The Effect of Weather and Air Pollution on Honest Behavior: A Lost Wallet Field Experiment on Campus

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Abstract

This study examines the influence of weather conditions and air pollution on honest behavior through two investigations. Study 1 reanalyzes the worldwide research data on honest behavior from Cohn et al. (2019), revealing effects of weather conditions and air pollution on honest behavior; Study 2 employs a quasi-experimental methodology, conducting a lost wallet experiment at three universities while recording the day' s weather and air pollution conditions. Together, the two studies indicate that: (1) under non-clear weather conditions, individuals exhibit more dishonest behavior; (2) as air pollution becomes more severe, people are more likely to engage in dishonest behavior.

Full Text

The Influence of Weather and Air Pollution on Honest Behavior: A Field Experiment about Lost Wallets on Campus

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Abstract

Objective: This paper investigates the influence of weather conditions and air pollution on honest behavior through two studies. **Methods:** Study 1 reanalyzed data from Cohn et al.'s (2019) global study on honest behavior, examining the effects of weather and air pollution. Study 2 employed a quasi-experimental design, conducting a lost wallet experiment across three university campuses while recording daily weather and air pollution conditions. **Results:** Both

studies revealed that (1) people exhibit more dishonest behavior in non-sunny weather, and (2) higher levels of air pollution increase the likelihood of dishonest behavior. **Limitations:** While quasi-experimental research allows us to observe the effects of weather and air pollution on honest behavior in natural settings, it consequently leaves the underlying mechanisms of honest behavior insufficiently explained. **Conclusions:** Weather conditions and air pollution are important factors influencing honest behavior.

Keywords: honest behavior; air pollution; weather conditions; field experiment

1. Introduction

Honest behavior forms the cornerstone of normal economic and social functioning. The release of the "Guiding Opinions on Strengthening the Construction of Personal Integrity System" at the end of 2016 elevated the prominent issue of personal credit system construction to a new level. Since the 18th National Congress of the Communist Party of China, the nation has accelerated the construction of its integrity system. However, numerous dishonest behaviors still constrain China' s economic and social development. According to reports from People' s Daily Online, China loses over 600 billion yuan annually due to integrity deficits. Though the nation signs more than 4 billion contracts each year, the fulfillment rate is only about 50%. Moreover, integrity deficits severely impact global economic development, with the annual cost of corruption and other illicit financial flows reaching approximately $1.3 trillion worldwide (Kar & Cartwright-Smith, 2009).

Consequently, extensive research has investigated factors influencing honest behavior. Domestically, Lu Huijing (2012) explored how self-deception affects the deception of others from an individual perspective. Additionally, many seemingly insignificant factors influence honest behavior, such as signature placement on documents: signing at the top tends to promote more honest behavior (Li He et al., 2014). Internationally, honest behavior has long been a research focus across numerous disciplines including psychology. In 2019, a study on global honest behavior published in *Science* examined the relationship between monetary temptation and honest behavior (Cohn, Maréchal, & Zünd, 2019), attracting widespread attention. Although research on factors influencing honesty continues to deepen, the field has rarely examined factors that constantly affect people' s daily lives. Therefore, this study explores how weather conditions and air pollution—ever-present environmental factors—influence honest behavior.

Regarding methodology, research on honest behavior has long emphasized actual behavior rather than honest intentions (Gerlach, Teodorescu, & Hertwig, 2019). Researchers typically employ clever experimental designs such as sender-receiver games, die-roll tasks, coin-flip tasks, and matrix tasks to investigate factors influencing honest behavior in laboratory settings. However, Gerlach et al.' s (2019) meta-analysis of 565 experiments revealed significant differences

between dishonest behavior in laboratory settings and real-world environments, with dishonest behavior being more prevalent in laboratory experiments (Peer, Brandimarte, Samat, & Acquisti, 2017). Therefore, field experiments testing honest behavior in natural environments are particularly important. Unfortunately, while international research began using field experiments to study honest behavior relatively early (Cunningham, 1979), domestic research in this area remains insufficient. In summary, considering the need for environmental factors in honesty research and the scarcity of field experiments, this study examines whether sunny weather and air quality affect honest behavior, providing important theoretical and empirical contributions to this field.

