANCOVA (in which total number of words was the covariate) was carried out to identify variations in scores between the variables. Because the sphericity assumption was violated, the more robust multivariate statistics were reported rather than the within-subjects statistics. The main effect for variable was significant, (F (18, 4332) = 2296.81, p < .001), with the means presented in Table 2 indicating considerable

differences between the variables, such that the highest scoring variables across the dataset were familiarity, insistence, human interest, self-reference, and tenacity; and the lowest scoring variables were variety, diversity, embellishment, centrality, and cooperation. As such, this indicates the most common and most infrequent lyrical themes in the lyrics, such that the high-scoring variables represent high repetition of nouns (insistence); frequent usage of words found commonly in English language usage (familiarity); reference to the self (self-reference); family members and relations (human interest); and frequent use of forms of the verb 'to be' (such as is, am, will, and shall) (tenacity): the vocabulary is, therefore, repetitive and tends to refer to the past, present, or future status of the lyricist and/or his/her familiars. In contrast, the low-scoring variables concern use of a variety of words, and the depiction of complex and relatively abstract subject matter (diversity, embellishment, centrality, and cooperation) that lyricists are either reluctant or perhaps simply unable to address, given the constraints of typically short song length.

- Table 2 about here -

Table 3 presents an overview of the GLMM analyses pertaining to each DICTION dictionary, and Table 4 lists the significant pairwise contrasts for each. Only the years that were significantly different from the overall mean are listed, and these results are discussed in the light of the hypotheses under the respective sub-headings below.

- Tables 3 and 4 about here -

Interpersonal relationships (H1). Hypothesis 1 addressed the prevalence of coverage of interpersonal relationships, which specific aspects of these are depicted most-commonly, and

whether there were differences between years on the scores concerning these variables. The Diction variables relevant to this are self-reference, praise, levelling, human interest, satisfaction, rapport, and exclusion. The results of the ANCOVA (see Table 2) indicate that human interest and self-reference were among the most frequent variables employed in the lyrics, and represent the most common subject matter (since the remaining variables that gave rise to high scores in Table 2 concerned the use of language rather than a particular subject matter).

Table 3 indicates that of those variables concerning interpersonal relationships, significant differences were found between years for self-reference, levelling, and satisfaction. Figure 1 summarises the results concerning the three significant variables that address interpersonal relationships, and shows that, compared to human interest, there was relatively infrequent usage of words indicative of levelling and satisfaction. As such, although interpersonal relationships are the most common theme in the lyrics as demonstrated by the ANCOVA means, the focus was self-centred and literal, concerning the lyricist (self-reference), family members, and specific individuals known to the lyricist (as denoted by human interest): there was relatively little emphasis on more abstract concepts or consequences associated with interpersonal relationships, such as words used to ignore individual differences and to build a sense of completeness and assurance (levelling) or terms associated with positive affective states (satisfaction).

- Figure 1 about here -

Table 4 indicates those years in which scores were significantly above or below the overall mean for each of self-reference, levelling, satisfaction. As such, the focus of the lyrics on self-reference, and coverage involving levelling, and satisfaction has varied in popularity;

and the middle to latter half of the first decade of the 21st century arguably represents a period of low scores.

Violence (H2). Hypothesis 2 addressed the prevalence of lyrical content concerning violence. The variables within Diction relevant to this are blame, aggression, rapport, and denial. Means are reported in Table 2. Table 3 indicates that of those variables concerning violence and defiance, significant variations were found between years for blame. Table 4 shows that levels of blame were significantly higher than the overall mean in 2006 and significantly lower than the overall mean in 1962, 1992, and 1994 (see also Figure 2). As such, the results show that coverage of issues related to violence focussed primarily on social inappropriateness, unfortunate circumstances, and outright denigrations rather than specific actions and circumstances concerning hostility per se. Comparison of Figures 1 and 2 also indicates one further interesting aspect of the lyrics. The levels of variables such as praise, satisfaction, and levelling shown in Figure 1 are consistently higher than the levels of negative variables such as blame shown in Figure 2. More simply, interactions between individuals are portrayed more often positively than they are negatively.

- Figure 2 about here -

Stimulation (H3). Hypothesis 3 addressed which particular years gave rise to less or more stimulating lyrics relative to the mean. The variables indicative of greater stimulation are number of words per song, number of different words employed per set of lyrics, ambivalence, collectives, aggression, cognitive terms, motion, variety, and complexity; and the variables indicative of lower levels of stimulation are passivity, familiarity, and concreteness. Of these variables, significant differences between years were found for total number of

words per song, number of different words per song, motion, variety, complexity, familiarity, and concreteness (see Table 3).

As Figure 3 shows (see also Table 4), of those years that give rise to scores that are higher than the mean for both total number of words and number of different words, there is a notable clustering towards more recent years. Both findings are consistent with the notion of recent lyricists striving to stimulate the audience by using a larger numbers of words and a larger number of different words. Motion and concreteness are also, to a more limited extent, consistent with this, although the small number of years that gave rise to scores that differed significantly from the overall mean makes it difficult to state this conclusion with confidence.

However, data in Table 4 concerning variety suggest a more sophisticated conclusion. Table 4 shows the years in which variety scores were higher/lower than the overall mean, such that there is a preponderance of lower scores in more recent years. (Although less clearly, complexity results also suggest that lower scores cluster towards more recent years.) Variety scores suggest that, although pop music lyrics have become longer, contain a larger number of different words (see Figure 3), and have arguably shown increases in other variables indicative of attempts to stimulate the audience, this has also been accompanied by greater repetition of words (low variety). Although lyricists have used a larger number of different words over time, they have also taken advantage of the overall increase in number of words to employ a greater degree of repetition. Indeed, it is tempting to speculate that lower levels of variety in the 21st century represent an attempt to compensate for the greater number of different words employed by lyricists and so avoid overloading the audience.

-Figure 3 about here-

Decades (H4). Hypothesis 4 addressed whether there was any evidence that the 1960s or any other decade included in the sample was a recognisable stylistic period relative to other decades, and if so then what the nature of any differences might be. To address this question, a MANCOVA (employing number of words per song as a covariate) investigated differences between lyrics released in each of 1962-1969, 1970-1979, 1980-1989, 1990-1999, and 2000-2009 on the Diction variables included in hypotheses 1-3. The result of this was significant (F (76, 16584) = 4.43, $p < .001$, $\eta_p^2 = .020$), and the results of univariate tests are presented in Table 5. This table indicates that there were significant differences between the decades for self-reference, praise, levelling, human interest, satisfaction, concreteness, denial, ambivalence, variety, complexity, familiarity, and insistence.

- Table 5 and Figure 4 about here -

There was evidence that specifically the 1960s gave rise to a particularly high proportion of scores at the poles of the distribution, as scores for this decade tended to be the highest or lowest of all the decades on three of the six variables that gave rise to significant differences ($\alpha = .001$) between the five decades in question (see Figure 4). Those variables on which the 1960s was the highest or lowest scoring decade detail the precise nature of how the 1960s represented a distinctive period: the highest scores concerned satisfaction and variety; and the lowest scores concerned denial and complexity. At the risk of imposing our own stereotypes on the findings, these variables are consistent with the notion of the 1960s as a period in which lyrics had an approach that was arguably positive (evidenced by high satisfaction and low denial), literary (evidenced by high variety), and simplistic (evidenced by low complexity).

Discussion

The results concerning the expression of interpersonal relationships supported Hypothesis 1a and indicated a consistent focus of pop music lyrics on these, although this was limited to human interest and self-reference, with relatively infrequent usage of words indicative of praise, levelling, satisfaction, rapport, and exclusion. The focus was on the lyricist and his/her immediate familiars, rather than more abstract concepts associated with interpersonal relationships, and this perhaps explains why pop music has so often adopted a sexual approach. There was also evidence of a difference in coverage of these factors by year, in support of Hypothesis 1b, and in conjunction these findings provide a more detailed account of interpersonal relationships in pop music lyrics than hitherto.

Concerning violence, Hypothesis 2a was supported to some extent: the lyrics contained prominent coverage of denial, but relatively infrequent usage of blame and aggression. The coverage of violence in the lyrics focussed therefore on contrariness and defiance rather than overt depictions per se. Moreover, coverage of even denial (the most prominent variable concerning aggression) clearly did not outweigh coverage of positive factors such as praise, satisfaction, or levelling. In support of Hypothesis 2b, levels of blame fluctuated over time. It is also noteworthy that the *lyrics* appear to place far less emphasis on overt violence than do those music *videos* studied in previous research: pop music videos may well be violent, but pop music lyrics place more emphasis on interpersonal relationships, and when they do address violence they focus on anti-authoritarian statements of resistance rather than commission of aggressive acts.

