Work Engagement through Collective Emotions of Japanese Workers

Keywords: Collective emotions; *Social media; Work engagement; Pearson correlation networks; Temporal dynamics*

Extended Abstract

Collective emotions have attracted growing attention as an important research topic for understanding the overall atmosphere and trends of society. Social networking service (SNS) data provide a valuable source because individual emotional expressions are accumulated on a large scale in real time, making it possible to quantitatively capture the "public mood." Previous studies have developed long-term happiness indicators [1] and examined long-term fluctuations in Japan's collective emotions [2,3]. However, previous studies focusing on specific attributes, such as the occupational status of posters are limited. Japan is known for its demanding working conditions, such as long working hours and even "karoshi" (death from overwork), and surveys suggest that Japanese workers show relatively low levels of work engagement compared to international standards. Visualizing worker's emotions and motivation is therefore both socially and academically significant. This study focuses on Japanese workers' posts on SNS to analyze the temporal structure of positive and negative emotions and aims to quantify their collective emotions as well as clarify structural patterns of word usage. By analyzing the co-occurrence patterns of positive and negative emotions over time, the study explores how working conditions and leisure activities may be reflected in the structure of collective emotion networks.

The dataset consists of a one-tenth random sample of Japanese X (formerly Twitter) posts collected via the Hottolink API [4] from October 2020 to October 2024. A lexicon of labor-related words, as well as positive and negative words, was developed with reference to UWES (Utrecht Work Engagement Scale) [5] and validated against actual usage on X. The lexicon used in this study was divided into three categories: all, positive, and negative. The all lexicon contained labor-related terms such as *"work"* and *"company"*. The positive lexicon included words expressing positive emotions, and the negative lexicon included words expressing negative emotions. We counted posts combining labor-related terms with positive emotion words as positive work engagement, and those with negative emotion words as negative work engagement. This procedure enabled us to track the number of labor-related posts that also expressed either positive or negative emotions for each day of the study period. This data only includes publicly available posts, and no personally identifiable information was included or analyzed. We normalized the frequency data to construct an index of workers' emotions, following the previous study [2]. To adjust for differences in posting volume across individual words, we applied a square-root transformation to word frequencies. The average of these transformed values within each emotion category was then squared to define the overall index. The index was normalized using 2021–2023 as the baseline period, with the average during this period set to one. The normalized emotion indices responded to several social events (Figure 1), and Prophet[6]-based weekly trend analysis indicated that negative emotions decreased on Saturdays, while positive emotions increased on weekends. To analyze structural relationships among words, we computed Pearson's correlation coefficients of daily word frequencies, generated a null distribution by shuffling dates 100 times within each month, and set the 95th percentile of this distribution as the threshold. Only word pairs whose correlations exceeded this threshold were retained as

edges. Monthly networks were constructed, aggregated across months, and compared between weekdays and holidays. The aggregated networks (Figure 2) showed strong connections among words within the same emotion category. The weekday–holiday comparison showed that the word "頑張り" (effort) appeared frequently on weekdays, whereas " 頑張る" (encouragement) was more common on holidays, highlighting contextual differences.

This study demonstrates that workers' collective emotions, derived from SNS data, exhibit structural characteristics or word usage. Future research will link the networks with COVID-19–related indicators, such as case numbers, government restrictions, and economic indicators.

Acknowledgment
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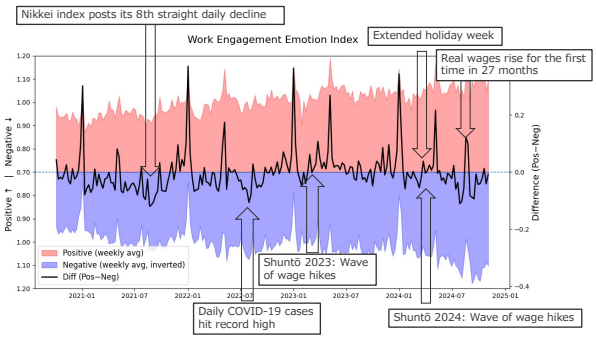

Figure 1 **Work Engagement Emotion.**
Normalized emotion scores were used to construct an index, which reflects collective reactions to social events.

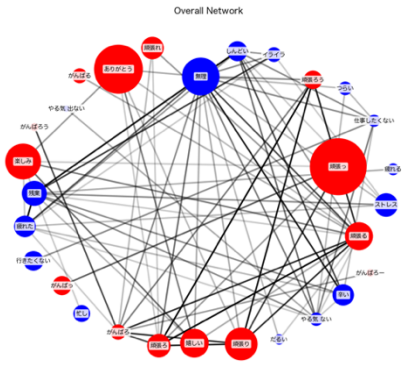

Figure 2 **Full-period Network.**
An overall network was constructed by aggregating monthly networks. Red nodes indicate positive words, while blue nodes indicate negative words.

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