



Information Research – Vol. 31 No. iConf (2026)

An asymmetric echo: tracing social sentiment through economic cycles in a large-scale corpus of American newspapers

Zihan Zeng, Yingyu Wang, Xiaofan Ran, and Qi Li, Liang Zhao

DOI: <https://doi.org/10.47989/ir31iConf64248>

Abstract

Introduction. This study investigates the relationship between social sentiment and macroeconomic cycles in the United States from 1919–1937, a period of profound economic transformation. It aims to quantify and analyse public emotion dynamics across the economic expansion period, the downturn period, and the recovery period, seeking to identify patterns in how macrosocial and economic factors influence social sentiment.

Method. A computational approach was employed, using natural language processing (NLP) and the LIWC lexicon to conduct sentiment analysis on a large-scale corpus of digitised historical newspapers from the *Chronicling America* database.

Analysis. Quantitative sentiment tendencies were compared using analysis of variance (ANOVA) and independent samples t-tests to identify significant variations and correlations across the distinct economic periods.

Conclusion. Findings reveal an asymmetric correlation: while positive sentiment is pro-cyclical, negative sentiment was counterintuitively suppressed during economic downturns. We attribute this paradox to a dual mechanism of individual psychological compensatory control and macro-level governmental expectation management. This research provides a novel framework for historical sentiment analysis, challenging conventional narratives about public responses to crises and offering insights for contemporary public opinion governance.

Introduction

Human beings exist within social environments where external events often elicit emotional responses. Through processes of imitation and contagion during social interaction, these individual emotions may converge into collective social sentiment (Zhang et al., 2016). Social sentiment not only bears cultural and moral imprints but also reflects the shifts in the social environment and historical context, making its formation and evolution an important subject of scholarly inquiry in recent years.

Emotions are expressed and released through multiple channels, among which written records are especially significant. As a principal medium of text, newspapers play a vital role in this process. With their authenticity, timeliness, and agenda-setting capacity, newspapers both reflect social sentiment and shape public opinion and social behavior (Wang, 2011; Fu, 2022). Numerous studies have utilised newspaper archives to retrospectively examine social sentiment in specific historical periods. This body of research shows that *'historical events occurring during periods of structural social transformation are most likely to cause intense social emotions to erupt among various social groups, leading to collective creation and collective action'* (Sewell, 2021, pp. 241-255). Building on this line of research, the present study also focuses on a period of profound social transformation.

However, existing research on historical social sentiment often concentrates on major historical events over short durations, such as wars, social movements, or conflicts (Zhang, 2019; Liu & Cui, 2021; Zhu, 2015; Zhang, 2009; Zheng, 2019; Ru, 2011), thereby neglecting complete developmental stages. Moreover, retrospective studies are frequently hampered by the subjectivity and arbitrariness of manual text interpretation, and they lack standardised metrics for measuring emotional dimensions. To address these gaps, this study broadens the temporal scope to focus on the extended process of American social transformation from 1919 to 1937. At the same time, it applies quantitative methods to mitigate subjective bias, employing consistent indicators to investigate the characteristics and patterns of collective psychological behavior in large populations (Cao, Zhang, & Huai, 2021). This approach aims to more precisely capture the positive and negative sentiment under varying economic conditions and to enable comparative analyses across different stages.

Socioeconomic conditions are closely linked to people's quality of life and thus influence fluctuations in social sentiment. When individuals perceive favorable economic prospects, they tend to exhibit stable and positive social sentiment. Conversely, during recessions, a weakened sense of control over life may foster feelings of helplessness and negative emotions among the public (Wang & Wang, 2017; Tan & Ma, 2019). On this basis, the present study proposes two hypotheses:

H1: Positive social sentiment will be significantly higher during periods of favorable socioeconomic conditions than during periods of unfavorable socioeconomic conditions.

H2: In favorable socioeconomic conditions, positive sentiment will be significantly higher than negative sentiment.