Hypothesis 3 considered Martindale's arguments concerning stimulation and was supported in the case of the total number of words per song, and the number of different words per song: in both cases, it was apparent that more recent years gave rise to higher scores on variables that indicate an attempt to stimulate the audience. This pattern held to a

more limited extent in the case also of specific types of vocabulary that would be expected to increase stimulation, namely collectives, motion, and (low levels of) concreteness. However, the data concerning variety show that, although higher scores on variables indicative of stimulation cluster toward more recent years, this has also been accompanied by greater repetition of words which would mitigate the ability of the other variables to increase stimulation. This latter finding is contrary to Martindale's (1990) theory, and perhaps reflects the constraints imposed on lyricists by their predominantly young audience.

Results of the analysis concerning whether particular decades might mark distinguishable periods in pop music lyrics suggest that Hypothesis 4 was supported. The MANCOVA showed differences between the five decades on the variables; and there were significant univariate differences between the decades, with the period 1962-1969 accounting for several of these, in support for the notion that these years represent a particularly 'different' period.

In summary, the results of Study 1 provide a detailed description of pop music lyrics from the 1960s until the present day in the context of previous content analyses of smaller samples that have addressed societal concerns with pop music culture. However, the second stage of the research addressed another aspect of the broad cultural commentary concerning pop music lyrics, namely how these might reflect broader societal trends, and in particular changes in the economy.

Study 2

Method

Lyrics. The same set of lyrics and coding process were employed as per Study 1, except that in this case the start point was selected as March 1960, using data from the entire history

of the UK chart. To test hypothesis 5, derived from Zullow's (1991) findings, the research employed the 'optimism' and 'certainty' composite variables. To test hypothesis 6, derived from Pettijohn and Sacco's (2009) findings, the research employed respectively (a) number of words (i.e., length); (b) complexity and variety (i.e., complex themes); (c) human interest and rapport (i.e., close relationships); (d) praise, levelling, and satisfaction (i.e., love and happiness); (e) concreteness, numerical terms, ambivalence (i.e., meaningfulness); (f) the certainty composite variable; and (g) the optimism composite variable.

Economic variables. Economic data was employed on an annual basis (i) to minimise any biases attributable to sampling error in measures of economic optimism (which is assessed by opinion polling), and very short-term volatility in stock markets arising from issues of limited relevance to population-level feelings of certainty and security (such as injudicious remarks by a politician or rumours of the merger of two major companies); and (ii) to ensure that the measurement at a given time-point was not influenced unduly by the small number of songs that appear in the top-five best-selling list within a given week or month (which is often a function of prevailing music industry marketing strategies). To test hypothesis 5, the research used the United Kingdom Economic Optimism Index (EOI) and Gross Domestic Product (GDP). The EOI is a measure of consumer confidence and was sourced from Ipso Mori (ipso-mori.com), which reports EOI as a percentage by polling "Do you think that the general economic condition of the country will improve, stay the same or get worse over the next 12 months?" on a monthly basis. Annual figures were computed by averaging the monthly values. GDP is a monetary measure of the United Kingdom's total value of goods and services produced in a year. GDP was sourced from the Organisation for Economic Co-operation and Development (stats.oecd.org). Specifically, annual values were taken from the "expenditure approach" GDP report indicating the "growth rate compared to

the previous quarter, seasonally adjusted" for which the reference year is 2010 with values expressed as percentages.

To test hypothesis 6, the research used both the annual range and standard deviation in the daily closing price of the FTSE 100 share index. The FTSE 100 represents the value of the 100 highest-priced shares on the London Stock Exchange, and the standard deviation of this indicates the volatility of the measure. The FTSE 100 has an advantage of being very responsive to external economic and financial turbulence. The stock market data was sourced from www.ftse.com, and annualised data was used for analysis.

Analysis. Data analyses for Hypothesis 5 were carried out using Mplus (v5.2). Data analyses for Hypothesis 6 were performed using Gretl (GNU Regression, Econometrics and Time-series Library, Mixon Jr. & Smith, 2006), an open-source analysis application designed for econometric research (Baiocchi & Distaso, 2003). With regard to the present data, an initial concern existed regarding the possible presence of autocorrelation due to the natural temporal ordering of both the top-selling songs and macroeconomic variables. The Durbin-Watson statistic (Montgomery, Peck, & Vining, 2001) was used to test for serial correlation in the annualized data. Gretl was selected as the analytical tool because it accepts time-series data and can adjust for any serial correlation that might be present.

Results

Hypothesis 5. Analyses for Hypothesis 5 tested 13 potential lagged relationships involving lags of 0-3 years in the case of the relationship between the lyrics and EOI, and a further possible lag of 0-3 years in the case of the relationship between EOI and GDP. The analysis was carried out first using the optimism composite variable from Diction and then again using the certainty composite variable. The significance of each of the 26 indirect pathways (optimism and certainty x 13 different lags) was estimated with a bootstrapping

procedure based on 1000 draws as implemented by Mplus. None of the indirect pathways for either optimism or certainty were significant. The results are reported in Table 6.

- Table 6 here -

Hypothesis 6. Analyses concerning Hypothesis 6 considered relationships between the lyrics and stock exchange volatility in the same year and also with one to three year time lags in which changes in stock exchange volatility precede changes in the lyrics. To test Hypotheses 6a-g, a series of multiple regressions was carried out, and the significant results of these are reported in Tables 7-10 (non-significant results are reported in the supplementary Tables 11a-g online). These regressions were evaluated using a restricted alpha level of .0125 to allow for the test of four temporal relationships per variable (i.e., no lag, lag of one year, two years, and three years).

With regard to Hypothesis 6a, Table 7 shows that the relationship between FTSE volatility (measured by both range and standard deviation) and the number of words was significant at all four of the points in time tested (i.e., no lag, and changes in stock market volatility associated with subsequent changes in the lyrics one year later, two years later, and three years later), such that greater stock exchange turbulence was associated subsequently with longer lyrics. Regarding Hypothesis 6b, the relationship between FTSE volatility and the two variables that capture complex themes, namely complexity and variety, was non-significant at all four time points in the case of both FTSE range and standard deviation. Concerning Hypothesis 6c, Table 8 shows that the relationship between FTSE volatility (both range and standard deviation) and the two variables that capture close relationships, namely human interest and rapport, was significant in the case of the one-year lag. The coefficients indicate that, at this point in time, the range of stock market closing prices was associated

negatively with human interest; and that the standard deviation of stock market closing prices was associated negatively with rapport. All of the tests concerning Hypothesis 6d (which concerned the three variables that capture happiness, namely praise, levelling, and satisfaction) were non-significant. With regard to Hypothesis 6e, Table 9 shows that the relationships between the range of FTSE closing prices and the three variables that capture meaningful content, namely numerical terms, concreteness, and ambivalence, were significant in the case of the one-, two-, and three-year lags for the range. The coefficients indicate that, at the two-year lag, stock market turbulence was associated negatively with ambivalence; and at the three-year lag, turbulence was associated negatively with concreteness. Finally, the tests of Hypothesis 6f and6g, which concerned the certainty and optimism composite variables respectively, all were non-significant.

The multiple regressions were then repeated using EOI in place of the stock exchange data. With regard to Hypothesis 6h, Table 10 shows that the relationship between EOI and the number of words was significant and negative at the three-year time lag. Table 7d shows that the relationships between EOI and the two variables that capture complex themes, namely complexity and variety, were significant at the three-year time lag. Specifically, complexity was associated positively with EOI while variety was associated negatively. No significant relationships were found concerning EOI with regard to coverage of close relationships, love and happiness (via the concepts of praise, togetherness, and satisfaction), or meaningfulness (through the expression of concrete terms and numerical concepts, and the avoidance of ambivalence). However, with regard to the composite variables, there was a significant positive association between EOI and each of optimism and certainty at the three-year time lag (Table 10).

- Tables 7-10 here -

Discussion

Hypothesis 5 predicted that changes in the optimism and certainty expressed in pop music lyrics should in turn lead to subsequent changes in the EOI which in turn leads to changes in GDP. Contrary to Zullow's (1991) results, no path was found from optimism in the lyrics through to EOI and in turn to GDP.

Hypotheses 6a-g predicted the reverse temporal relationship between the economy and lyrics, and focussed explicitly on economic turbulence, in predicting that the range and standard deviation of the closing price of the London Stock Exchange, and also EOI, should subsequently influence the extent to which subsequent pop music lyrics express maturity, comfort, and certainty. The 'hard' version of this hypothesis stated that the lyrics should subsequently change in an ameliorative manner that provides succour to the populace, whereas the 'weaker' version of this hypothesis noted that the change in the lyrics may instead reflect the behaviour of the FTSE and EOI values. The results provide support for this hypothesis, and particularly its weaker version. Specifically, for the operationalization of expression of maturity, comfort, and certainty as lyrics that (a) are longer, (c) emphasise relationships, and (e) are meaningful, the analyses were able to identify instances in which stock market turbulence was associated with change in the lyrics at a later lagged point in time: that is, the coefficients point more often to relationships in which the lyrics mirror stock market turbulence by expressing less maturity, comfort, and certainty, rather than ameliorating the effects of stock market turbulence by expressing more maturity, comfort, and certainty (although there were instances of the latter).

