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Happiness on wheels: what makes cyclists happy?

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ABSTRACT

Physical exercise has been shown to promote psychological well-being. This study is the first to test the relationship between cycling and happiness and to identify the factors associated with the joy of cycling in Hong Kong, a Chinese community with low bicycle usage. The data were collected through an 8-week diary study ($N = 443$; 3536 observations), including reports of happiness after each bike ride. A multilevel model was used to examine the effects of weather conditions on the relationship between cycling and happiness, controlling for covariates such as weekday/weekend, type of cyclist, number of peers, age, and gender. A subsample ($n = 200$; 2874 observations) completed the Big Five personality questionnaire, allowing us to map the relationship between personality, cycling, and happiness. The results showed that the issuance of a thunderstorm warning, a red rainstorm warning, or a tropical cyclone warning signal diminished cyclists' happiness. Furthermore, individuals who scored higher in extraversion and agreeableness derived more happiness from cycling. Overall, the findings suggest that the relationship between cycling and happiness is not linear, as weather conditions and personality differences significantly influence the enjoyment derived from cycling. Happy cyclists tend to be extraverted and agreeable, and prefer to cycle in good weather. These findings offer valuable implications for mental health promotion in everyday life.

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Lay summary

We sought to identify the factors associated with happiness after cycling using data from an 8-week diary study in which cyclists reported their level of happiness after each ride. We found that happy cyclists tend to be extraverted and agreeable, and that they prefer to cycle in good weather.

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Implications

- Cycling in good weather can enhance mental well-being in a Chinese community with low bicycle usage, offering valuable insights for urban planning.
- Community education regarding the relationship between happiness, cycling, and adverse weather conditions (thunderstorm warning, red rainstorm warning, and tropical cyclone warning signal) can enhance individuals' awareness of the importance of regulating their happiness by cycling at the right time.
- Community education about cycling and personality traits could maximise the mental health benefits of cycling.

The relationship between physical activity and well-being has received considerable attention in psychological and health research (e.g., Fossati et al., 2021; Herbert, 2022). Physical activity, including cycling, significantly enhances happiness and overall mental health (Bauman et al., 2022; Buecker et al., 2020; Silva et al., 2023; Xu et al., 2022). Meta-analyses have consistently demonstrated that physical activity is associated with reduced symptoms of depression and anxiety, highlighting its critical role in promoting psychological health (Mahindru et al., 2023). As a form of aerobic exercise, cycling has been shown to offer similar benefits (e.g., Berrie et al., 2024; Ma et al., 2021). However, most studies have focused on communities with high bicycle usage in Europe and the U.S., where cycling facilities are well established (e.g., Shaker et al., 2021; Wild & Woodward, 2019). In contrast, our study focused on Hong Kong, a Chinese community consistently with low bicycle usage and only one bike-sharing platform (Zhang et al., 2025).[1] We empirically tested the relationship between cycling and happiness in a large sample using an 8-week experience sampling method, during which cyclists reported their level of happiness after each bike ride. The results can inform urban development strategies.

The endorphin hypothesis

Serving both as a leisure activity and as a mode of transportation, cycling has been found to be positively associated with subjective well-being (Tian et al., 2020). Cyclists consistently report higher levels of happiness than sedentary people (Fan et al., 2025; Friel et al., 2024; Roberts et al., 2018). Cycling is often perceived as more relaxing and enjoyable than commuting by car or public transport (Fan et al., 2019; Glasgow et al., 2019; Lancée et al., 2017; Mokhtarian et al., 2014). Competitive mountain cyclists have reported enhanced mental health and well-being from their cycling experiences (Roberts et al., 2018). Research also suggests that physical activities programmes that align with young people's values and technological preferences can increase their likelihood of participating in physical activities (Piepiora et al., 2024). For example, a sports programme that uses a popular fitness app to track progress and share achievements with friends can motivate more youth to participate. Taken together, this line of research highlights the multifaceted benefits of cycling as a contributor to mental health and overall life satisfaction, suggesting a potential link between physiological responses and cycling.

The endorphin hypothesis (Boecker & Dishman, 2013) posits that physical exercise triggers the release of endorphins, which are natural chemicals that help relieve pain and improve mood. This physiological response to exercise often leads to a feeling of euphoria

commonly referred to as "runner's high." During aerobic activities, the body experiences physiological changes including an increase in heart rate and blood flow, which stimulate the release of endorphins by the pituitary gland and hypothalamus. Boecker et al. (2008) showed that endorphins bind to opioid receptors in the brain, resulting in pain relief and heightened feelings of happiness. Although the endorphin hypothesis offers a compelling explanation for the positive relationship between happiness and cycling, it does not explain how other factors, such as cycling ambition, social interactions, and environmental conditions, moderate the effect of cycling on happiness (see Kesenheimer et al., 2023).