Nevertheless, scholars on sudden public events have found that although negative emotions such as panic and anxiety are prevalent, people often display a stronger tendency to share positive emotions such as joy, trust, and sympathy (Qiu, Shen, Zhao, et al., 2020; Tausczik, Faasse, Pennebaker, et al., 2012; Yang & Ma, 2020; Zhu, Wu, Miao, et al., 2008). This phenomenon can be explained by Compensation Control Theory: when facing economic downturns or experiencing a lack of control, individuals may express positive emotions to reduce anxiety and uncertainty (Friesen, Kay, Eibach, et al., 2014; Huang, 2018; Wang, 2021; Zhong, 2020). Therefore, during an economic downturn, overall social sentiment may not necessarily tilt toward negative; in fact, positive sentiment may even outweigh negative sentiment.

On this basis, the study proposes two additional hypotheses:

H3: Negative social sentiment will not be significantly higher during periods of unfavorable socioeconomic conditions than during periods of favorable socioeconomic conditions.

H4: Under unfavorable socioeconomic conditions, negative sentiment will not be significantly higher than positive sentiment.

Grounded in social psychology theory, this study employs *the Chronicling America: Historic American Newspapers database* from the Library of Congress to conduct quantitative sentiment analysis, interpreting the results through statistical modeling. By examining this period of American economic history from both socio-psychological and emotional perspective, this research seeks to advance understanding of the intrinsic connections among social change, socioeconomic conditions, and social psychology.

Method

The dataset

This study uses the Chronicling America database (see Figure 1), an open-access database of U.S. historical newspapers. It was jointly created by the National Endowment for the Humanities and the Library of Congress. Currently, it contains over 13 million pages of newspapers, with the collection continuously expanding.

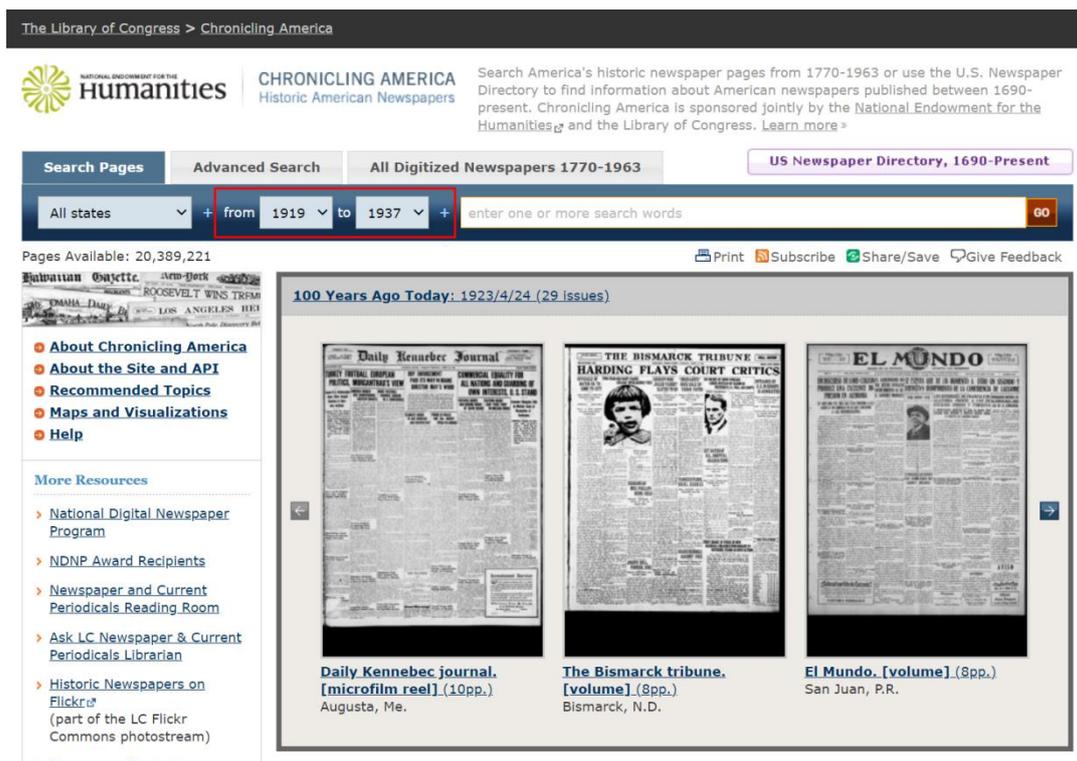


Figure 1. The interface of the Chronicling America database and the options for period selection