When repeating the analyses by replacing stock market data with that concerning economic optimism (Hypothesis 6h), the results indicated that the latter was associated negatively with number of words and variety, and positively with complexity, optimism, and

certainty: low economic optimism was associated with lyrics that were subsequently longer and more varied, and lyrics that were subsequently less optimistic and certain. As such, the results support Pettijohn and Sacco's claim that economic turbulence precedes changes in pop culture, but provide less (although still some notable instances of) support for their stronger claim that pop culture is used as an adaptive ameliorative that counters the psychological strain of this turbulence.

Note that this conclusion is based upon a much larger set of lyrics than was Pettijohn and Sacco's (2009) original claim, and that the current set of lyrics was machine-coded, which arguably represents a more reliable method than that employed by Pettijohn and Sacco (and Zullow). However, there are other possible sources of the discrepancy between the two sets of findings. Most obviously, Pettijohn and Sacco employed data from the USA whereas the present research used United Kingdom data: whereas the USA's musical culture may attempt to more unequiviocally *ameliorate* economic turbulence, it is possible that British musical culture may instead sometimes do the same but sometimes attempt to instead reflect it. (We note in this context the well-known tendency within British cinema and television towards the latter, such as the 'kitchen sink realism' of the early 1960s (e.g., Cooke, 2015).) Future research would of course be required to test this explicitly. Similarly, the specific means by which researchers operationalise 'economic turbulence' and the lyrics seem to lead to quite differing patterns of statistical significance and time orderings of the relationship: the relationships may well be subtle and idiosyncratic.

General Discussion

We conclude by briefly noting a few more general issues that arise from the present research. Computer-analysis appears to have considerable potential for analysing lyrics, allowing the unbiased consideration of a very large sample of songs that far exceeds the

number included in previous similar research. There are also a number of inherent limitations to the approach, however. For instance, future research could instead provide a global assessment that directly addresses use of metaphor and humour, and otherwise measures the *overall* message contained in the lyrics. Second, the importance of deriving accurate records of the lyrics in question precluded the use of automated web crawling software in collecting lyrics, and use of an even wider range of songs. One consequence of this is that absent from the data set were some culturally-significant lyrics and genres that did not enjoy immediate high-level commercial success to the extent that they appeared in the top 5 singles chart. Finally, the present research does not consider music per se. Although testing of the present hypotheses obviously did not require this, it would clearly be interesting to test how lyrics and music relate to one another, and whether (as Study 2 implies) macroeconomic conditions might be related to the popularity of complex music with harsh timbres. In the meantime, the present results provide a detailed account of the commercially-successful pop music lyrics of the past 50 years; and how these relate to macroeconomic factors. The approach adopted here has the potential to shed considerable light on the factors underlying one of the most prevalent and commented upon cultural phenomena of recent decades.

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Table 1.
Summary of the 'Diction' Dictionaries Employed in the Present Research (taken from Hart, 1997)

Dictionary	Definition
Numerical terms	Any sum, date or product. Each separate group of integers is treated as a single word.
Ambivalence	Words expressing hesitation or uncertainty.
Self-reference	Contains all first-person references.
Tenacity	All uses of the verb 'to be' (is, am, will, shall), three definitive verb forms (has, must, do) and their variants, and all associated contractions (he'll, they've, ain't).
Levelling	Words used to ignore individual differences and to build a sense of completeness and assurance.
Collectives	Singular nouns connoting plurality that function to decrease specificity e.g. social groupings, task groups (e.g. army), and geographical entities.
Praise	Affirmations of some person, group, or abstract entity.
Satisfaction	Terms associated with positive affective states.
Inspiration	Abstract virtues deserving of universal respect.
Blame	Terms designating social inappropriateness (e.g. naïve), evil, unfortunate circumstances, unplanned vicissitudes, and outright denigrations.
Hardship	Contains natural disasters, hostile actions, censurable human behaviour, unsavoury political outcomes, normal human fears and incapacities
Aggression	Terms embracing human competition and forceful actions.
Accomplishment	Words expressing task completion and organized human behaviour.
Communication	Terms referring to social interaction.
Cognitive terms	Contains words referring to cerebral processes, both functional and imaginative.
Passivity	Words ranging from neutrality to inactivity.
Spatial awareness	Terms referring to geographical entities, physical distances, and modes of measurement.
Familiarity	A selected number of Ogden's (1960) 'operation' words, which he calculates to be the most common words in the English language. Includes common prepositions (across, over, through), demonstrative pronouns (this, that), interrogative pronouns (who, what), and a variety of particles, conjunctions, and connectives (a, for, so).
Temporal awareness	Terms that fix a person, idea, or event within a specific time interval.
Present concern	Selective list of common present-tense verbs concerning general physical activity, social operations, and task performance.
Human interest	Includes standard personal pronouns, family members and relations, and generic terms (e.g. friend).
Concreteness	Words concerning tangibility and materiality.

Past concern	Past tense form of the verbs contained in the Present Concern dictionary.
Centrality	Terms denoting institutional regularities and/or substantive agreement on core values.
Rapport	Words denoting attitudinal similarities among people.
Cooperation	Words describing behavioural interactions among people that often result in a group product.
Diversity	Words describing individuals or groups of individuals differing from the norm.
Exclusion	Describes the sources and effects of social isolation.
Liberation	Includes terms describing the maximizing of individual choice and the rejection of social conventions.
Denial	Standard negative contractions (aren't), negative function words (nor), and terms designating null sets (nothing).
Motion	Terms connoting human movement, physical processes, journeys, speed, and transit.
Insistence	A measure of code restriction and semantic 'contentedness'. Includes all words occurring three or more times that function as nouns or noun-derived adjectives, and calculates (number of eligible words x sum of their occurrences) / 10.
Embellishment	Calculated as [praise + blame + 1] / [present concern + past concern + 1].
Variety	The number of different words divided by total words.
Complexity	Mean number of characters per word.
Certainty	Language indicating resoluteness, inflexibility, and completeness and a tendency to speak ex cathedra. Calculated as [Tenacity + Leveling + Collectives + Insistence] – [Numerical Terms + Ambivalence + Self Reference + Variety]
Activity	Language featuring movement, change, the implementation of ideas and the avoidance of inertia. Calculated as [Praise + Satisfaction + Inspiration] – [Blame + Hardship + Denial]
Optimism	Language endorsing some person, group, concept or event, or highlighting their positive entailments. Calculated as [Aggression + Accomplishment + Communication + Motion] – [Cognitive Terms + Passivity + Embellishment]
Realism	Language describing tangible, immediate, recognizable matters that affect people's everyday lives. Calculated as [Familiarity + Spatial Awareness + Temporal Awareness + Present Concern + Human Interest + Concreteness] – [Past Concern + Complexity]
Commonality	Language highlighting the agreed-upon values of a group and rejecting idiosyncratic modes of engagement. Calculated as [Centrality + Cooperation + Rapport] – [Diversity + Exclusion + Liberation]

Table 2.
One-Way ANCOVA Results

Dictionary variable	Mean	Std. Error	95% Confidence Interval	
Self-reference	38.874	0.384	38.122	39.627
Praise	7.554	0.137	7.286	7.822
Levelling	9.034	0.155	8.730	9.338
Human interest	46.462	0.369	45.738	47.185
Satisfaction	12.036	0.233	11.579	12.492
Concreteness	14.765	0.215	14.344	15.187
Rapport	1.211	0.056	1.100	1.321
Exclusion	1.649	0.061	1.529	1.768
Blame	2.453	0.083	2.291	2.614
Aggression	2.642	0.101	2.444	2.840
Passivity	6.711	0.135	6.447	6.976
Denial	13.704	0.228	13.257	14.151
Ambivalence	15.986	0.210	15.573	16.398
Collectives	1.713	0.076	1.563	1.863
Cognitive terms	7.437	0.125	7.192	7.682
Motion	8.159	0.186	7.794	8.523
Variety	0.335	0.002	0.332	0.339
Complexity	3.589	0.009	3.572	3.606
Familiarity	87.475	0.491	86.513	88.437

Note. For the covariate, Total words, the value = 314.553.

Table 3.