Weather conditions

Weather conditions could moderate the relationship between cycling and happiness. Previous studies have generally focused on how weather conditions affect the performance of transport systems, including traffic accidents, disruptions, and maintenance costs (Dwivedi & Soni, 2024; Gössling et al., 2023), but there is a growing interest in understanding how these conditions affect psychological well-being.

Temperature, precipitation, and wind have been shown to significantly influence the mood and well-being of cyclists. For instance, Ettema et al. (2017) found that sunny weather could increase negative mood in cyclists. Böcker et al. (2013) reported that cyclists exhibited lower mood levels in dark and gloomy conditions or extreme temperatures. St-Louis et al. (2014) found that both cycling and walking received lower satisfaction ratings during Canada's cold, snowy winters, with cyclists being particularly affected. Furthermore, a recent study showed that the number of people using bike-sharing systems in China fell during weather conditions such as rain, high humidity, and high temperatures, emphasising the possible negative impact of adverse weather conditions on cycling activities (Li et al., 2021). These findings highlight the need to further explore the impact of different weather conditions on cyclists' emotional experiences within a single study.

In this paper, we tested the moderating effects of different weather conditions on the joy of cycling in the first-ever study conducted in Hong Kong, a Chinese community with low bicycle usage. Specifically, we focused on four weather warnings:[2] (a) very hot weather warnings, indicating high temperatures that may pose health risks; (b) thunderstorm warnings, signalling thunderstorms characterised by lightning and heavy rain; (c) rainstorm warnings, forecasting significant rainfall that could lead to flooding and other adverse outdoor conditions; and (d) tropical cyclone warnings, indicating severe tropical storms accompanied by strong winds and heavy rain. Together, these conditions present distinct challenges that can significantly impact the cycling experience in the community.

Personality of happy cyclists

Research has shown that personality traits significantly affect physical activity levels, including cycling. The concept of "personality" is well summarised by the Big Five personality traits, namely neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness (McCrae & John, 1992), which have been extensively studied in the context of cycling (Kesenheimer et al., 2023). Extraversion and conscientiousness have been linked to higher levels of physical activity, while neuroticism has often been associated with lower levels of activity, possibly due to increased anxiety and self-consciousness

(Rhodes & Pfaeffli, 2012). Meta-analyses have found that agreeableness does not have a significant influence on physical activity levels, suggesting that the propensity for cooperation and social harmony does not directly translate into higher participation in physical activity (Rhodes & Smith, 2006; Wilson & Dishman, 2015). The results regarding openness to experience remain inconclusive, although some studies have reported a weak positive correlation, suggesting that individuals who are open to new experiences may be more inclined to try different forms of exercise (Rhodes & Smith, 2006; Wilson & Dishman, 2015). Further investigation is needed to fully understand how personality influences the enjoyment of cycling. In this study, we examined the role of the Big Five personality traits in moderating the happiness–cycling relationship.

Experience sampling

Most studies on the relationship between cycling and happiness have relied on a cross-sectional design that collects retrospective happiness data at a single point in time (e.g., Fan et al., 2021; Ma et al., 2021). These studies have failed to collect real-time data on individuals' emotions and experiences during actual bike rides, thereby overlooking important fluctuations in mood and the contextual elements that contribute to the overall cycling experience. It is well known that emotional data are susceptible to memory bias during information retrieval (Sharma et al., 2023).

To overcome the limitations of cross-sectional designs, we used an experience sampling method in which cyclists reported their level of happiness after each bike ride during the 8-week study period. These data offered deep insights into the dynamic interplay between cycling, happiness, and external variables over time (Dejonckheere et al., 2022). This technique allows researchers to carry out assessments in real-life circumstances, to collect ecologically valid data across a wide range of everyday situations (see Yik & Siu, 2024, 2025). The resulting data provide more accurate inferences about the relationship between happiness and cycling over 8 weeks, while accounting for the nested structure of the data (Tuerlinckx et al., 2025).

The current study

Our study aimed to answer the following questions: "What makes cycling enjoyable?" and "What personality traits are associated with happy cyclists?" First, we used multilevel modelling to reveal the relationship between cycling and happiness. Second, we examined how personality traits influenced the cycling–happiness relationship while considering weather conditions and demographics. The results can be used to derive theoretically sound interventions that promote physical activity and enhance mental well-being through cycling. Overall, our results underscore the multifaceted benefits of cycling, both as a form of exercise and as a means of transportation, ultimately contributing to a healthier and happier society.