To quantify the sentiment tendency, this study employs the widely used LIWC (Linguistic Inquiry and Word Count) sentiment lexicon, which comprises 640 positive emotion words and 741 negative emotion words (Pennebaker et al., 2015). A multithreaded crawler program was developed in Python to traverse lexicon entries, submit the positive/negative emotion words as query requests, access newspaper results pages, and parse the extracted content into variables including date, publication name, total number of pages, query term frequency, and the total number of search

results encoded in the webpage source. The extracted data items from each returned result were then permanently stored in an Excel spreadsheet, forming the dataset for this study.

To generate a standardised measure of daily sentiment intensity, we formulated the equation (1):

$$\text{Emotion}_{m,d} = \frac{\sum \text{Freq}_{m,d,i}}{\text{COUNT}_{m,i} \times \sum \text{Page}_{m,d,i}} \quad (1 \leq m \leq 5) \quad (1)$$

where m denotes the social sentiment dimension, Freq the frequency of the i -th word in dimension m on day d , $\sum \text{Freq}_{m,d,i}$ denotes the total word frequency within dimension m on day d . Similarly, $\sum \text{Page}_{m,d,i}$ indicates the total number of newspaper pages on which all words in dimension m appeared on day d . Since words occur more often in newspapers with larger page counts, it is necessary to calculate the normalised word frequency concentration per newspaper page. $\text{COUNT}_{m,i}$ denotes the total number of words included in emotion dimension m . Because categories with more entries in the dictionary yield higher total word frequencies, standardisation across dimensions is required to account for differences in vocabulary size. Finally, $\text{Emotion}_{m,d}$ is calculated, representing the intensity value of emotion dimension m on day d .

Period division

Drawing on established literature and macroeconomic data, this study divides the period of American economic development from 1919 to 1937 into three distinct phases.

The first phase, from 1919 to 1928, is identified as a period of economic expansion. Zhu (2019) characterised this era as an ‘explosive boom’ for the American economy. The second phase, from 1929 to 1933, corresponds to the economic downturn, followed by the third phase of recovery from 1934 to 1937. This periodisation, particularly for the post-1929 years, is strongly supported by Gross Domestic Product (GDP) indicators, which provide robust quantitative evidence of economic performance. Data from Statista, an authoritative statistical database, confirm that 1929-1933 represented a sustained recession, while 1934-1937 exhibited a clear upward trajectory (see Figure 2). By integrating scholarly research with authoritative quantitative data, the periodisation adopted in this study rests on a scientifically sound foundation.