1.1 Factors Influencing Honest Behavior

Given honesty' s crucial role in socio-economic development, numerous studies across disciplines including psychology have investigated factors influencing honest behavior. On one hand, honest behavior is affected by individual-level factors. For instance, profession and identity likely influence a person' s honest behavior (Fosgaard, Bucciol, Hansen, & Piovesan, 2013). Even among students, academic majors may differentially affect honest behavior, with economics and business majors potentially making students more dishonest (Lewis et al., 2012; Lundquist, Ellingsen, Gribbe, & Johannesson, 2009). On the other hand, economic research suggests that whether a person engages in dishonest behavior depends on the magnitude of benefits, the probability of being discovered, and potential punishments (Becker, 1968).

Beyond these factors, people' s daily environments also significantly influence honest behavior. For example, environmental cleanliness constitutes an important factor affecting moral behavior. When in clean environments, people' s moral self-standards increase. Helzer and Pizarro (2011) found that when reminded to wash their hands (the concept of cleanliness), people expressed stronger criticism of immoral behavior. Similarly, when thinking about their own clean image, people maintain stricter moral standards (Zhong, Strejcek, & Sivanathan, 2010). Correspondingly, in dirty environments, people are more likely to engage in dishonest or even illegal behaviors such as lying and stealing (Keizer, Lindenberg, & Steg, 2008). Beyond cleanliness, brightness also correlates closely with honest behavior. Crime rates increase significantly in darker conditions, which is precisely why the introduction of streetlights in the 19th century substantially reduced crime rates in many areas (Bouman, 1987). This occurs because people mistakenly believe that dark environments can conceal their immoral behavior—what is known as illusory anonymity.

Since environments affect honest behavior, how might weather and air—ever-present environmental factors—influence people' s honest behavior?

1.2 The Influence of Weather Conditions on Moral Behavior

Weather affects our daily lives in myriad ways, from national economic production, especially agricultural activities, to our daily study and work schedules. Weather conditions also constitute important factors influencing people' s psychology and behavior (Watson, 2000).

Among studies on weather' s influence on human behavior, lighting has received considerable attention. This is primarily because, compared to other weather factors, sunlight' s effect on mood is often immediate. Mood improvement often manifests after the first intense light intervention (Kripke, 1998). Lambert et al. (2002) found that light exposure promotes serotonin production in the brain, and even artificial sunlight (produced by a very bright lamp) can have similar effects. Consequently, this approach has become an important means of alleviating depressive symptoms (Kripke, 1998). Winslow and Herrington (1936) found that the correlation coefficient between daily sunshine duration and people' s mood pleasure could reach as high as 0.78. Therefore, under suitable lighting conditions, the duration people spend outdoors positively correlates with positive mood (Keller et al., 2005). Seasonal Affective Disorder (SAD) also represents a typical case of lighting affecting mood. SAD refers to a psychological disorder characterized by depression during specific seasons, particularly winter. It not only causes lethargy but also impairs memory, learning ability, and even visual capacity (Michalon, Eskes, & Mate-Kole, 1997). The primary cause of this psychological disorder is the short daylight hours in winter, which explains why this affective disorder is common in mid-to-high latitude regions. In fact, lighting-induced mood problems often have more serious consequences, with related research finding that rainy and snowy weather (weak light) often leads to more suicide cases (Digon & Bock, 1966).

Through emotional mechanisms, lighting prompts people to engage in more prosocial behavior. Cunningham (1979) randomly selected restaurants in the Chicago area over 13 days and had six servers record the amounts of the first ten tips received each day until 1 PM, comparing them with daily sunlight data. The results showed that people were more willing to give tips to servers on sunny days. Other experimental studies have also demonstrated that when people expect sunny weather in the coming days, they engage in more prosocial behavior (Rind & Strohmetz, 2001).

In summary, whether it is sunny likely affects people' s honest behavior. Therefore, we propose:

Hypothesis 1: Whether it is sunny influences honest behavior, with fewer dishonest behaviors occurring under sunny conditions and more dishonest behaviors under non-sunny conditions.

1.3 The Influence of Air Pollution on Moral Behavior

People' s growing concern about air pollution stems primarily from its threat to human health and life. However, air pollution' s negative impact on human social development extends far beyond physiological effects. On one hand, air pollution affects people' s emotions and even negatively impacts their well-being (Zheng, Wang, Sun, Zhang, & Kahn, 2019). Research has found that the happiness expressed in social media posts significantly declines as PM2.5 levels rise. Air pollution not only reduces positive emotional expression but also increases negative emotions, most notably anxiety (Lu, Lee, Gino, & Galinsky, 2018). This is primarily because air pollution has long been closely associated with the concept of death, making pollution-induced anxiety similar to death anxiety (Greenberg et al., 2003).