Method

Data collection and participants

In total, 443 participants (43.34% female, $M_{age} = 32.77$, $SD_{age} = 9.76$), aged at least 18 years and had resided in Hong Kong for at least 5 years, were recruited through social media,

mass invitation emails, and advertisements on the bike-sharing platform app Locobike. Our sample size was informed by power and sample size estimation, aiming for 80% power to detect a moderate effect (Cohen's d ≈ 0.50) at α = 0.05. We recognised the necessity of a relatively large sample for multi-level modelling to ensure sufficient variability across different levels and individuals, as recommended by Snijders and Bosker (2011), which suggests at least 30–50 individuals per level for stable estimations. Therefore, the current recruitment of over 400 participants is deemed adequate and sufficient for the study.

The participants completed a survey measuring their level of happiness after each bike ride during the 8-week diary study. The average number of bike rides during the study period was 7.98 (SD = 12.62). These responses were used to examine the effect of weather conditions on cycling behaviour and overall happiness. Among the 443 participants, 200 (37.50% female, $M_{age} = 34.72$, $SD_{age} = 9.67$) also completed post-diary questionnaires, including a personality inventory. The data from this subsample were used to conduct a more focused analysis of how personality traits influence cycling behaviour and happiness levels, while controlling for weather conditions.

Procedure

The 8-week study was conducted from 26 July to 18 October 2024. Data collection was conducted through the Locobike app on mobile devices. All materials were presented in traditional Chinese, and the study protocols were approved by the Human and Artefacts Research Ethics Committee of HKUST. The study was divided into three parts (see Table 1). During the pre-diary session, 443 participants gave their informed consent and answered demographic questions, including age, gender, years of residence in Hong Kong, and type of cyclist. All of the participants began the 8-week diary study one day after completing the pre-diary survey, during which they completed the happiness survey after each bike ride. Following the 8-week cycling diary session, a subsample of 200 participants completed the NEO Five-Factor Inventory (NEO FFI; Costa & McCrae, 1992) and the Satisfaction with Life Scale (SWLS; Diener et al., 1985).

During the cycling diary session, the participants indicated the number of people accompanying them before starting their ride. After completing the ride, they rated their current feeling of pleasure using four affect adjectives (i.e., "happy," "pleased," "content," and "satisfied") selected from the "pleasure" segment of the 12-Point Affect Circumplex (Yik et al., 2011; see also Yik, 2009), on a 5-point scale ranging from 0 (*not at all*) to 4 (*extremely*). The overall level of happiness was computed by averaging the four item

Table 1. Data collection during the three sessions in 2024.

Session	Dates	Study Day	Measures
Pre-diary	26 July to 19 August	0	• Consent form • Demographics
Cycling diary	27 July to 14 October	1–57	• Number of peers riding together • Ratings on four pleasure items
Post-diary	21 September to 1 November	Upon completion of the cycling diary	• NEO Five-Factor Inventory • Satisfaction with Life Scale

scores, resulting in a possible score ranging from 0 to 4. Cronbach's alpha for the scale was 0.96 for both the full sample and the subsample.

Measures

Weather conditions

To assess the impact of weather conditions on happiness during cycling, we scraped weather data from the Hong Kong Observatory, including very hot weather warnings, thunderstorm warnings, rainstorm warnings, and tropical cyclone warnings. These weather variables, along with the day of the week, were included in the analyses to explore their potential influence on the participants' happiness while cycling.

NEO Five-Factor Inventory (NEO FFI)

The NEO FFI (Costa & McCrae, 1992) consists of 60 statements measuring five factors: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. The participants were asked to rate their degree of agreement with each statement on a 5-point scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). In this study, Cronbach's alpha values were 0.86 for neuroticism, 0.77 for extraversion, 0.68 for openness to experience, 0.71 for agreeableness, and 0.80 for conscientiousness (see Yik et al., 2023; Yik et al., 2026).

Satisfaction with Life Scale (SWLS)

To assess life satisfaction, the participants indicated their degree of agreement with each of the five statements (e.g., "In most ways, my life is close to my ideal") on the SWLS (Diener et al., 1985), using a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The five ratings were then averaged, with higher values indicating greater life satisfaction. Cronbach's alpha for the scale was 0.87.

Covariates

Age, gender, number of peers, and SWLS scores were included in the analyses given their documented associations with the study variables (Erinne et al., 2022; Ma & Ye, 2021; Pearson et al., 2023). Weekends were also included as a covariate.