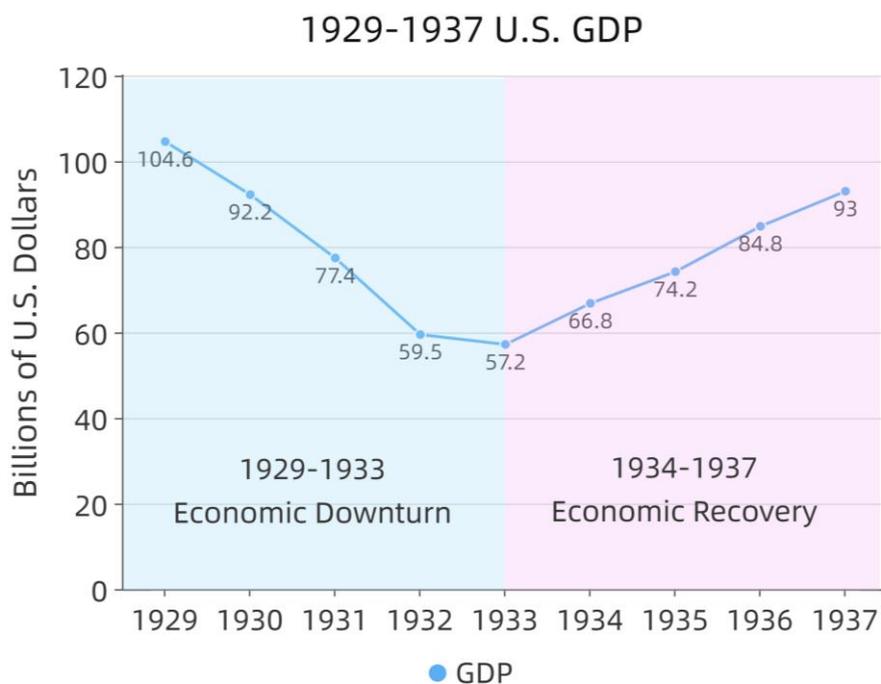


Figure 2. U.S. GDP trend from 1929 to 1937.

Data preprocessing

During data cleaning, instances of zero-word frequency were detected. Upon inspection, these were traced to page rendering failures during web scraping, which produced recognition errors. Such records were excluded from the dataset, resulting in 319,759 valid data points for analysis.

Prior to parameter testing, the sentiment variables were evaluated for normality. Both the Kolmogorov-Smirnov and Shapiro-Wilk tests yielded significance values below 0.05 ($p < .05$), and skewness z -scores greater than 3 indicated a moderate positive skew. To correct this non-normality and satisfy the assumptions of subsequent statistical tests, a logarithmic transformation was applied in the form $\ln(x + K)$, where K is a constant selected according to data characteristics.

After transformation, all emotional variables, as well as the positive emotion rate, approximated a normal distribution, meeting the requirements for further statistical analysis.

Results

Overall characteristics of social sentiment across different economic periods

Table 1 summarises the descriptive statistics and post-hoc test results (Tamhane's T^2 , $\alpha = 0.05$) for each sentiment dimension across economic periods. The constant K values used in logarithmic transformation for different comparison dimensions were as follows: $K = 12$ for positive and negative emotions, and $K = 4$ for the positive emotion rate.

Overall, positive sentiment reached its highest level during the expansion period, declined significantly during the downturn. Negative sentiment, by contrast, exhibited the opposite trend: it declined rather than increased during the downturn and continued to decrease in the recovery phase. The positive sentiment rate was highest in the expansion period, lowest in the downturn, and intermediate during recovery.

	Period1(1919-1928)		Period2 (1929-1933)		Period3 (1934-1937)		LSD
	Mean	SD	Mean	SD	Mean	SD	
Positive	4.124	1.054	3.677	1.103	3.606	0.998	A>B=C
Negative	3.547	0.812	3.374	0.946	3.204	0.904	A>B>C
Positive Emotion Rate	4.577	0.827	4.307	0.976	4.407	0.821	A>C>B

Table 1. Mean, Standard Deviation, and Post-Hoc test results for each sentiment dimension across different economic periods.

Note: A = Period 1; B = Period 2; C = Period 3; LSD = least significant difference test.

Period differences in positive emotions

ANOVA revealed a statistically significant difference in positive sentiment across the three economic periods ($F = 177.04, p < .001, \eta^2 = .049$), as illustrated in Figure 3. Post-hoc tests indicated that positive sentiment during the economic expansion period (Period 1) was significantly higher than during both the downturn (Period 2) and recovery (Period 3) ($p < .001$). However, the difference between the downturn and recovery periods was not significant ($p = .162$). These findings support Hypothesis H1, confirming a positive association between positive social sentiment and the socioeconomic environment.