Overall GLMM Analysis Details Concerning Lyrical Content by Year (N = 4351)

Analysis dependent variable	Overall model	Fixed Effect variable: Year		Covariate: Length of song (total words)	
	F	*F*	η_p^2	*F*	η_p^2
Self-reference	F (50, 4300) = 2.34, p < .001	F (49, 4300) = 1.97, p < .001	0.022	F (1, 4300) = 4.64, p = .031	0.001
Praise	F (50, 4300) = 0.73, p = .927	F (49, 4300) = 0.74, p = .913	0.008	F (1, 4300) = 1.83, p = .177	0.000
Levelling	F (50, 4300) = 1.96, p < .001	F (49, 4300) = 1.95, p < .001	0.022	F (1, 4300) = 6.83, p = .009	0.002
Human interest	F (50, 4300) = 2.70, p < .001	F (49, 4300) = 1.42, p = .029	0.016	F (1, 4300) = 71.20, p < .001	0.016
Satisfaction	F (50, 4300) = 2.30, p < .001	F (49, 4300) = 1.74, p < .001	0.019	F (1, 4300) = 7.37, p = .007	0.002
Concreteness	F (50, 4300) = 2.03, p < .001	F (49, 4300) = 1.96, p < .001	0.022	F (1, 4300) = 1.11, p = .292	0.000
Rapport	F (50, 4300) = 0.91, p = .659	F (49, 4300) = 0.91, p = .656	0.010	F (1, 4300) = 7.03, p = .008	0.002
Exclusion	F (50, 4300) = 2.04, p < .001	F (49, 4300) = 1.67, p = .002	0.019	F (1, 4300) = 13.57, p < .001	0.003
Blame	F (50, 4300) = 1.98, p < .001	F (49, 4300) = 1.74, p = .001	0.019	F (1, 4300) = 3.71, p = .054	0.001
Aggression	F (50, 4300) = 1.72, p = .001	F (49, 4300) = 1.25, p = .117	0.014	F (1, 4300) = 3.28, p = .070	0.001
Passivity	F (50, 4300) = 1.35, p = .052	F (49, 4300) = 1.34, p = .058	0.015	F (1, 4300) = 0.35, p = .553	0.000
Denial	F (50, 4300) = 1.90, p < .001	F (49, 4300) = 1.44, p = .025	0.016	F (1, 4300) = 4.20, p = .041	0.001
Ambivalence	F (50, 4300) = 1.16, p = .213	F (49, 4300) = 1.18, p = .189	0.013	F (1, 4300) = 1.80, p = .180	0.000
Collectives	F (50, 4300) = 1.56, p = .007	F (49, 4300) = 1.59, p = .006	0.018	F (1, 4300) = 0.50, p = .479	0.000
Cognitive terms	F (50, 4300) = 1.08, p = .330	F (49, 4300) = 1.03, p = .417	0.012	F (1, 4300) = 0.28, p = .599	0.000
Motion	F (50, 4300) = 2.68, p < .001	F (49, 4300) = 1.95, p < .001	0.022	F (1, 4300) = 10.47, p = .001	0.002
Variety	F (50, 4300) = 5.86, p < .001	F (49, 4300) = 4.80, p < .001	0.052	F (1, 4300) = 0.30, p = .581	0.000
Complexity	F (50, 4300) = 2.37, p < .001	F (49, 4300) = 2.40, p < .001	0.027	F (1, 4300) = 20.86, p < .001	0.005
Familiarity	F (50, 4300) = 2.79, p < .001	F (49, 4300) = 2.19, p < .001	0.024	F (1, 4300) = 38.15, p < .001	0.009
Total words	F (49, 4301) = 33.77, p < .001	F (49, 4301) = 33.77, p < .001	0.278	n/a	
Different words	F (49, 4301) = 13.38, p < .001	F (49, 4301) = 13.38, p < .001	0.132	n/a	

Table 4.

Significant Deviation Contrasts Pertaining to the GLMM Lyrical Content Analyses

Diction variable	Years significantly above overall mean	Years significantly below overall mean
Self reference	1964, 2002, 2004	1981, 1984, 1985, 1990
Levelling	1986, 1989, 1996	1962, 1963, 1969, 1978, 1981, 1987
Satisfaction	1964, 1975	1971, 1999, 2003, 2004, 2007, 2009
Concreteness	1972, 1975	1962, 1963, 1964, 1997, 2000, 2001, 2007, 2009
Blame	2006	1962, 1992, 1994
Motion	1966	1977, 1978, 1982, 2004
Variety	1964, 1966, 1967, 1968, 1969, 170, 1972, 1975	1963, 1983, 1993, 1999, 2000, 2001, 2002, 2003, 2004, 2006, 2007, 2008, 2009, 2010, 2011
Complexity	1966, 1967, 1975, 1983, 1984, 1986, 1990, 1992	1963, 1977, 2001, 2002, 2010
Familiarity	1984, 1985, 1986	1962, 1963, 1977, 2001, 2004, 2009, 2010, 2011
Total words	1993, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011	1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1980, 1981
Different words	1998, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011	1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1980, 1987

Table 5.
Results of Univariate Tests by Decade

Dictionary variable	*F*	*p*	η_p^2
Self-reference	7.77	< .001	0.007
Praise	2.46	0.043	0.002
Levelling	2.50	0.041	0.002
Human interest	3.02	0.017	0.003
Satisfaction	5.08	< .001	0.005
Concreteness	6.83	< .001	0.007
Rapport	0.78	0.538	0.001
Exclusion	0.97	0.421	0.001
Blame	1.01	0.399	0.001
Aggression	1.56	0.182	0.001
Passivity	1.30	0.268	0.001
Denial	4.21	0.002	0.004
Ambivalence	4.21	0.002	0.004
Collectives	0.44	0.782	0.000
Cognitive terms	1.14	0.335	0.001
Motion	1.02	0.396	0.001
Variety	22.31	< .001	0.021
Complexity	6.16	< .001	0.006
Familiarity	7.13	< .001	0.007

Note. Degrees of freedom = 4.

Figure Captions

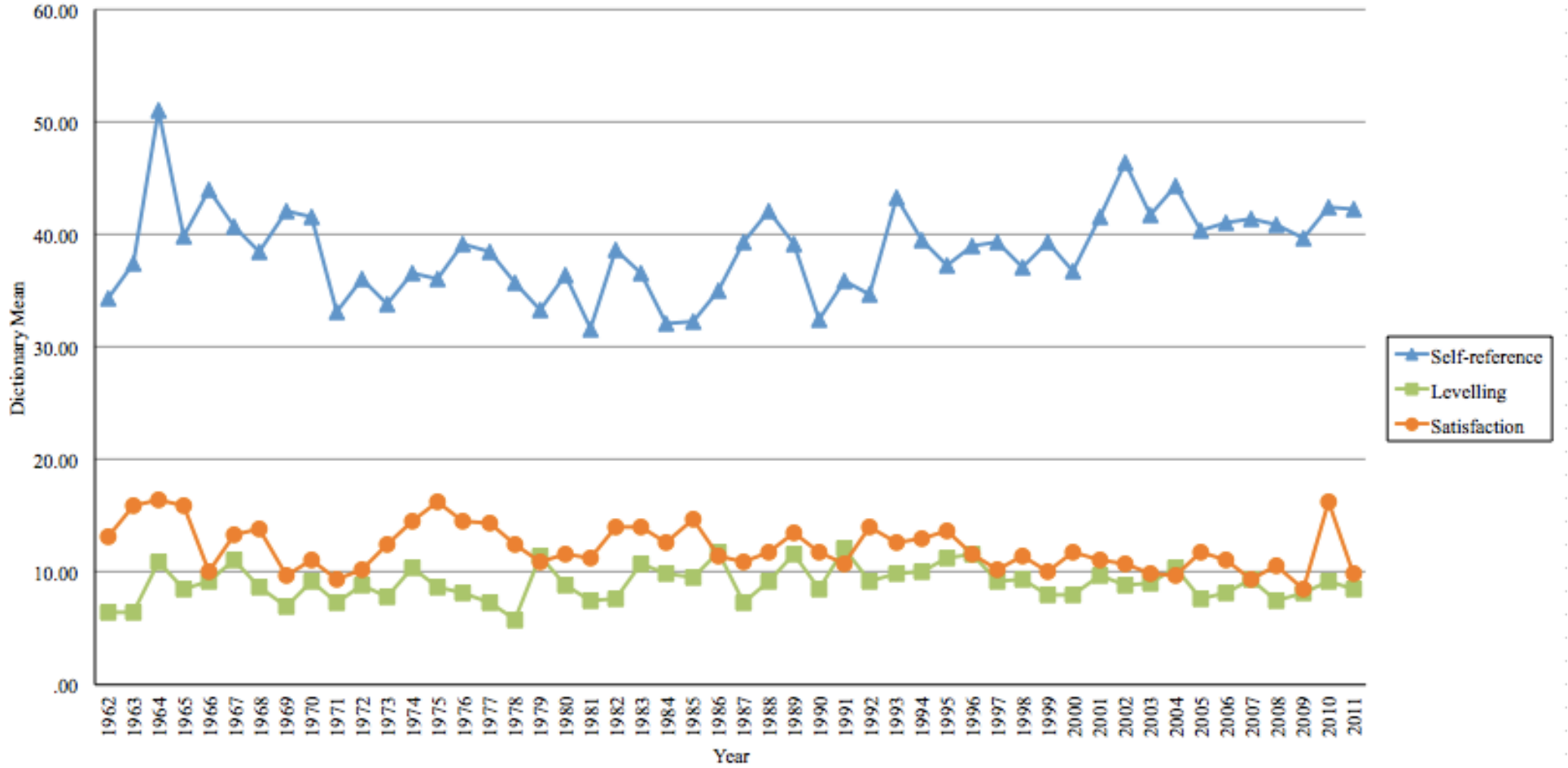
Figure 1: Dictionaries Concerning Interpersonal Relationships

Figure 2: Dictionaries Concerning Violence

Figure 3: Dictionaries Concerning Stimulation

Figure 4: Means by Decade

Figure 1.