Analytical strategy

As the dataset had a hierarchical data structure in which repeated measures of happiness were nested within each participant, multilevel modelling was deemed suitable for statistical analysis (Lafit et al., 2021). We grand-mean centred the personality factors for within- and between-person analyses. Gender was coded 0 for male and 1 for female. Weekdays and weekends were coded 0 and 1, respectively. Warning signals for thunderstorms and very hot weather were coded 0 if "absent" and 1 if "present." Rainstorm warning signals were coded 0 for "no signal," 1 for "amber signal," 2 for "red signal," and 3 for "black signal." Tropical cyclone warning signals were coded 0 for "no signal," 1 for "Signal No. 1," 2 for "Signal No. 3," and 3 for "Signal No. 8."[3] Finally, type of cyclist was coded 0 for "professional cyclist," 1 for "amateur cyclist," 2 for "cycling enthusiast," 3 for "everyday user," and 4 for "other."

Results

Figure 1 shows the daily average happiness levels in relation to weather conditions throughout the 57-day study period. The average happiness score was consistently above 1.88 on the 0-4 scale during the study period, indicating a generally positive mood among our participants. However, these happiness levels exhibited complex relationships with different weather conditions.

Table 2 presents the descriptive statistics of the study variables and covariates for the subsample ($n = 200$). The analysis revealed a positive correlation between average happiness scores and several demographic and contextual variables, including gender, age, number of peers participating in cycling activities, type of cyclist, and day of the week. Happiness was significantly correlated with all Big Five personality traits. Similarly, SWLS scores were significantly correlated with all factors except openness to experience.[4]

To assess the proportion of variance in happiness attributable to the between- versus within-person levels, an empty multilevel model with a random intercept was fitted to the data (Snijders & Bosker, 2011). The analysis revealed significant between-person variance (F [442, 3093] = 2.04, $p < .001$), suggesting meaningful variability in happiness levels between individuals. The computed intraclass correlation coefficient was 0.62, with a 95% confidence interval of [0.61, 0.66]. This implies that between-person differences accounted for 62% of the variance in happiness scores. These results provided a solid basis for the implementation of multilevel analysis at both level 1 (within-person) and level 2 (between-person), justifying the need to account for the nested structure of the data.

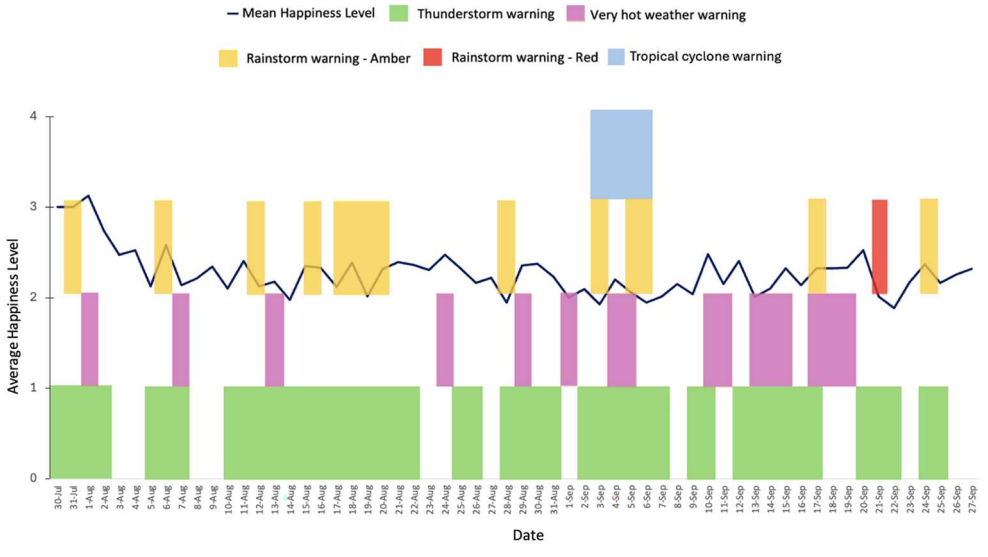

Figure 1. Daily happiness levels and weather conditions during the study period (30 July to 27 September 2024; $N = 443$).

Note: Possible happiness levels ranged from 0 to 4; actual scores ranged from 1.88 to 3.13. During this period, no black rainstorm warning signals were issued. As tropical cyclone warning signals can change throughout the day, we use shades of blue to indicate the timeframe when tropical cyclone Signals No. 1, 3, and 8 were in effect.

Table 2. Descriptive statistics of the continuous variables and covariates for the subsample ($n = 200$).