Anxiety itself also strongly influences honest behavior, with anxious individuals being more likely to lie or engage in other dishonest means to benefit themselves (Kouchaki & Desai, 2015). This is because dishonesty serves as a coping mechanism for anxiety, with research showing that anxiety levels significantly decrease after people engage in immoral behavior (Lee-Won, Herzog, & Park, 2015).

In summary, we believe air pollution affects honest behavior and therefore propose:

Hypothesis 2: Air pollution levels influence honest behavior, with fewer dishonest behaviors occurring when air pollution is low and significantly more dishonest behaviors when air pollution is high.

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2. Study 1

Study 1 examined the influence of weather conditions and air pollution on honest behavior using secondary data. Our data source is the study published in *Science* by Cohn et al. in 2019. To verify the relationship between money and honest behavior, Cohn et al. conducted a global study on civic honesty, performing a "lost wallet" field experiment in over 40 countries. During the experiment, researchers handed transparent wallets containing the owner' s contact information (email address) to staff at various institutions, indicating they had found the wallet but had no time to return it, thus hoping the staff would contact the owner. Whether staff proactively contacted the owner via email served as the measure of honest behavior.

Although this study ultimately discovered a relationship between money and honest behavior, weather and air pollution conditions as factors independent of monetary amount did not receive researchers' attention. This paper utilizes this study' s data.

2.1 Data Source and Description

This study used all experimental data from China and the United States, totaling 1,400 cases, and supplemented records of weather conditions and air pollution on experimental days. We selected data from these two countries because weather and air pollution data are relatively easy to collect for both nations. Additionally, regarding air pollution, both China and the United States use the Air Quality Index (AQI) as the air quality standard with identical classification levels (0-50: excellent; 51-100: good; 101-150: light pollution; 151-200: moderate pollution; 201-300: heavy pollution; >300: severe pollution). Other countries often adopt different standards. For example, the European Union uses the Common Air Quality Index, which also has five levels but with completely different standards from those used by China and the US (0-25: very low; 25-50: low; 50-75: moderate; 75-100: high; >100: very high).

Among the 400 cases from China, data were collected in eight cities: Beijing, Chengdu, Guangzhou, Hangzhou, Shanghai, Shenzhen, Tianjin, and Xi' an. The experimental period was mainly from July 7, 2015, to July 24, 2015. The 1,000 cases from the United States included 25 cities such as Washington and New York, with the experimental period concentrated between August 17, 2015, and October 17, 2015. Therefore, this dataset has broad representativeness. Regarding overall honest behavior, among the 1,400 field experiment cases from China and the United States, 585 wallets were returned (41.8%), while 815 were not returned (58.2%).

Notably, during the experiment, Cohn et al. recorded emails for 100 days after wallet drop-off as the criterion for participant honesty. However, when exactly did participants make their decision to return or not? The data used in Study 1 did not record the precise time when participants made their honest behavior decision, yet when and under what weather and air conditions participants made decisions is crucial for this study. In fact, based on analysis of when participants proactively contacted owners via email, overall, across 40 countries worldwide, the median return time was 26 minutes, with no significant differences between countries (Cohn et al., 2019). For the Chinese and US experimental data selected in this study, over 85% of participants contacted owners via email on the first day of wallet loss, and over 90% contacted owners within two days of finding the wallet. Therefore, we have reason to infer that the vast majority of participants made their decisions on the day they found the wallet, generally within three days.

2.2 The Influence of Weather on Dishonest Behavior

Regarding weather' s effect on honest behavior, we coded sunny weather as 1 and non-sunny weather as 0. In this study, 217 cases occurred under sunny conditions, with 104 wallets returned (47.9%). Under non-sunny conditions, there were 1,183 cases, with 481 wallets returned (40.7%). Whether the weather was sunny was statistically significantly correlated with wallet return (^{2}(1, N=1,400)

= 3.98, p = 0.046, Φ = 0.05). Participants were significantly more likely to proactively return wallets under sunny conditions than under non-sunny conditions. In other words, people are more likely to engage in honest behavior on sunny days. See Figure 1 [Figure 1: see original paper].

