Analyzing the Relationship Between Exercise Check-ins, Individual Personality, and Satisfaction Using Weibo Big Data

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Abstract

Check-in challenges have become prevalent across social media platforms. Does exercise check-in exert a positive influence on personal development? Through data mining techniques and employing Weibo exercise check-ins as an indicator, this study endeavors to analyze the performance of exercise-persistent individuals across various dimensions of the Big Five personality traits and life satisfaction indicators, thereby providing empirical evidence for the positive effects of exercise on individual life satisfaction and personal development. The results reveal that within high-frequency check-in cohorts, check-in frequency demonstrates significant negative correlations with agreeableness, extraversion, and openness; positive correlations with confidence in national government, satisfaction with social equity, satisfaction with social risk, and collective efficacy; and negative correlations with life satisfaction, income satisfaction, social status satisfaction, and confidence in local government.

Full Text

Preamble

The Relationship Between Exercise Check-ins and Individual Personality and Satisfaction: A Big Data Analysis of Weibo Posts

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With check-in activities flourishing online, does exercise check-in have a positive impact on individual development? This study attempts to use data mining

techniques, with Weibo exercise check-ins as an indicator, to analyze the performance of individuals who persist in exercise across Big Five personality traits and various life satisfaction indices, providing evidence for the positive influence of exercise on individual life satisfaction and personal development. Results reveal that for high-frequency check-in groups, check-in frequency is significantly negatively correlated with agreeableness, extraversion, and openness, positively correlated with national government confidence, social fairness satisfaction, social risk satisfaction, and collective efficacy, and negatively correlated with life satisfaction, income satisfaction, social status satisfaction, and local government confidence.

Keywords: exercise check-in, high-frequency group, social satisfaction, Big Five personality, correlation analysis

The adage "life lies in movement" is a well-worn topic, but are people who love exercise truly healthier across various physiological and psychological indicators? Numerous empirical studies have demonstrated that physical exercise has positive effects on health, including reducing overall mortality, improving musculoskeletal health and stress regulation, and decreasing the probability of heart disease, obesity, stroke, and various cancers (Lee IM et al., 2012). Rhodes and Smith (2006) conducted a meta-analysis revealing that motivation for physical exercise may be closely related to certain dimensions of the Big Five personality (such as extraversion, conscientiousness, and neuroticism). Simultaneously, physical exercise positively influences life satisfaction. However, few studies have analyzed the positive impacts of exercise by combining novel online platform check-in data with machine learning principles.

This study attempts to use data mining techniques, with Weibo exercise check-ins as an indicator, to analyze the performance of individuals who persist in exercise across Big Five personality traits and various life satisfaction indices, providing evidence for the positive influence of exercise on individual life satisfaction and personal development.

1.1 The Prevalence of Check-in Practices

With the popularization of social media platforms like Weibo and WeChat, the general public uses these platforms to share personal information, express emotions, and create personal spaces. Throughout this process of online social interaction and self-development, check-in behaviors for online learning and daily exercise are widespread, encompassing numerous intrinsic socio-psychological factors.

In his theory of everyday practice, de Certeau proposed that individuals have a need to possess their own "territory" in daily life practices. With rapid development of modern science and technology, the virtual dimension represented by mobile interfaces and various services is reflected in this "territory," such as social platforms like WeChat, Momo, and Weibo. While producers can define product style and function by occupying resources, users, though unable to own

their own "territory," still have a need to exert control over products, creating highly personalized "spaces" to possess their own "territory." Ma Xiaoxia (2017) discovered through interview surveys that the significance of Weibo check-ins lies in special locations, having companions present, and more importantly, the psychological state that exists during check-in. Whether Weibo users check in and their choice of check-in methods are constrained by their psychological choice to record life experiences and states. Weibo check-ins also provide opportunities for self-disclosure, reflecting the process of personal image construction, which involves subjective performance components to attract public attention. People generally possess a self-serving bias of being superior to others, and Weibo's characteristics of high subjectivity, freedom, and equal rights provide opportunities for individuals to escape subordinate status in real life and fully exert subjective initiative. Maslow's hierarchy theory proposes that the need for esteem must be satisfied for individuals to have self-confidence, recognize their self-worth, and feel satisfied with society. External esteem refers to the need for individuals to obtain affirmation of themselves through positive evaluations from others and status and honor conferred by society. Zhang Suoxun (2017) believes that likes and comments in WeChat Moments can make posters feel they are being constantly watched by seeing friends' feedback, thereby obtaining external esteem and being appreciated for their persistence. Simultaneously, their learning achievements also serve to lead and drive their friends in the social circle.