			Correlations						
Variable	M	SD	1.	2.	3.	4.	5.	6.	7.
1. Happiness	2.25	1.07							
2. N	2.21	0.67	−0.20*						
3. E	1.92	0.53	0.24*	−0.57*					
4. O	2.44	0.45	0.05*	−0.05*	0.01				
5. A	2.16	0.41	0.13*	−0.31*	0.19*	0.26*			
6. C	2.53	0.50	0.05*	−0.25*	0.19*	0.06*	0.25*		
7. Age	34.72	9.67	0.17*	−0.33*	0.09*	−0.09*	0.26*	0.20*	
8. SWLS	4.43	1.16	0.16*	−0.50*	0.37*	−0.03	0.20*	0.35*	0.18*

Note: Happiness = average happiness score; possible scores ranged from 0 to 4; N = neuroticism; E = extraversion; O = openness to experience; A = agreeableness; C = conscientiousness; possible scores ranged from 0 to 48; SWLS = Satisfaction with Life Scale; possible scores range from 1 to 7.
* $p < .05$.

To systematically analyze how weather conditions moderated the relationship between cycling and happiness over the 57 days, we fitted the data from the full sample ($N = 443$) using the happiness score per ride as the dependent variable and weather conditions as the independent variable. The results are presented in Table 3.

Table 3. Modelling happiness levels based on weather conditions ($N = 443$).

Effects	Reference category	Value of category	Happiness Level, *b (95% CI)*	
			Null Model	Model 1
Constant			2.241*** (2.206, 2.276)	3.033*** (1.411, 4.655)
WEATHER CONDITIONS				
Very hot weather warning	None issued	Issued		0.024 (−0.022, 0.070)
Thunderstorm warning	None issued	Issued		−0.059* (−0.127, 0.010)
Rainstorm warning	None issued	Amber		−0.069 (−0.412, 0.274)
		Red		−1.265** (−2.491, −0.038)
Tropical cyclone warning	None issued	No. 1		−0.340*** (−0.510, −0.170)
		No. 3		−0.104 (−0.270, 0.063)
		No. 8		−0.180* (−0.388, 0.028)
COVARIATES				
Gender	Male	Female		0.148* (−0.015, 0.311)
Age				0.009** (0.0003, 0.017)
No. of Peers		0–9		0.040 (−0.009, 0.089)
Type of Cyclist	Professional	Amateur cyclist		−1.532 (−3.533, 0.470)
		Cycling enthusiast		−1.122 (−2.701, 0.458)
		Everyday user		−1.125 (−2.700, 0.451)
		Other		−0.986 (−2.683, 0.711)
Weekday	Sunday	Monday		−0.013 (−0.103, 0.076)
		Tuesday		0.051 (−0.041, 0.142)
		Wednesday		0.024 (−0.063, 0.111)
		Thursday		0.037 (−0.049, 0.124)
		Friday		0.113** (0.027, 0.199)
		Saturday		0.049 (−0.037, 0.135)
Random Effects				
Log Likelihood				−3,810.167
LRT, χ2 (*df*)				2891.23 (2)***
Goodness of fit				
AIC				7666.334
BIC				7808.248
Residual Std. Error			1.071 (*df* = 3535)	

Note: AIC = Akaike information criterion; BIC = Bayesian information criterion. 95% confidence intervals are given in parentheses. All of the models were fitted using a likelihood ratio test (LRT) estimation.
*$p < .05$; **$p < .01$; ***$p < .001$.

We observed a significant random effect for days (χ^2 (2) = 2891.23, $p < .001$), indicating that variation in the weather conditions contributed significantly to the variability in their happiness levels. The constant term of the Null Model was significant ($b = 2.241$, $p < .001$), indicating that baseline happiness scores were positively associated with cycling. The results of Model 1 revealed that adverse weather conditions significantly moderated the relationship between cycling and happiness. Specifically, happiness decreased during thunderstorms ($b = -0.059$, $p < .05$), when a red rainstorm signal was issued ($b = -1.265$, $p < .01$), and when tropical cyclone warning Signals No. 1 ($b = -0.340$, $p < .001$) and No. 8 ($b = -0.180$, $p < .05$) were issued. These findings suggest that unfavourable weather conditions discourage cycling activities and have a negative impact on the joy of cycling.

To test the relationship between personality and happiness, we next fitted two models to the personality data from the subsample ($n = 200$). Model 2a sought to cross-validate the relationship between happiness and weather conditions from the full sample (see Model 1 in Table 3), and Model 2b tested the relationship between personality and happiness. In both models, we included satisfaction with life as an additional covariate.