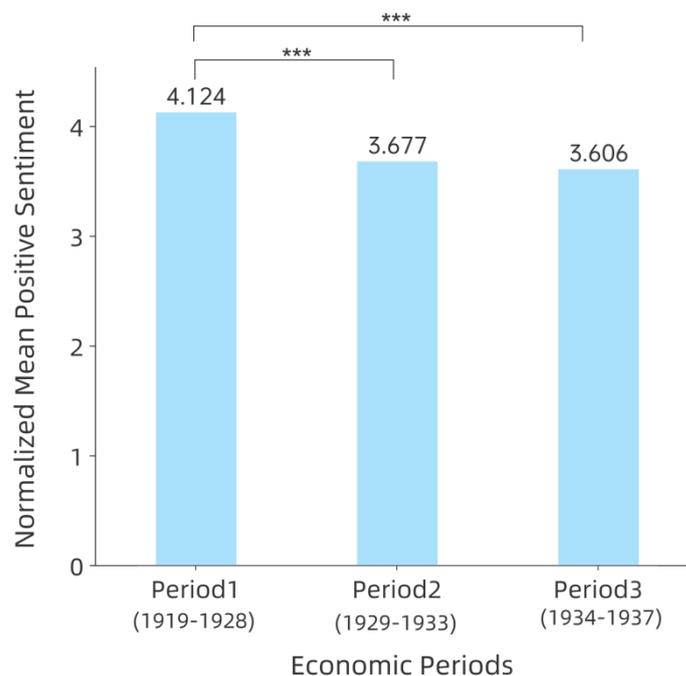


Figure 3. Mean positive emotion across economic periods with significance levels of between-group differences.

Period differences in negative emotions

A significant main effect of economic period was observed for negative sentiment ($F = 86.23, p < .001, \eta^2 = .024$), as shown in Figure 4. Notably, post-hoc comparisons revealed a counterintuitive pattern. Negative sentiment during the downturn (Period 2) was significantly lower than during

the expansion (Period 1; $p < .001$) and decreased further during the recovery (Period 3; $p < .001$). These findings support Hypothesis H3, indicating that the downturn did not lead to an increase in negative social sentiment; on the contrary, a suppressive trend was observed.

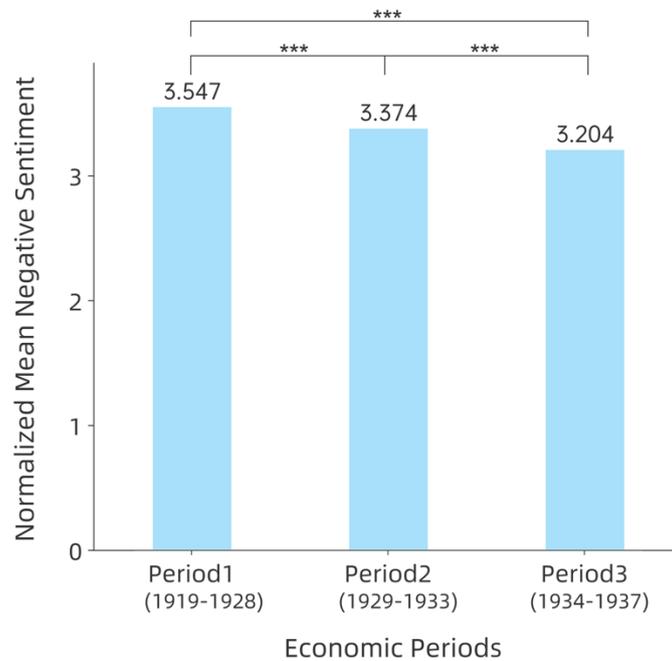


Figure 4. Mean negative emotion across periods with significance of between-group differences.

Comparison of emotional structure within economic periods

To examine the dominant sentiment within each period, independent samples t -tests were conducted to compare the intensity of positive and negative sentiment. Results indicated that in all three periods, the mean level of positive sentiment was significantly higher than that of negative sentiment ($p < .001$ for all comparisons; see Figure 5). In Period 1 (Expansion), positive sentiment ($M = 4.12, SD = 1.05$) was significantly higher than negative sentiment ($M = 3.55, SD = 0.81$), $t = 26.16, p < .001, Cohen'd = 0.61$. In Period 2 (Downturn), positive sentiment ($M = 3.677, SD = 1.103$) was significantly higher than negative sentiment ($M = 3.37, SD = 0.95$), $t = 8.82, p < .001, Cohen'd = 0.30$. In Period 3 (Recovery), positive sentiment ($M = 3.61, SD = 1.00$) was significantly higher than negative sentiment ($M = 3.20, SD = 0.90$), $t = 11.38, p < .001, Cohen'd = 0.42$. These findings support Hypotheses H2 and H4, demonstrating that positive sentiment remained dominant in the overall social emotional landscape, even during the economic downturn.