Bandura proposed self-efficacy, which in actual online society forms internet self-efficacy (ISE). Internet self-efficacy refers to netizens' belief and confidence in whether they can use various online behaviors to achieve certain goals. Bi Hongyin (2013) believes that netizens with high internet self-efficacy think that continuously sharing original content and blog posts can increase others' attention and recognition. This optimistic confidence in online behavior also drives check-in practitioners to continuously practice their daily lives through check-in methods.

1.2 Physical Exercise

(1) Physical Exercise and Mental Health

Research shows that regular physical activity has positive effects on both physiological quality (Hillman, Erickson, & Kramer, 2008) and psychological mood improvement (Kanning & Schlicht, 2010; Hyde, Maher, & Elavsky, 2013). As an effective way to improve mood, physical activity is more economical and effective compared to other leisure methods (such as watching movies and traveling) (Haskell et al., 2007; Khan, Marlow, & Head, 2008). Chekroud et al. (2018) conducted a cross-sectional study analyzing data from 1,237,194 individuals aged 18 or older from the U.S. Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System in 2011, 2013, and 2015, finding that physical exercise has a significant and meaningful association with self-reported mental health burden. After beginning physical exercise, the positive emotions brought

by physical activity become a driving force for individuals to continue exercising, urging them to maintain physical exercise (Dunton & Vaughan, 2008; Conner, Rhodes, Morris, McEachan, & Lawton, 2011; Catellier & Yang, 2013). Therefore, when individuals begin physical exercise, various bodily functions and physical health improve, and this positive feedback motivates exercising individuals to persist in physical exercise, creating a virtuous cycle.

(2) Neurophysiological Mechanisms of Exercise Promoting Health

Researchers have used Positron Emission Tomography (PET) technology to explore the relationship between exercise and endorphin release in the brain and the connection between endorphin release amount and emotion. Results found that when endorphin release in the brain increases (as shown through PET scans), the degree of mood change is greater (Boecker et al., 2008). Other studies have found that during or after exercise, endocannabinoids activate cannabinoid receptors in the brain's reward area, thereby producing reward responses and enabling exercisers to experience "Runner's High," which includes mood improvement, well-being, anxiety reduction, and post-exercise calmness (Dietrich & McDaniel, 2004; Ogles & Masters, 2003). Additionally, research has found that exercise increases dopamine release, which can alleviate or reduce negative emotions such as depression (O'neal, Dunn, & Martinsen, 2000).

Beyond hormone secretion, long-term physical activity may change the structure and function of the frontal lobe, with the most obvious impact on frontal lobe-dependent tasks (such as executive control tasks) (Kramer, Humphrey, Larish, Logan, & Strayer, 1994). Changes in hormone secretion and brain structure provide neurophysiological support for exercise promoting health and development.

1.3 Overview of Machine Learning and Measurement Indicators

(1) Machine Learning

Broadly speaking, machine learning refers to programming machines to learn autonomously, thereby achieving purposes that cannot be realized through human programming alone. However, in practical terms, machine learning is actually a method that uses models for prediction. In the process of predictive modeling, certain data must be utilized to ultimately train a model, which is then used for prediction. Supervised learning and unsupervised learning are two forms of machine learning. Supervised learning refers to machines learning from given data through extensive trial training to derive a function, which can then be used to analyze new data when imported. Classification and prediction are the main applications of supervised learning. Common supervised learning algorithms include regression analysis and statistical classification. Unsupervised learning establishes centers through K-means methods, using cyclic and decremental operations to minimize errors as much as possible for classification.

(2) Satisfaction

Satisfaction reflects individuals' subjective evaluation of social and personal states, with higher satisfaction levels indicating greater well-being. Satisfaction with different objects and environments also reflects individuals' specific subjective attitudes toward different dimensions such as society, individuals, or government. The satisfaction indicators adopted in this study can be specifically divided into life satisfaction, income satisfaction, social status satisfaction, national government satisfaction, local government satisfaction, national economic satisfaction, local economic satisfaction, social fairness satisfaction, national government confidence, local government confidence, collective behavior intention, etc. Multiple surveys targeting college students and the elderly have shown that life satisfaction is closely related to sports (Du Huiling, 2015).