Echoing the results obtained from the full sample ($N = 443$), the analysis of the subsample ($n = 200$) also revealed significant between-person variance (F [199, 2,674] = 3.29, $p < .001$), suggesting meaningful variability in happiness levels between individuals. The computed intraclass correlation coefficient was 0.66, with a 95% confidence interval of [0.61, 0.66], suggesting that between-person differences accounted for 66% of the variance in happiness. These results provided a solid basis for the implementation of multilevel analysis at both level 1 (within-person) and level 2 (between-person), justifying the need to account for the nested structure of the data.

Table 4 summarises the results of Models 2a and 2b. Model 2a replicated the significant effects of weather conditions on cycling and happiness obtained with Model 1 (see Table 3). Life satisfaction was also significantly related to happiness ($b = 0.04$, $p < .001$). Similarly, we observed a significant random effect for days in Model 2a (χ^2 (2) = 2,505.44, $p < .001$), indicating that variation in the participants' characteristics contributed significantly to the variability in their happiness levels.

In Model 2b, we tested the influence of the Big Five personality traits on the cycling–happiness relationship. The random effect for days in Model 2b was significant (χ^2 (2) = 2461.43, $p < .001$). The results also indicated that extraversion significantly influenced happiness levels ($b = 0.021$, $p < .05$), suggesting that individuals with higher extraversion scores experienced greater happiness while cycling. Additionally, agreeableness emerged as a significant predictor ($b = 0.029$, $p < 0.01$), indicating that agreeable individuals derived more happiness from their cycling experiences. These results support the hypothesis that personality traits play a crucial role in determining which cyclists are the happiest. Although the effects of weather conditions and weekends remained significant, the other covariates were no longer significant when personality traits were included as predictors.

Overall, the results provide compelling evidence that both weather conditions and personality traits significantly influence happiness among cyclists, emphasising the importance of contextual variables and individual differences in enhancing the level of happiness while cycling. These findings highlight the multifaceted benefits of cycling as a physical activity, together with the complex interplay between predispositions and environmental factors, which collectively enhance individual well-being.

Table 4. Modelling happiness levels based on weather conditions and the big five personality traits ($n = 200$).

Effects	Reference category	Value of category	Happiness Level, *b (95% CI)*		
			Null Model	Model 2a (Without Personality)	Model 2b (With Personality)
Constant			2.247*** (2.208, 2.286)	2.789*** (0.979, 4.599)	2.275** (0.388, 4.161)
WEATHER CONDITIONS					
Very hot weather warning	None issued	Issued		0.015 (−0.035, 0.065)	0.016 (−0.034, 0.066)
Thunderstorm warning	None issued	Issued		−0.064* (−0.137, 0.009)	−0.067* (−0.140, 0.007)
Rainstorm warning	None issued	Amber		−0.133 (−0.517, 0.251)	−0.123 (−0.508, 0.262)
		Red		−1.275** (−2.498, −0.053)	−1.279** (−2.505, −0.054)
Tropical cyclone warning	None issued	No. 1		−0.370*** (−0.549, −0.190)	−0.372*** (−0.552, −0.192)
		No. 3		−0.078 (−0.250, 0.095)	−0.079 (−0.253, 0.096)
		No. 8		−0.162 (−0.376, 0.052)	−0.168 (−0.382, 0.046)
PERSONALITY					
N					−0.002 (−0.021, 0.018)
E					0.021* (−0.001, 0.043)
O					−0.004 (−0.027, 0.019)
A					0.029** (0.002, 0.055)
C					−0.005 (−0.027, 0.017)
COVARIATES					
Gender	Male	Female		0.067 (−0.184, 0.318)	0.022 (−0.230, 0.274)
Age				0.015** (0.003, 0.028)	0.009 (−0.004, 0.022)
No. of Peers		0–9		0.039 (−0.017, 0.094)	0.037 (−0.019, 0.093)
Type of Cyclist	Professional	Cycling enthusiast		−1.220 (−2.944, 0.504)	−1.076 (−2.755, 0.602)
		Everyday user		−1.183 (−2.901, 0.534)	−1.012 (−2.681, 0.657)
		Other		−0.291 (−2.262, 1.679)	−0.072 (−1.997, 1.852)
Weekday	Sunday	Monday		0.004 (−0.093, 0.102)	−0.002 (−0.100, 0.097)
		Tuesday		0.080 (−0.019, 0.179)	0.078 (−0.021, 0.178)
		Wednesday		0.041 (−0.053, 0.135)	0.037 (−0.058, 0.131)
		Thursday		0.061 (−0.033, 0.155)	0.062 (−0.033, 0.157)
		Friday		0.137*** (0.043, 0.230)	0.136*** (0.042, 0.230)
		Saturday		0.086* (−0.008, 0.180)	0.085* (−0.009, 0.180)
SWLS				0.040*** (0.019, 0.061)	0.027** (0.002, 0.052)
Random effects					
Log Likelihood			−4273.100	−3020.390	−3000.679
LRT, χ2 (*df*)				2505.44 (2)***	2461.43 (2)***
Goodness of fit					
AIC				6084.779	6057.358
BIC				6215.960	6223.972
Residual Std. Error			1.071 (*df* = 2873)		