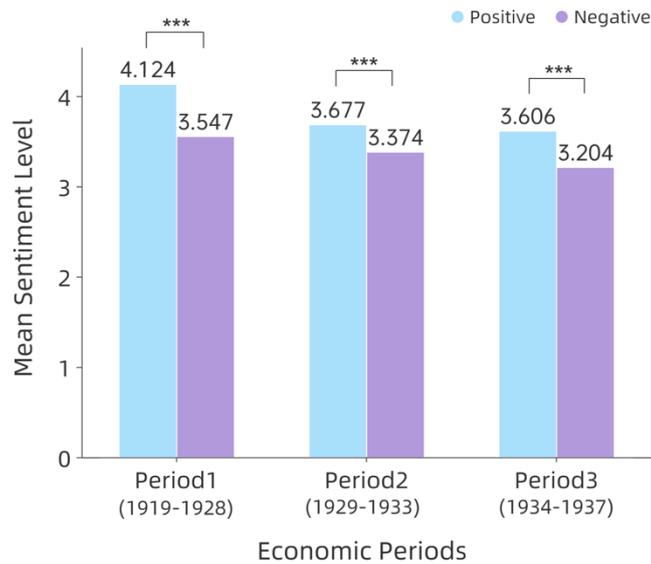


Figure 5. Comparison of positive and negative sentiment across the three periods.

To further investigate the dynamic changes in emotional structure, a positive-to-negative emotion ratio was derived from the raw sentiment scores. ANOVA revealed a significant main effect of economic period on this ratio ($F = 61.48, p < .001, \eta^2 = .018$), as illustrated in Figure 6.

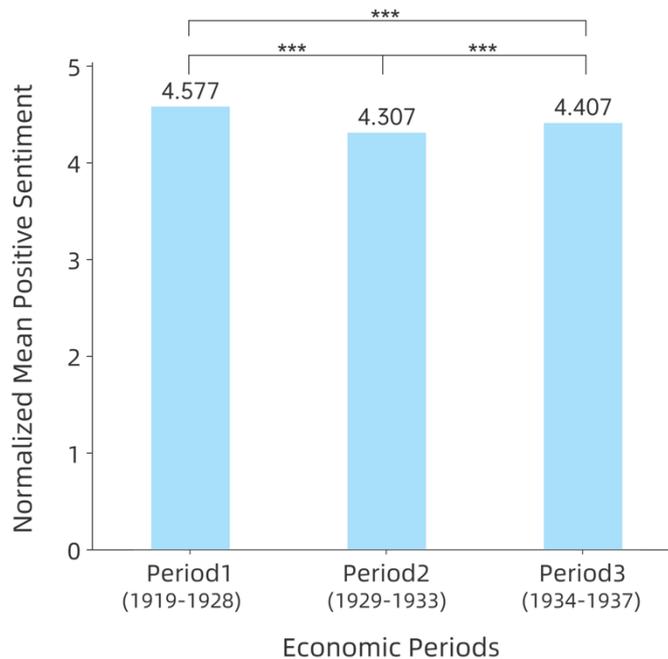


Figure 6. Mean positive sentiment rate and significance of between-group differences.

Post-hoc comparisons indicated that the positive sentiment rate was highest during the economic expansion period and lowest during the downturn, with the recovery period falling in between.

Notably, the rate during recovery was significantly higher than during the downturn ($p = .006$), demonstrating a clear upward trend. These results suggest that while a deteriorating economic environment suppresses public positivity, positive sentiment shows strong restorative capacity during the economic recovery phase, further confirming its resilience within the overall structure of social sentiment.