(3) Personality

Openness, conscientiousness, extraversion, agreeableness, and neuroticism/emotional stability are the five dimensions of the Big Five personality. This model currently has in-depth applications in clinical, health, developmental, and management psychology.

Pang Liang and Zhao Junrong (2013) found through research that college students who like and participate in sports activities show significantly improved mental health levels; whether college students participate in sports activities also shows significant differences in the personality traits of extraversion and neuroticism; college students' participation in sports activities is significantly correlated with mental health and personality traits. Zhang Guoquan (2015) found that exercise motivation can be predicted through personality. After surveying Chinese college students, it was concluded that conscientiousness, extraversion, and agreeableness are key dimensions of their exercise motivation. Different populations are suited to different personality prediction models. For example, the neuroticism dimension is closely connected with male exercise motivation, while the extraversion dimension is closely related to only children's exercise motivation. This differs somewhat from foreign research, which considers neuroticism as the main dimension for predicting exercise motivation, while this research shows agreeableness. Considering the difference between Chinese collectivism and foreign individualism, the different predictive dimensions may be related to individuals' socio-cultural environment.

In this study, we used Python programming language to crawl exercise check-in related data from Weibo users, applied machine learning principles to obtain and organize indicators such as satisfaction and Big Five personality, and combined psychological methods to analyze and interpret the data. This study hypothesizes that Weibo users with higher check-in frequency have higher social satisfaction levels and show significant differences in Big Five personality dimensions.

2.1 Participants

Based on predetermined exercise check-in keywords, we used Python 3.6 to randomly conduct web crawling of some Sina Weibo users' posted content from the past three years. We ultimately obtained check-in information and related Weibo data and content from 8,000 users. We selected the top 1% of users by check-in frequency as the high-frequency exercise check-in group and analyzed their related information. A total of 793 Weibo users were included in the high-frequency check-in group, including 115 males and 678 females. The average number of check-ins for high-frequency check-in group members was 38 times.

2.2 Web Crawling Keywords

The keywords selected for web crawling were "exercise check-in," "running check-in," "fitness check-in," and "workout check-in."

2.3 Social Attitude and Big Five Personality Analysis

We established social satisfaction analysis models and Big Five personality analysis models based on previous experience and trained the models. We then analyzed users' social satisfaction and Big Five personality traits according to their Weibo content. Social satisfaction can be specifically measured as life satisfaction, income satisfaction, social status satisfaction, national government satisfaction, local government satisfaction, national economic satisfaction, local economic satisfaction, social fairness satisfaction, national government confidence, local government confidence, collective behavior intention, etc.

2.4 Data Analysis

Based on data obtained from the machine learning models, we conducted descriptive statistics on the scores of various social satisfaction indicators and the five Big Five personality traits for the high-frequency exercise check-in group, and performed correlation analysis between exercise check-in frequency and each indicator.

3.1 Correlation Analysis Between Exercise Check-in Frequency and Social Satisfaction Indicators

Exercise check-in frequency was negatively correlated with life satisfaction ($r = -0.091$, $p = 0.011$), income satisfaction ($r = -0.082$, $p = 0.021$), social status satisfaction ($r = -0.151$, $p < 0.001$), and local government confidence ($r = -0.104$, $p = 0.003$), and showed a negative correlation trend with local economic satisfaction ($r = -0.066$, $p = 0.064$). Exercise check-in frequency was positively correlated with national government confidence ($r = 0.105$, $p = 0.003$), social fairness satisfaction ($r = 0.102$, $p = 0.004$), social risk satisfaction ($r = 0.166$, $p < 0.001$), and collective efficacy ($r = 0.128$, $p < 0.001$), and showed a positive

correlation trend with national government satisfaction (r = 0.059, p = 0.096). Exercise check-in frequency showed no significant correlation with local government satisfaction (p = 0.619), national economic satisfaction (p = 0.165), anger emotion (p = 0.245), or collective behavior intention (p = 0.365).

3.2 Correlation Analysis Between Exercise Check-in Frequency and Big Five Personality Traits

Exercise check-in frequency was negatively correlated with agreeableness (r = -0.186, p < 0.001), extraversion (r = -0.236, p < 0.001), and openness (r = -0.203, p < 0.001), and showed a negative correlation trend with conscientiousness (r = -0.066, p = 0.062). No significant correlation was found with neuroticism (p = 0.458).