2.3 The Influence of Air Pollution on Honest Behavior

Regarding air pollution, this study first coded air quality rated as excellent and good as 0 = no pollution, and air quality worse than good as 1 = air pollution. We grouped excellent and good air quality together primarily based on the "Technical Regulations on Ambient Air Quality Index (AQI) (Trial)," which states that when the air pollution index is below 100 (excellent 50; good 100), people can engage in normal activities, and under normal circumstances, general residential and commercial areas have air pollution indices within 100.

Although coding for the presence or absence of air pollution did not yield a significant effect on honest behavior (^{2}(1, N=1,400) = 0.02, NS), AQI serves as a more accurate measure of air quality. Regression analysis revealed a marginally significant negative effect of air pollution on honest behavior (b = -0.003, Wald = 3.07, p = 0.08, 95% Exp(B) [0.99, 0.10]). Under air pollution conditions, people were more likely to engage in dishonest behavior. Moreover, PM10 significantly influenced whether people proactively returned wallets (b = -0.02, Wald = 75.75, p < 0.001, 95% Exp(B) [0.98, 0.99]). The higher the PM10 concentration in the air, the more likely people were to engage in dishonest behavior by not returning wallets. We believe this is primarily because PM10, as larger inhalable particles, has a greater impact on air visibility. When PM10 concentrations are high, environmental visibility significantly decreases, ultimately leading to significantly increased dishonest behavior.

2.4 Robustness Analysis

Considering that data collection times differed between the two countries and that temperatures varied considerably across cities, we supplemented the dataset with average daily temperature data as an important control variable to test whether weather conditions and air pollution still affected honest behavior after controlling for temperature. In fact, temperature may also influence honest behavior. Previous research indicates that temperature' s effect on mood follows an inverted U-shape, with people experiencing more positive emotions and engaging in more positive behaviors under moderate temperatures, while excessively high or low temperatures often produce clear negative effects (Anderson, 1989). For example, violent behavior increases significantly in hot weather.

In summary, the robustness analysis in Study 1 focused on examining temperature' s influence. Additionally, although we have reason to infer that most participants made their honest behavior decisions on the experimental day, the possibility remains that some decided on subsequent days. Considering that over 90% of proactive returns occurred within three days, we supplemented weather

and air pollution data for the two days following the experiment and conducted logistic regression analysis.

Regarding temperature, results showed that even after controlling for temperature, both weather conditions and air pollution still influenced honest behavior. Specifically, people were more likely to engage in honest behavior under sunny conditions (b = 0.49, Wald = 9.51, p = 0.002, 95% Exp(B) [1.20, 2.23]), while more severe air pollution increased the likelihood of dishonest behavior by not returning wallets (b = -0.02, Wald = 57.26, p < 0.001, 95% Exp(B) [0.98, 0.99]). Additionally, results indicated that the day' s average temperature negatively affected honest behavior, meaning that higher average temperatures were associated with more dishonest behavior by not proactively returning wallets (b = -0.07, Wald = 16.78, p < 0.001, 95% Exp(B) [0.90, 0.96]). Considering the data collection periods in Study 1—China in July and the US from August to October —data were collected during months with relatively high average temperatures in both countries. Under higher average temperatures, temperature may have a significant negative effect on honest behavior.

Beyond temperature' s influence, results showed that weather conditions on subsequent days (Day 2: b = 0.45, Wald = 11.53, p < 0.001, 95% Exp(B) [1.21, 2.03]; Day 3: b = 0.87, Wald = 37.65, p < 0.001, 95% Exp(B) [1.81, 3.16]) and air pollution (Day 2: b = -0.01, Wald = 45.47, p < 0.001, 95% Exp(B) [0.98, 0.99]; Day 3: b = -0.014, Wald = 41.56, p < 0.001, 95% Exp(B) [0.98, 0.99]) also affected honest behavior as hypothesized. Therefore, whether predicting honest behavior using the day of wallet loss or the following two days' weather and air pollution conditions, people were more likely to proactively email owners to return wallets under sunny, low-pollution conditions, while non-sunny, heavily polluted conditions increased dishonest behavior. See Table 1 .

The table appears to contain statistical results but the formatting is corrupted. The meaningful content suggests various coefficients with p-values and confidence intervals, but the fragmented numbers should be treated as corrupted data and omitted for clarity.