Discussion

This study employs NLP techniques combined with statistical analysis to conduct large-scale sentiment mining and measurement using digitised American newspapers from 1919 to 1937. The results reveal that positive sentiment was significantly elevated during periods of economic expansion. Contrary to conventional expectations, negative sentiment did not rise during economic downturns but instead appeared suppressed. Moreover, positive sentiment consistently exceeded negative sentiment across all three periods, collectively supporting all four research hypotheses.

These findings suggest a strong relationship between the orientation of social sentiment (positive or negative) and the quality of the macroeconomic environment. A favorable socioeconomic climate stimulates greater positive sentiment, whereas deteriorating conditions correspond with declines in positivity. Moreover, the lagged effects of economic downturns result in a prolonged recovery of positive sentiment, producing countercyclical trends relative to economic indicators at certain intervals. Within the context of a broader economic recession, immediate negative emotional responses are buffered by compensatory control mechanisms at both individual and national levels. Individuals may focus on positive aspects of events to regain a sense of control, while governments employ regulatory and expectation-management strategies to channel social negativity, prevent extreme group behaviors, and mitigate instability. The combined effect of these forces explains the observed phenomenon: negative sentiment does not rise, while positive sentiment continues to dominate.

By leveraging digital newspaper archives, this study represents the first long-term, large-scale quantitative retrospective analysis of social sentiment in early 20th-century America. It reconstructs historical social realities and challenges conventional assumptions. This approach establishes a novel paradigm for historical sentiment research, providing comparative insights for studies of other periods and nations. It also underscores the value of digital publishing resources in advancing humanities research by offering a rich empirical foundation for uncovering subtle patterns embedded within large textual datasets.

The findings further extend compensation control theory: when individuals experience reductions in control due to environmental change, they compensate by adjusting attitudes and expressions of emotion, thereby mitigating negative effects. Beyond theoretical implications, these insights carry practical relevance for contemporary public opinion governance and mindset development, highlighting the importance for governments to foster positive societal sentiment and a healthy collective outlook.

This study has several limitations. First, relying on newspapers as a proxy for social sentiment may introduce bias, as media outlets reflect vested interests and do not always accurately capture public opinion compared to modern social media. Second, sentiment analysis based on emotion dictionaries lacks contextual sensitivity, potentially producing discrepancies between genuine sentiment and extracted emotional cues. This discrepancy stems from the inherent limitation of dictionary-based methods—failure to fully capture context-dependent expressions like irony or metaphor. Future research could adopt context-aware approaches (e.g., BERT) to improve accuracy. Third, the historical periodisation adopted here may overlook internal nuances and contextual factors. Finally, newspapers are treated uniformly as reflections of public sentiment,

neglecting heterogeneity shaped by social class and other structural influences. These limitations highlight avenues for further in-depth research.

Acknowledgements

This work was supported by Intelligent Computing Laboratory for Cultural Heritage (Wuhan University), and the Key Research Project of Key Research Institute of Humanities and Social Sciences at Universities, Center for Studies of Information Resources, Wuhan University (Project No. WHXZ2022-06).

About the authors

Zihan Zeng is a master's student at the School of Information Management, Wuhan University. Her research interests primarily include user behavior and digital humanities. She can be contacted at 2020301041148@whu.edu.cn

Yingyu Wang is an undergraduate student at the School of Information Management, Wuhan University. Her research interests primarily include human-computer interaction (HCI) and digital humanities. She can be contacted at yingyuwang@whu.edu.cn

Xiaofan Ran gets her master's degree from the School of Information Management, Wuhan university. Her research interests include publishing science and digital humanities. She can be contacted at Dochi_xfran@outlook.com

Qi Li is a senior engineer at the Faculty of Psychology, Beijing Normal University. Her research interests primarily include social computing and computational psychology. She can be contacted at liqi2018@bnu.edu.cn

Liang Zhao is an associate professor at the School of Information Management, Wuhan University. She is the corresponding author of this paper. Her research interests include data mining and digital humanities. She can be contacted at liangzhao@whu.edu.cn