Based on the data analysis results, we can conclude that for high-frequency check-in groups, exercise check-in frequency is negatively correlated (or shows a negative trend) with life satisfaction, income satisfaction, social status satisfaction, local government confidence, and local economic satisfaction—meaning that individuals with more check-ins have lower satisfaction with their life, income, and social status. Exercise check-in frequency is positively correlated (or shows a positive trend) with national government confidence, social fairness satisfaction, social risk satisfaction, collective efficacy, and national government satisfaction—meaning that individuals with more check-ins are more satisfied with these indicators. Regarding the Big Five personality dimensions, exercise check-in frequency is negatively correlated (or shows a negative trend) with agreeableness, extraversion, openness, and conscientiousness—meaning that individuals with more check-ins score lower on these dimensions.

Motivation is a goal-directed, stimulating, and sustaining psychological process that arises within humans and forms the internal basis for human behavior (Rayn et al., 2000). Push motivations are a specific branch of motivation and also a psychological theory. Push motivations refer to the process by which people propel themselves toward goals or achieving certain objectives, such as desires for prestige, health and fitness, adventure, and social interaction (Uysal et al., 1994). Push motivations can be positive factors or negative forces. Through research on social networks, it has been found that this negative force is typically regret and dissatisfaction (Chang et al., 2014). This aligns with our data analysis results. High-frequency exercise check-in groups often have lower scores on evaluations closely related to personal life, such as life satisfaction and income satisfaction. Exercise can be understood as part of an individual's efforts to change their life; dissatisfaction with one's environment and the desire to improve quality of life motivate high-frequency check-in groups to engage in higher-frequency exercise. Maslow's hierarchy of needs theory posits that people actively pursue and fulfill safety-level needs. High-frequency check-in groups maintain their physical and mental health through regular exercise and also prevent loss of property and career through a series of changes beginning with fitness exercise. This is an exploration of the exercise motivation and habits of

high-frequency check-in groups. Regarding check-in behavior, American sociologist Erving Goffman believed that human nature is performance, with the stage being everyday life. During social interaction, people continuously change their actions according to the situation. The performance stage can be divided into front stage and back stage. The front stage is the area where ongoing performance can be seen by others, while the back stage is the area that cannot be seen by others. Content presented on social media platforms is mostly private back-stage content. However, the back-stage content on social platforms is not all back-stage content but rather "front-stage" content that has been screened and can be seen by others. This process is called "impression management" (Ma Xiaoxia, 2017). Frequently sharing one's exercise status is also a process of constructing self-image. This high-frequency check-in behavior also aligns with Maslow's theory. High-frequency check-in groups construct healthy, positive, and upward images through exercise check-ins, hoping to obtain internal and external respect, which is part of self-actualization.

Attitude is a relatively stable psychological cognition of individuals toward specific objects, including subjective evaluations and derived behavioral tendencies. High-frequency exercise check-in groups show high national government satisfaction and confidence. The cognitive function of attitude suggests that individuals' behavioral patterns are supported by beliefs provided by attitude, enabling stable orientation of cognition and behavior toward objects, similar to the functions of schemas and frameworks. The value-expressive function of attitude suggests that individuals' expression of core self-concept values cannot be separated from attitude. Therefore, the satisfaction and confidence shown by high-frequency check-in groups at the national and social levels reflect their correct values and continue to drive them to obtain internal satisfaction and achieve self-worth through these values and sense of responsibility. Collective efficacy is a term in criminological sociology that refers to community members' ability to control individuals and collectives within the community. High collective efficacy is conducive to building orderly communities and public environments (Sampson et al., 1997). People who can persist in exercise and check-ins are often more self-disciplined and good at self-control. This may be why high-frequency check-in groups are positively correlated with collective efficacy.

Some domestic research has revised the Big Five Inventory (BFI-44) and established norms. The norms have means of 22.98-31.83 across the five dimensions, with standard deviations of 3.835-5.309 (Zhu Xiaojia, 2012). According to normal distribution, moderate scores are within one standard deviation of the mean, low scores are 1-2 standard deviations below the mean, very low scores are more than 2 standard deviations below the mean, high scores are 1-2 standard deviations above the mean, and very high scores are more than 2 standard deviations above the mean. Our trained results show that high-frequency check-in groups have average scores of 49.95-58.8 across the five Big Five personality (BFI-44) dimensions, all at very high levels. High neuroticism (N) scores suggest that high-frequency check-in groups may experience anxiety in life and

tend to have psychological stress. High extraversion (E) scores indicate that high-frequency check-in groups are sociable and have positive personality traits such as optimism, friendliness, and confidence. High openness (O) scores suggest that high-frequency check-in groups generally have exploratory attitudes, can think independently, and may have more interests and hobbies. High agreeableness (A) scores indicate that high-frequency check-in groups have friendly attitudes toward others, are willing to help, and emphasize cooperation. High conscientiousness (C) scores suggest that high-frequency check-in groups are planning-oriented and can persist for long periods.