60.00
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Year
Self-reference
Levelling
Satisfaction

Figure 2.

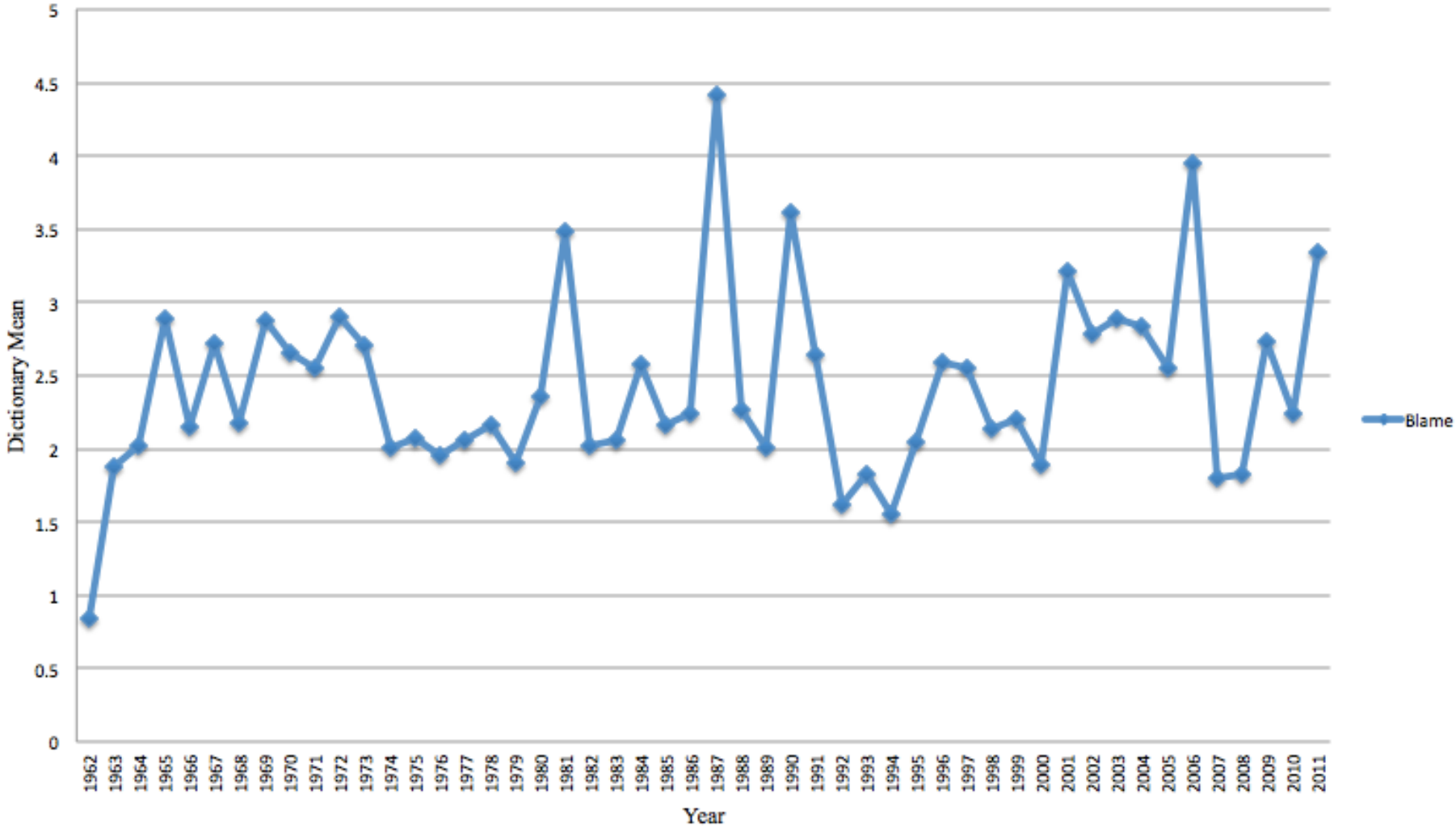
Dictionary Mean
Year
Blame
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

Figure 3.

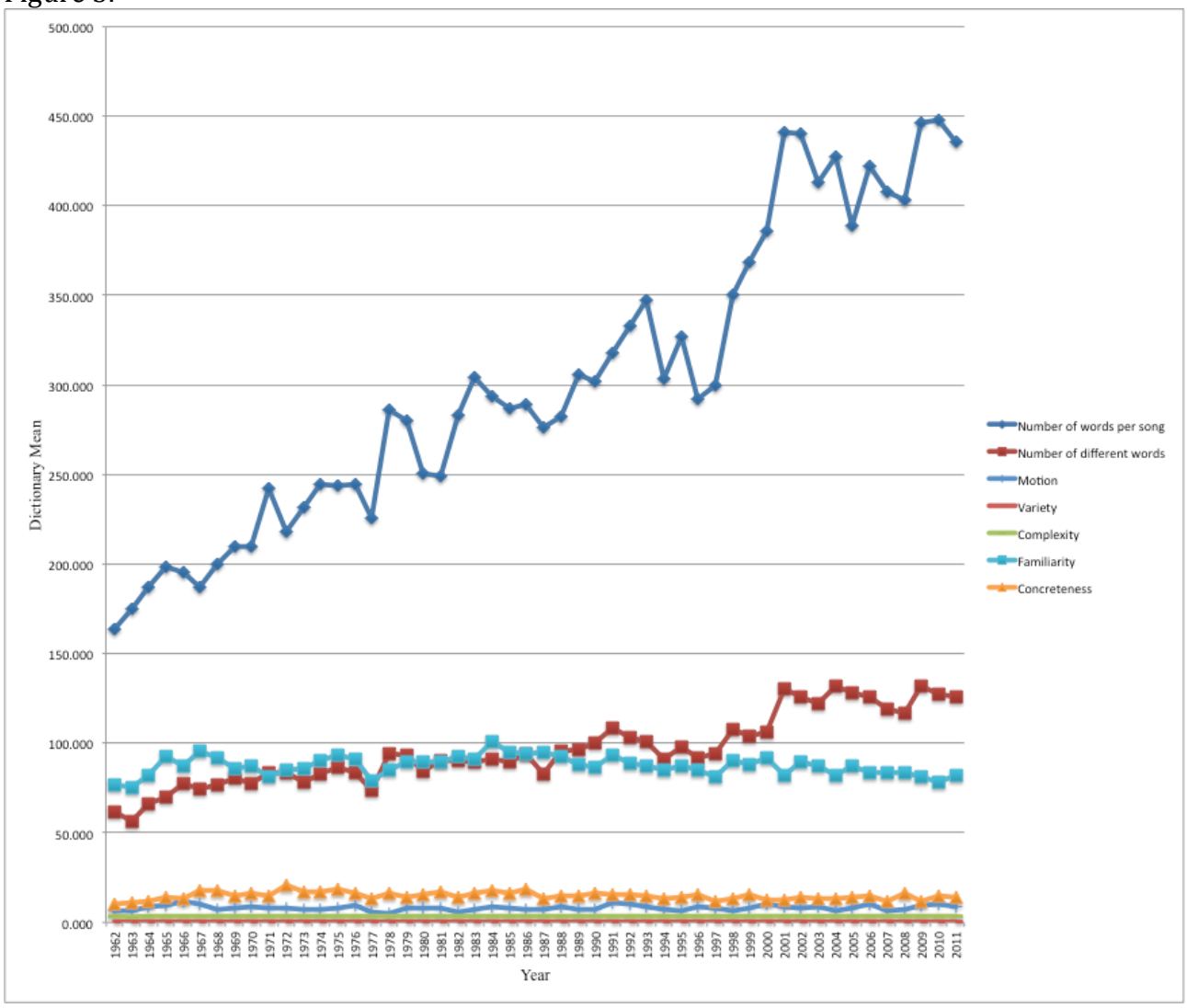
500.000
450.000
400.000
350.000
300.000
250.000
200.000
150.000
100.000
50.000
0.000
Dictionary Mean
1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
Year
Number of words per song
Number of different words
Motion
Variety
Complexity
Familiarity
Concreteness

Figure 4.