Note: N = neuroticism; E = extraversion; O = openness to experience; A = agreeableness; C = conscientiousness; SWLS = Satisfaction With Life Scale; AIC = Akaike information criterion; BIC = Bayesian information criterion. 95% confidence intervals are given in parentheses. All models were fitted using a likelihood ratio test (LRT) estimation. In the main effects and interaction models, the slopes of the predictor variables could vary freely. The Big Five personality traits were mean-centred.
*$p < .05$; **$p < .01$; ***$p < .001$.

Discussion

In recent years, cycling has received considerable attention, not only as a mode of transportation but also as a source of joy and well-being. Most studies have focused on communities with high bicycle usage. In contrast, our study sought to empirically test the relationship between cycling and happiness and the role of personality in cycling joy in Hong Kong, a community with low bicycle usage (Zhang et al., 2025). The results of our 8-week diary study reinforce the widely held belief that cycling is positively associated with individuals' psychological well-being (e.g., Fossati et al., 2021; Herbert, 2022) and that extraverted and agreeable cyclists find more enjoyment in cycling.

Previous studies have predominantly relied on available datasets collected through retrospective self-reports of happiness among cyclists (e.g., Meenar et al., 2019), which can be vulnerable to memory or selection bias. For instance, cyclists may simply recall their happiest moments while cycling, and happy cyclists may be more likely to volunteer to participate in national surveys. To collect ecologically valid measures of cyclists' happiness, we used the experience sampling method, in which the participants reported their level of happiness after each bike ride, allowing for real-time assessments of emotions. Our study provides the first empirical evidence that cycling can enhance overall happiness using real-time measures (cf. Biddle & Asare, 2011; Singh et al., 2025). These encouraging results offer support for Hong Kong to develop its cycling infrastructure to enhance residents' psychological well-being.

Why is cycling a source of joy?

The broaden-and-build theory posits that positive emotions broaden an individual's thought–action repertoire, thereby enhancing their psychological resilience (Roth et al., 2024; Sriwidharmanely et al., 2022). Cycling has been shown to evoke positive emotions, thereby contributing to overall well-being (Tian et al., 2020). Similarly, self-determination theory emphasises that cycling fulfils people's intrinsic needs for autonomy, competence, and relatedness, leading to greater fulfilment and happiness (Griffin et al., 2020). The emotional benefits of cycling can cultivate a culture that prioritises physical activity, thereby enhancing public health. Previous research has also shown that cycling is beneficial for physical and mental health by lowering the risk of mortality (Ried-Larsen et al., 2021), improving mood and energy, and reducing stress (Leyland et al., 2019). Our study contributes to the growing body of evidence regarding the positive effects of cycling on well-being, highlighting the importance of promoting cycling to foster happiness and improve quality of life (Wild & Woodward, 2019).

Our multilevel modelling analysis revealed that the relationship between cycling and happiness is influenced by weather conditions. Specifically, the participants who cycled during thunderstorm warnings, red rainstorm warnings, or tropical cyclone warning signals reported lower levels of happiness. These results align with research indicating that adverse weather conditions have a negative impact on the enjoyment of cycling (Zhao et al., 2018). Notably, in our study, tropical cyclone warning Signal No. 1 had a significant negative influence on the relationship between cycling and happiness, as it is an advisory signal that encourages individuals to prepare for an approaching cyclone, although cycling activities can continue. This need for preparation may have generated

anxiety and concern, which may have harmed happiness. In contrast, Signals No. 3 and 8 indicate immediate danger, leading to the closure of schools and public services and the cessation of all outdoor activities, including cycling. These findings underscore the importance of weather conditions in the cycling experience, emphasising the need to consider situational factors when evaluating the benefits of cycling and other forms of physical activity.