Based on data analysis and discussion, we can conclude that high-frequency check-in groups attempt to change their mindset and improve their lives through high-frequency exercise in daily life. They also hope to construct a good self-image and obtain respect and responses through post-exercise check-ins. We generally hold an encouraging attitude toward this, believing that more people, especially young people, can enrich their lives through positive and suitable physical exercise, bringing about good quantitative and qualitative changes. Regarding issues involving the nation and society, high-frequency check-in groups demonstrate mature and excellent qualities. According to attitude-related theories, their satisfaction and confidence in the nation and society will correctly guide their future behavior, forming a virtuous cycle to ensure good social order. Furthermore, high-frequency check-in groups show high scores across all five Big Five personality dimensions, proving that although they may have some psychological stress, it also brings them motivation to some extent, helping them pursue better lives based on mature and complete personality qualities.

References

[1] Wang Di, Xie Bin. Promoting College Students' Exercise Behavior: The Contribution of Exercise Intensity Preference and Exercise Intensity Tolerance to TPB[A]. Sports Psychology Branch of China Sport Science Society, Sports Psychology Professional Committee of Chinese Psychological Society. Abstracts of the 11th National Conference on Sports Psychology (Post-Conference Edition)[C]. Sports Psychology Branch of China Sport Science Society, 2018:1.

[2] Ma Xiaoxia. Analyzing WeChat Users' Check-in Practices from the Perspective of Everyday Practice Theory[J]. New Media Research, 2017, 3(22):30-32.

[3] Xiao Kaijun, Liu Zhongqiang. Exploring the Different Effects of Fitness Levels on Human Health Based on Big Data Models[A]. Hong Kong Health Pharmaceutical Co., Ltd. Proceedings of the 2017 Boao Medical Forum[C]. Hong Kong Health Pharmaceutical Co., Ltd.: Hong Kong New Century Cultural Publishing Co., Ltd., 2017:1.

[4] Zhang Suoxun. Analysis of WeChat Sharing Motivations of Mobile Learning APP Users[J]. Communication World, 2017(09):285-286.

[5] Jiang Yan. Research on the Influence Mechanism of Urban Residents' Leisure

Skills on Well-being—A Case Study of Hangzhou[J]. Journal of Chongqing Jiaotong University (Social Sciences Edition), 2015, 15(06):41-47+60.

[6] Zhu Jinwei. Empirical Evidence for Lifestyle Improving Mental Health[J]. Journal of Shaanxi Normal University (Philosophy and Social Sciences Edition), 2015, 44(05):123-128.

[7] Xu Yaling. A Study on the Intervention of Mindfulness Training on Prosocial Behavior of Rural Left-Behind Children[D]. Nanjing University, 2015.

[8] Zhang Guoquan. A Study on Personality Predicting College Students' Exercise Motivation[J]. Journal of Bohai University (Philosophy and Social Sciences Edition), 2015, 37(01):117-121.

[9] Jiang Changhao, Chen Tingting. The Influence of Physical Activity on Emotion and Its Brain Mechanism[J]. Advances in Psychological Science, 2014, 22(12):1889-1898.

[10] Shi Zhenguo, Zhao Yihu. Experience: A Psychological Perspective for Interpreting the Implication of Leisure Sports[J]. China School Sports (Higher Education), 2014, 1(01):19-22.

[11] Bi Hongyin. Analysis of Netizens' Psychological Factors Affecting Weibo Information Dissemination[J]. Journal of Tianjin University (Social Sciences Edition), 2013, 15(04):311-314.

[12] Pang Liang, Zhao Junrong. A Study on the Correlation Between Sports Activities and College Students' Mental Health and Personality Traits[J]. Journal of Huaihai Institute of Technology (Humanities & Social Sciences Edition), 2013, 11(07):40-43.

[13] Li Haiting. An Investigation on the Personality Traits and Types of College Students Participating in Different Sports Projects[D]. Beijing Sport University, 2007.

[14] Zhu Xiaojia (2012) Preliminary Revision of the Big Five Inventory (BFI). Yangzhou University.

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Note: Figure translations are in progress. See original paper for figures.