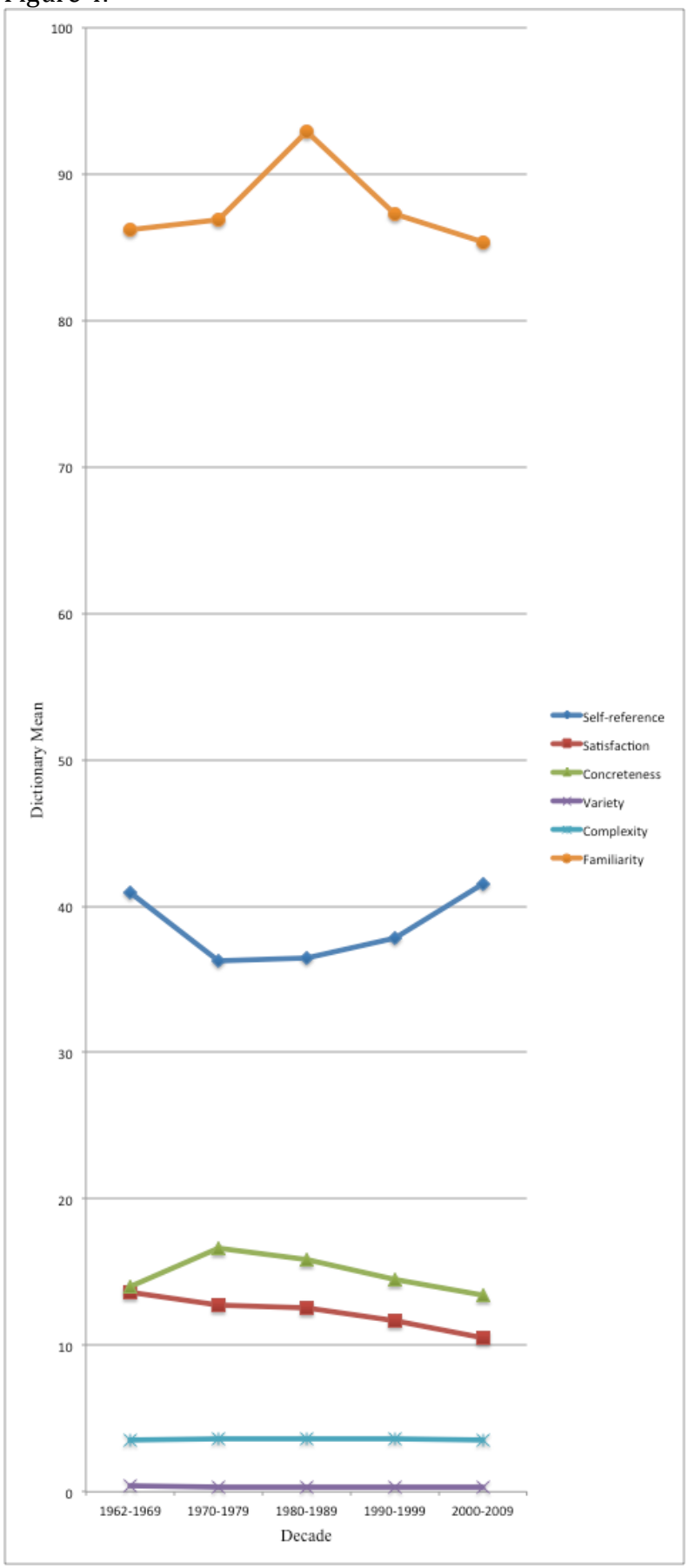
100
90
80
70
60
50
40
30
20
10
0
Dictionary Mean
1962-1969
1970-1979
1980-1989
1990-1999
2000-2009
Decade
Self-reference
Satisfaction
Concreteness
Variety
Complexity
Familiarity

Table 6
Details of the Analyses Concerning Hypothesis 5

Time lag			Effective sample size	Significance [a]
Lyric variable	EOI	GDP		
		Optimism		
0	0	0	34	.405
0	1	1	34	.461
0	1	2	33	.233
0	1	3	32	.327
0	1	4	31	.942
0	2	2	34	.519
0	2	3	33	.287
0	2	4	32	.299
0	2	5	31	.948
0	3	3	34	.654
0	3	4	33	.544
0	3	5	32	.570
0	3	6	31	.930
		Certainty		
0	0	0	34	.452
0	1	1	34	.417
0	1	2	33	.214
0	1	3	32	.334
0	1	4	31	.832
0	2	2	34	.469
0	2	3	33	.187
0	2	4	32	.219
0	2	5	31	.886
0	3	3	34	.530
0	3	4	33	.328
0	3	5	32	.359
0	3	6	31	.773

[a] one-tailed *p*-value for the indirect effect from the lyric variable (optimism or certainty) via EOI to GDP.

Table 7.

Significant Regression Analyses Addressing Hypothesis 6a Concerning Number of Words

Time Lag	Predictor Coefficient	SE	*t*	*F*		*p*	R^2	Adjusted R^2	Rho	Durbin-Watson	f^2
FTSE Range											
0	5.117	1.682	3.042	F(1, 25)	9.253	0.005	0.398	0.374	0.045	1.894	0.662
1	5.739	1.578	3.638	F(1, 24)	13.235	0.001	0.432	0.408	0.025	1.932	0.759
2	6.027	1.669	3.612	F(1, 23)	13.048	0.001	0.440	0.416	0.034	1.900	0.785
3	5.625	1.504	3.740	F(1, 22)	13.988	0.001	0.365	0.336	-0.021	1.609	0.576
FTSE Standard deviation											
0	1.345	0.444	3.026	F(1, 25)	9.157	0.006	0.334	0.308	0.035	1.916	0.502
1	1.466	0.438	3.345	F(1, 24)	11.187	0.003	0.362	0.336	0.023	1.931	0.568
2	1.557	0.483	3.225	F(1, 23)	10.400	0.004	0.381	0.354	0.050	1.863	0.616
3	1.345	0.411	3.275	F(1, 22)	10.724	0.003	0.278	0.245	-0.063	1.706	0.385

Note. SE = standard error.

Table 8.

Significant Regression Analyses Addressing Hypothesis 6c Concerning Close Relationships and Love

Time Lag	Predictor variable	Coefficient	SE	*t*	*p*	*F*		*p*	R^2	Adjusted R^2	Rho	Durbin-Watson	f^2
FTSE Range													
1	Mean human interest	-6.454	2.873	-2.246	0.035	F(2, 23)	7.234	0.004	0.474	0.428	0.052	1.881	0.901
	Mean rapport	-139.399	67.691	-2.059	0.051								
FTSE Standard deviation													
1	Mean human interest	-1.631	0.793	-2.058	0.051	F(2, 23)	7.692	0.003	0.453	0.406	0.052	1.875	0.829
	Mean rapport	-43.146	18.860	-2.288	0.032								

Note. SE = standard error.

Table 9.
Significant Regression Analyses Addressing Hypothesis 6e Concerning More Meaningful

Time Lag	Predictor variable	Coefficient	SE	*t*	*p*	*F*		*p*	R^2	Adjusted R^2	Rho	Durbin-Watson	f^2
FTSE Range													
1	Mean numerical	18.808	10.911	1.724	0.099	F(3, 22)	5.468	0.006	0.448	0.372	-0.014	2.008	0.810
	Mean concreteness	-17.416	8.840	-1.970	0.062								
	Mean ambivalence	-14.949	7.820	-1.912	0.069								
2	Mean numerical	4.839	10.496	0.461	0.650	F(3, 21)	4.927	0.010	0.503	0.432	0.044	1.871	1.012
	Mean concreteness	-15.241	8.657	-1.761	0.093								
	Mean ambivalence	-17.106	7.562	-2.262	0.034								
3	Mean numerical	-1.110	12.128	-0.092	0.928	F(3, 20)	4.731	0.012	0.288	0.181	-0.085	1.763	0.404
	Mean concreteness	-24.301	10.971	-2.215	0.039								
	Mean ambivalence	-3.827	8.736	-0.438	0.666								

Note. SE = standard error.

Table 10.