The finding that extraverted individuals experienced greater happiness while cycling suggests that personality traits significantly moderate the relationship between cycling and well-being. Extraverts thrive in social settings and derive joy from engaging with others (Schueller, 2012; Yik & Siu, 2024), with cycling providing such opportunities. Furthermore, agreeableness emerged as a significant factor, indicating that agreeable cyclists tend to experience increased happiness (cf. Rhodes & Smith, 2006; Wilson & Dishman, 2015). We suspect that this may be attributable to the inherently social nature of cycling, as agreeable individuals are often more inclined to participate in group activities that foster positive interactions (Kallianou, 2024). Such connections enhance the overall cycling experience and contribute to cyclists' sense of belonging and social support. By cultivating meaningful relationships during their bike rides, agreeable individuals may further amplify their happiness, highlighting the importance of personality traits in understanding the well-being benefits of cycling.

Finally, our findings illuminate broader implications for advancing physical activity engagement across diverse contexts and populations. The observed link between cycling and happiness aligns with a growing body of evidence showing that regular physical activity, walking, cycling, and other moderate-intensity activities included, is associated with better mood, reduced stress, and greater life satisfaction (Buecker et al., 2020; Teychenne et al., 2026). The social and environmental contexts, such as group activities and safe infrastructure, may possibly enhance mental health benefits of physical activity in diverse populations (see Bernard et al., 2021; Koh et al., 2022). Future studies should examine whether the cycling-happiness relationships can be cross-validated across other physical activities using longitudinal designs so as to establish the causal pathways.

Limitations and future research directions

Our reliance on the only bike-sharing platform in Hong Kong may have affected our results by limiting the diversity of cycling experiences. Cyclists who use their bikes for work (e.g., food delivery) may prioritise efficiency over enjoyment, whereas those who cycle for leisure may focus on enjoyment and relaxation. Therefore, the relationship between cycling and happiness may differ between different types of cyclists. Extending our study to include a wider variety of cyclists is needed to advance our understanding of the relationship between cycling and happiness. Future studies should also include other high cycling usage areas in Asia, such as mainland China (e.g., Gu et al., 2021; Sun et al., 2023). Our results could then be cross-validated on different cycling platforms and in various social contexts.

To address the limitations inherent in cross-sectional designs, we used the experience sampling method to collect real-time data on individuals' emotions and experiences while cycling. This methodology allowed us to capture the dynamic interplay between situational and personal factors, thus providing a better understanding of how various elements affect cycling and happiness. Instantaneous measurement of happiness

enabled us to more effectively capture fluctuations in mood and contextual influences, thereby enhancing the ecological validity of our findings. To further advance our understanding of the multifaceted cycling experience, future research should integrate biosensing data with happiness data. Mobile sensing data represent a promising way to complement subjective measures (e.g., self-reported happiness) in traditional experience sampling designs for mental health research, providing continuous, objective, and real-time data without imposing additional burdens on participants (Tuerlinckx et al., 2025). Indeed, mobile sensing leverages smartphone sensors to passively collect information on physical activity, GPS locations, and device interactions, thereby creating a digital "fingerprint" that reflects participants' physical health. Finally, future studies should aim to collect both subjective self-reported data and objective cycling activity data (Mehl et al., 2023). This could offer a more holistic view of the cycling experience and its relationship with physical and psychological well-being.

Conclusion

The present study enhances our understanding of the relationship between cycling and happiness, particularly in Hong Kong, a region characterised by low bicycle usage. Adverse weather conditions (i.e., thunderstorms, rainstorms, and cyclones) negatively affect cyclists' happiness. Moreover, personality traits play a crucial role: more extraverted and agreeable individuals derived greater joy from cycling. These findings suggest that the relationship between cycling and happiness is complex and influenced by environmental and individual differences factors. Cycling should not only be used as a mode of transportation but also as a strategy for improving mental health and enhancing overall quality of life.

Notes

1. According to the Luko Global Bicycle Cities Index 2022, Hong Kong ranked 84th out of 90 cities in terms of bike-friendliness. This index evaluates cities based on factors such as weather, bike usage, crime and safety, infrastructure, sharing options, and awareness events (RankingRoyals, n.d.). Notably, the only available cycling study conducted by the Transport Department of Hong Kong, which dates back to 2004, revealed that only 0.5% of the population uses cycling as a regular mode of transportation (Transport Department, 2004).
2. For more details, please visit the Hong Kong Observatory website at https://www.hko.gov.hk/en/wservice/warning/details.htm.
3. Hong Kong's tropical cyclone warning system uses a five-level system: 1 = standby signal, 3 = strong wind signal, 8 = gale or storm signal, 9 = increasing gale or storm signal, and 10 = hurricane signal. These levels are directly related to the Beaufort Scale by describing the expected wind conditions and indicating the potential impact of a tropical cyclone (Hong Kong Observatory, n.d.).
4. Similar patterns of relationships were found for the full sample ($N = 443$).

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