References

- Cao, T., Zhang, X., & Huai, A. (2021). Spatiotemporal analysis method of social emotions in public health emergencies: A case study of the COVID-19 epidemic. *Geography and Geo-Information Science*, 37(6), 16-23.
- Fu, W. (2022). Textual interpretation of Marx's thought on journalism and publishing and its contemporary enlightenment. *Journal of Xiamen University (Philosophy and Social Sciences Edition)*, 72(3), 9-20.
- Friesen, J. P., Kay, A. C., Eibach, R. P., et al. (2014). Seeking structure in social organisation: Compensatory control and the psychological advantage of hierarchy. *Journal of Personality and Social Psychology*, 106.
- Huang, Y. (2018). Compensatory control mechanism and empirical research for coping with out-of-control situations. (Master's thesis, Ningbo University).
- Liu, G., & Cui, K. (2021). Historical events and national crisis memory: The 'September 18th Incident' in newspaper media—Focusing on the 'Anti-Japanese War Newspaper Prose' in Shenbao in 1931. *Contemporary Literary Criticism*, 258(4), 183-188.

- Pennebaker J. W., Boyd R. L., Jordan K., Blackburn K. (2015). *The Development and Psychometric Properties of LIWC2015*. Austin, TX: University of Texas at Austin.
- Qiu, J., Shen, B., Zhao, M., et al. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: Implications and policy recommendations. *General Psychiatry*, 33(2), e100213.
- Ru, Y. (2011). An analysis of America's response to the Russian Revolution (1905-1920). *World History*, 207(2), 49-56+158.
- Sewell, W. H., Jr. (2021). *Logics of History: Social Theory and Social Transformation* (Zhu, L. B., & Fei, Y., Trans.). Shanghai People's Publishing House.
- Tan, R., & Ma, Y. (2019). The impact of non-capital function relocation on the residential intention and social emotions of the floating population in Beijing. *Urban Development Studies*, 26(12), 95-101.
- Tausczik, Y., Faasse, K., Pennebaker, J. W., et al. (2012). Public anxiety and information seeking following the H1N1 outbreak: Blogs, newspaper articles, and Wikipedia visits. *Health Communication*, 27(2), 179-185.
- Wang, F., & Wang, X. (2017). Does social emotion affect stock market returns—Evidence from Sina Weibo. *Journal of Shanxi University of Finance and Economics*, 39(2), 35-46.
- Wang, T. (2011). Modern Chinese newspapers and social history. *Journal of Anhui University (Philosophy and Social Sciences Edition)*, 35(2), 120.
- Wang, Y. (2021). Subjective interpretation of life course. (Master's thesis, Harbin Engineering University).
- Yang, H., & Ma, J. (2020). How an epidemic outbreak impacts happiness: Factors that worsen (vs. protect) emotional well-being during the Coronavirus Pandemic. *Psychiatry Research*, 289, e113045.
- Zhang, D. (2019). Observers' perspectives: The May 4th Movement in the view of British and American people in China and newspapers. *Republican Archives*, 136(2), 80-87.
- Zhang, J. (2009). The ruling party and the Shanghai press around 1949. *CPC History Studies*, 137(11), 64-74.
- Zhang, Q., Lu, J., Yan, Z., & Chen, C. (2016). The mechanism of emotional contagion. *Acta Psychologica Sinica*, 48(11), 1423-1433.
- Zheng, D. (2019). A study of British anti-German sentiment from the perspective of mass politics (1904-1914). (Master's thesis, Tianjin Normal University).
- Zhu, J. (2019). The development of the American automobile industry in the 1920s and its economic impact. (Master's thesis, Liaoning University).
- Zhu, X. (2015). A study of Shenbao and the Sino-French War. (Master's thesis, Anhui University).
- Zhu, X., Wu, S., Miao, D., et al. (2008). Changes in emotion of the Chinese public in regard to the SARS period. *Social Behavior and Personality: An International Journal*, 36(4), 447-454.
- Zhong, C. (2020). The impact of ritual actions on social pain and physical pain. (Master's thesis, Zhejiang Normal University).

© [CC-BY-NC 4.0](#) The Author(s). For more information, see our [Open Access Policy](#).