Significant Regression Analyses Addressing Hypothesis 6h Concerning EOI

Time Lag	Predictor variable	Coefficient	SE	*t*	*p*	*F*		*p*	R^2	Adjusted R^2	Rho	Durbin-Watson	f^2
Number of words													
3	Number of words	-0.233	0.086	-2.720		F(1, 28)	7.399	0.011	0.354	0.330	0.166	1.354	0.547
Complex themes													
3	Mean complexity	4.642	1.332	3.486	0.002	F(2, 27)	8.781	0.001	0.523	0.488	0.312	1.030	1.096
	Mean variety	-13.670	7.177	-1.905	0.068								
Certainty composite variable													
3	Certainty	0.207	0.061	3.417		F(1, 28)	11.678	0.002	0.450	0.431	0.254	1.171	0.819
Optimism composite variable													
3	Optimism	0.150	0.048	3.164		F(1, 28)	10.011	0.004	0.427	0.406	0.285	1.107	0.745

Note. SE = standard error.

SUPPLEMENTARY TABLES

Supplementary Table 11a.

Non-Significant Regression Analyses Addressing Hypothesis 6h Concerning Number of Words

Time Lag	Predictor Coefficient	SE	*t*	*F*		*p*	R^2	Adjusted R^2	Rho	Durbin-Watson	f^2
0	-0.023	0.049	-0.470	F(1, 31)	0.221	0.642	0.106	0.077	0.125	1.565	0.119
1	0.004	0.053	0.078	F(1, 30)	0.006	0.939	0.126	0.096	0.124	1.581	0.144
2	-0.004	0.054	-0.079	F(1, 29)	0.006	0.938	0.111	0.081	0.107	1.531	0.125
3	-0.233	0.086	-2.720	F(1, 28)	7.399	0.011	0.354	0.330	0.166	1.354	0.547

Note. SE = standard error.

Supplementary Table 11b.

Non-Significant Regression Analyses Addressing Hypothesis 6b and 6h Concerning Complex Themes

Time Lag	Predictor variable	Coefficient	SE	*t*	*p*	*F*		*p*	R^2	Adjusted R^2	Rho	Durbin-Watson	f^2
FTSE Range													
0	Mean complexity	-137.423	59.913	-2.294	0.031	F(2, 24)	2.855	0.077	0.410	0.361	0.023	1.935	0.694
	Mean variety	571.411	336.112	1.700	0.102								
1	Mean complexity	-2.322	65.540	-0.035	0.972	F(2, 23)	1.012	0.379	0.326	0.267	-0.018	1.997	0.484
	Mean variety	-236.865	367.557	-0.644	0.526								
2	Mean complexity	-29.265	68.338	-0.428	0.673	F(2, 22)	0.097	0.908	0.280	0.214	-0.010	2.002	0.388
	Mean variety	122.775	377.783	0.325	0.748								
3	Mean complexity	-9.177	71.443	-0.128	0.899	F(2, 21)	0.163	0.851	0.188	0.111	-0.049	1.547	0.232
	Mean variety	-59.831	396.607	-0.151	0.882								
FTSE Standard deviation													
0	Mean complexity	-41.577	17.714	-2.347	0.028	F(2, 24)	3.009	0.068	0.341	0.287	0.013	1.947	0.518
	Mean variety	182.306	103.476	1.762	0.091								
1	Mean complexity	-7.058	19.150	-0.369	0.716	F(2, 23)	1.282	0.297	0.260	0.196	0.022	1.910	0.352
	Mean variety	-43.136	111.360	-0.387	0.702								
2	Mean complexity	-19.015	19.840	-0.958	0.348	F(2, 22)	0.524	0.599	0.232	0.162	0.053	1.866	0.302
	Mean variety	77.094	113.518	0.679	0.504								
3	Mean complexity	-5.660	20.903	-0.271	0.789	F(2, 21)	0.426	0.659	0.115	0.030	-0.011	1.538	0.130
	Mean variety	-18.572	123.673	-0.150	0.882								
EOI													
0	Mean	-1.016	1.743	-0.583	0.564	F(2, 30)	1.667	0.206	0.189	0.135	0.139	1.534	0.233

	complexity												
	Mean variety	13.707	10.529	1.302	0.203								
1	Mean complexity	-0.438	1.825	-0.240	0.812	F(2, 29)	0.032	0.968	0.127	0.067	0.119	1.596	0.146
	Mean variety	2.696	10.743	0.251	0.804								
2	Mean complexity	0.069	1.871	0.037	0.971	F(2, 28)	0.399	0.675	0.131	0.069	0.114	1.522	0.151
	Mean variety	-4.768	10.679	-0.446	0.659								

Note. SE = standard error.

Supplementary Table 11c.

Non-Significant Regression Analyses Addressing Hypothesis 6c and 6h Concerning Close Relationships and Love

Time Lag	Predictor variable	Coefficient	SE	*t*	*p*	*F*		*p*	R^2	Adjusted R^2	Rho	Durbin-Watson	f^2
FTSE Range													
0	Mean human interest	-4.865	3.288	-1.480	0.152	F(2, 24)	2.251	0.127	0.298	0.240	0.002	1.984	0.425
	Mean rapport	-59.891	70.336	-0.852	0.403								
2	Mean human interest	-7.550	3.208	-2.354	0.028	F(2, 22)	4.465	0.024	0.341	0.281	-0.013	1.955	0.518
	Mean rapport	-59.797	84.168	-0.710	0.485								
3	Mean human interest	-8.988	3.270	-2.748	0.012	F(2, 21)	3.821	0.038	0.356	0.295	0.064	1.422	0.553
	Mean rapport	47.180	79.079	0.597	0.557								
FTSE Standard deviation													
0	Mean human interest	-1.766	0.867	-2.038	0.053	F(2, 24)	4.259	0.026	0.289	0.229	-0.002	1.996	0.406
	Mean rapport	-18.126	18.918	-0.958	0.348								
2	Mean human interest	-2.255	0.911	-2.476	0.021	F(2, 22)	3.793	0.038	0.289	0.224	-0.017	1.952	0.406
	Mean rapport	-0.958	24.094	-0.040	0.969								
3	Mean human interest	-2.285	0.902	-2.534	0.019	F(2, 21)	3.544	0.047	0.279	0.210	0.016	1.534	0.386
	Mean rapport	6.168	23.240	0.265	0.793								
EOI													
0	Mean human interest	0.076	0.086	0.880	0.386	F(2, 30)	1.113	0.342	0.158	0.102	0.096	1.609	0.188
	Mean rapport	-2.163	1.606	-1.347	0.188								
1	Mean human interest	-0.065	0.086	-0.758	0.455	F(2, 29)	0.524	0.598	0.157	0.098	0.118	1.562	0.186
	Mean rapport	1.338	1.619	0.826	0.415								
2	Mean human	0.013	0.082	0.158	0.876	F(2, 28)	2.340	0.115	0.239	0.184	0.003	1.744	0.313

	interest												
	Mean rapport	3.483	1.651	2.109	0.044								
3	Mean human interest	0.057	0.091	0.619	0.541	F(2, 27)	0.376	0.690	0.244	0.189	0.164	1.396	0.324
	Mean rapport	-1.222	1.777	-0.688	0.497								

Note. SE = standard error.

Supplementary Table 11d.

Non-Significant Regression Analyses Addressing Hypothesis 6d and 6h Concerning Comforting

Time Lag	Predictor variable	Coefficient	SE	*t*	*p*	*F*		*p*	R^2	Adjusted R^2	Rho	Durbin-Watson	f^2
FTSE Range													
0	Mean praise	-4.039	13.236	-0.305	0.763	F(3, 23)	1.093	0.372	0.353	0.269	-0.005	1.987	0.546
	Mean leveling	-5.257	4.850	-1.084	0.290								
	Mean satisfaction	-5.884	3.723	-1.580	0.128								
1	Mean praise	-15.811	13.413	-1.179	0.251	F(3, 22)	1.462	0.252	0.355	0.268	0.020	1.927	0.552
	Mean leveling	-8.209	5.008	-1.639	0.115								
	Mean satisfaction	-3.330	3.924	-0.849	0.405								
2	Mean praise	-14.838	14.043	-1.057	0.303	F(3, 21)	0.548	0.655	0.327	0.231	-0.028	2.040	0.486
	Mean leveling	1.538	5.090	0.302	0.765								
	Mean satisfaction	1.735	3.832	0.453	0.655								
3	Mean praise	-12.256	13.666	-0.897	0.380	F(3, 20)	1.889	0.164	0.311	0.208	0.023	1.441	0.452
	Mean leveling	-11.275	5.181	-2.176	0.042								
	Mean satisfaction	-0.417	4.066	-0.103	0.919								
FTSE Standard deviation													
0	Mean praise	-2.591	3.694	-0.702	0.490	F(3, 23)	1.914	0.155	0.308	0.218	0.002	1.966	0.445
	Mean leveling	-2.290	1.407	-1.627	0.117								
	Mean satisfaction	-1.833	1.111	-1.650	0.113								
1	Mean praise	-5.085	3.765	-1.351	0.191	F(3, 22)	1.907	0.158	0.301	0.205	0.014	1.932	0.430
	Mean leveling	-2.340	1.444	-1.621	0.119								
	Mean satisfaction	-1.184	1.153	-1.026	0.316								
2	Mean praise	-5.944	4.035	-1.473	0.156	F(3, 21)	0.758	0.530	0.263	0.158	0.042	1.863	0.358

	Mean leveling	-0.588	1.517	-0.387	0.702							
	Mean satisfaction	-0.161	1.173	-0.137	0.892							
3	Mean praise	-2.555	3.830	-0.667	0.512	F(3, 20)	1.852	0.170	0.252	0.140	-0.009	1.507	0.337
	Mean leveling	-3.239	1.486	-2.180	0.041							
	Mean satisfaction	0.050	1.182	0.042	0.967							
EOI												
0	Mean praise	-0.124	0.329	-0.377	0.709	F(3, 29)	0.127	0.943	0.111	0.020	0.133	1.540	0.125
	Mean leveling	0.063	0.136	0.465	0.646							
	Mean satisfaction	0.027	0.111	0.245	0.808							
1	Mean praise	-0.048	0.320	-0.151	0.881	F(3, 28)	0.670	0.578	0.184	0.097	0.177	1.455	0.226
	Mean leveling	-0.055	0.139	-0.397	0.695							
	Mean satisfaction	0.138	0.106	1.307	0.202							
2	Mean praise	-0.011	0.340	-0.032	0.974	F(3, 27)	0.604	0.618	0.159	0.065	0.169	1.425	0.189
	Mean leveling	-0.005	0.139	-0.037	0.971							
	Mean satisfaction	-0.141	0.106	-1.339	0.192							
3	Mean praise	0.388	0.323	1.200	0.241	F(3, 26)	1.579	0.218	0.336	0.260	0.272	1.195	0.506
	Mean leveling	0.072	0.120	0.601	0.553							
	Mean satisfaction	0.179	0.090	1.986	0.058							

Note. SE = standard error.

Supplementary Table 11e.

Non-Significant Regression Analyses Addressing Hypothesis 6e and 6h Concerning More Meaningful

Time Lag	Predictor variable	Coefficient	SE	*t*	*p*	*F*		*p*	R^2	Adjusted R^2	Rho	Durbin-Watson	f^2
FTSE Range													
0	Mean numerical	3.950	11.144	0.354	0.726	F(3, 23)	2.447	0.089	0.378	0.296	0.032	1.912	0.607
	Mean concreteness	-9.166	8.672	-1.057	0.302								
	Mean ambivalence	-14.677	8.106	-1.811	0.083								
FTSE Standard deviation													
0	Mean numerical	0.621	3.219	0.193	0.849	F(3, 23)	2.606	0.076	0.330	0.242	0.031	1.913	0.492
	Mean concreteness	-2.613	2.472	-1.057	0.301								
	Mean ambivalence	-3.972	2.311	-1.719	0.099								
1	Mean numerical	3.789	3.215	1.178	0.251	F(3, 22)	4.379	0.015	0.365	0.278	-0.019	2.014	0.574
	Mean concreteness	-4.227	2.609	-1.620	0.119								
	Mean ambivalence	-3.998	2.303	-1.736	0.097								
2	Mean numerical	1.633	3.086	0.529	0.602	F(3, 21)	4.186	0.018	0.439	0.359	0.046	1.857	0.782
	Mean concreteness	-4.376	2.548	-1.718	0.101								
	Mean ambivalence	-4.249	2.214	-1.920	0.069								
3	Mean numerical	0.764	3.478	0.220	0.828	F(3, 20)	3.257	0.043	0.228	0.112	-0.110	1.802	0.296
	Mean concreteness	-5.966	3.127	-1.908	0.071								
	Mean ambivalence	-1.021	2.496	-0.409	0.687								
EOI													

0	Mean numerical	-0.098	0.303	-0.323	0.749	F(3, 29)	0.626	0.604	0.148	0.060	0.123	1.572	0.174
	Mean concreteness	-0.222	0.229	-0.972	0.339								
	Mean ambivalence	-0.095	0.237	-0.400	0.692								
1	Mean numerical	-0.243	0.310	-0.784	0.440	F(3, 28)	0.265	0.850	0.149	0.058	0.129	1.578	0.175
	Mean concreteness	0.102	0.233	0.438	0.665								
	Mean ambivalence	-0.001	0.239	-0.005	0.996								
2	Mean numerical	0.459	0.311	1.475	0.152	F(3, 27)	0.858	0.475	0.188	0.098	0.060	1.640	0.231
	Mean concreteness	-0.076	0.226	-0.336	0.740								
	Mean ambivalence	0.026	0.235	0.110	0.913								
3	Mean numerical	0.054	0.269	0.200	0.843	F(3, 26)	1.270	0.305	0.321	0.242	0.150	1.366	0.472
	Mean concreteness	0.109	0.224	0.488	0.630								
	Mean ambivalence	0.336	0.218	1.542	0.135								

Note. SE = standard error.

Supplementary Table 11f.

Non-Significant Regression Analyses Addressing Hypothesis 6f and 6h Concerning the Certainty Composite Variable

Time Lag	Predictor Coefficient	SE	*t*	*F*	*p*	R^2	Adjusted R^2	Rho	Durbin-Watson	f^2
FTSE Range										
0	-4.514	2.510	-1.799	F(1, 25)	3.235	0.084	0.353	0.327	0.010	1.960	0.546
1	-4.219	2.571	-1.641	F(1, 24)	2.694	0.114	0.332	0.305	-0.012	1.981	0.498
2	0.449	2.815	0.160	F(1, 23)	0.025	0.875	0.275	0.243	-0.047	2.075	0.379
3	-3.937	2.661	-1.479	F(1, 22)	2.188	0.153	0.223	0.188	-0.001	1.526	0.288
FTSE Standard deviation										
0	-1.272	0.703	-1.809	F(1, 25)	3.272	0.083	0.274	0.245	0.017	1.942	0.378
1	-1.304	0.707	-1.844	F(1, 24)	3.401	0.078	0.271	0.240	0.022	1.907	0.371
2	-0.470	0.784	-0.600	F(1, 23)	0.360	0.554	0.210	0.175	0.017	1.933	0.265
3	-1.106	0.710	-1.557	F(1, 22)	2.425	0.134	0.152	0.114	-0.004	1.561	0.180
EOI										
0	0.094	0.066	1.422	F(1, 31)	2.023	0.165	0.154	0.127	0.151	1.499	0.182
1	-0.017	0.071	-0.242	F(1, 30)	0.059	0.810	0.127	0.098	0.121	1.592	0.145
2	-0.033	0.073	-0.445	F(1, 29)	0.198	0.660	0.115	0.084	0.121	1.513	0.130

Note. SE = standard error.

Supplementary Table 11g.

Non-Significant Regression Analyses Addressing Hypothesis 6g and 6h Concerning the Optimism Composite Variable

Time Lag	Predictor Coefficient	SE	*t*	*F*		*p*	R^2	Adjusted R^2	Rho	Durbin-Watson	f^2
FTSE Range											
0	-3.084	1.981	-1.557	F(1, 25)	2.423	0.132	0.336	0.309	0.006	1.968	0.506
1	-2.945	2.037	-1.446	F(1, 24)	2.091	0.161	0.322	0.294	-0.022	1.999	0.476
2	0.276	2.154	0.128	F(1, 23)	0.016	0.899	0.275	0.243	-0.046	2.072	0.379
3	-1.928	2.177	-0.885	F(1, 22)	0.784	0.386	0.195	0.159	-0.033	1.547	0.243
FTSE Standard deviation											
0	-0.867	0.568	-1.526	F(1, 25)	2.329	0.140	0.254	0.224	0.011	1.952	0.340
1	-0.951	0.571	-1.665	F(1, 24)	2.773	0.109	0.261	0.231	0.016	1.915	0.354
2	-0.234	0.618	-0.378	F(1, 23)	0.143	0.709	0.206	0.171	0.012	1.947	0.259
3	-0.672	0.592	-1.135	F(1, 22)	1.289	0.269	0.123	0.083	-0.010	1.555	0.140
EOI											
0	0.089	0.053	1.682	F(1, 31)	2.828	0.103	0.173	0.146	0.136	1.549	0.209
1	0.017	0.056	0.310	F(1, 30)	0.096	0.758	0.128	0.099	0.131	1.555	0.147
2	-0.057	0.058	-0.989	F(1, 29)	0.977	0.331	0.129	0.099	0.139	1.472	0.149

Note. SE = standard error.