Results also suggest that weather conditions on subsequent days appear to have a stronger influence than the first day. This may be because: first, weather variables measured in "days" exhibit some continuity over short periods. For example, logistic regression shows a significant positive correlation between Day 1 and Day 2 weather conditions (b = 3.34, Wald = 283.66, p < 0.001, 95% Exp(B) [19.13, 41.61]). This correlation may explain why subsequent days' weather conditions also correlate significantly with honest behavior. Additionally, although Day 3 weather appears to have higher significance, we tested whether Day 3 weather had a significantly larger effect than Day 1 weather using Day 1 and Day 3 weather as repeated-measure independent variables and found no significant interaction effect (p = 0.356). This indicates that Day 1 and Day 3 weather effects did not differ significantly.

2.5 Summary and Discussion

Study 1 utilized recently published experimental data on honest behavior, selecting 1,400 representative cases from China and the United States and supplementing weather and air pollution data for experimental dates to verify environmental factors' influence on honest behavior. On one hand, whether the weather was sunny significantly affected honest behavior, with participants from both countries more likely to engage in dishonest behavior by not returning wallets under non-sunny conditions. On the other hand, air pollution conditions on different dates in both countries also influenced honest behavior, with participants more likely to exhibit dishonest behavior by not returning wallets in polluted environments.

However, Study 1 has clear limitations. Although we used all experimental data from China and the United States, data collection times differed between the two countries. Even after controlling for temperature, this issue cannot be completely resolved. Additionally, climatic differences between the two countries challenge the robustness of Study 1's results. Furthermore, although we inferred most participants' decision times from relevant data, we still could not determine the exact timing of participants' honest decisions in Study 1, which also affects the robustness of weather and air pollution effects. To address these limitations, we conducted Study 2.

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3. Study 2

While Study 1 verified our hypotheses using secondary data, Study 2' s main purpose was to further validate Study 1's conclusions and address its limitations through a quasi-experimental method. Specifically, Study 2 was conducted in two Chinese cities, overcoming potential large differences in meteorological factors and air pollution between different countries. Additionally, Study 2 fully considered the issue of participants' decision timing, ensuring through research design that participants made honest behavior decisions on the day of wallet loss. Given that weather and air pollution are difficult to manipulate, quasi-experimental research becomes an important method for studying these issues (Campbell, Stanley, & Gage, 1969). Therefore, this study drew on previous field experiments on honest behavior (Frank, Gilovich & Regan, 1993) to conduct a quasi-experimental study on weather and air quality's influence on honest behavior.

For recording convenience and to exclude confounding factors such as pedestrian flow, this study was conducted at three domestic universities. To make the scenario more realistic, we used campus cards common in university settings, placing cash and owner contact information in transparent cardholders to observe students' honest behavior after finding the cards and money.

3.1 Participants

The experiment was conducted at Tsinghua University, Peking University, and Zhejiang University, collecting 407 cases. Considering that previous research found course content could influence students' honest behavior (Frank, Gilovich & Regan, 1993), we selected three types of courses at each university to exclude course effects: ideological and political courses, economics courses, and history courses. Ultimately, we collected 138 cases from ideological and political courses, 129 from economics courses, and 140 from history courses. Since the experiment occurred in real classroom settings, participants' personal information was not recorded.

3.2 Experimental Design

(1) Materials: The main experimental materials were campus cards from the three schools. To avoid personal information influencing honest behavior, all campus cards used the same person' s information, including the photo. Each card was packaged in a transparent cardholder with a contact phone number on the front and 20 yuan cash placed on the back to increase students' motivation for dishonest behavior (Becker, 1968).

(2) Procedure: The experimental procedure included:

Before the experiment, researchers recorded the day' s weather conditions, including whether it was sunny, temperature, air quality index (AQI), PM2.5, PM10, presence of pollution (coded: excellent/good air quality = no pollution; light pollution or worse = pollution), and other meteorological factors such as temperature and maximum wind speed.

Before class, researchers randomly placed the corresponding school' s campus card in a desk in the classroom. To maximize the chance of students seeing the card, it was placed on the outer side of the desk (near the student). Researchers recorded the campus card number and specific seat location.

To make the scenario more realistic and credible, only one campus card was placed in each classroom. After placing the card, the researcher would sit near the location until class began, then leave. This was done to confirm that someone was present at or near the location where the card was placed; otherwise, the data would be considered invalid and not recorded.

After class, researchers retrieved the campus card and money from the corresponding location and recorded the recovery status. The recording standard was uniform: recovered (both retrieved), lost (either the card or money or both missing). To confirm the card' s loss, if the card and money were not at the placement location, researchers would search elsewhere in the classroom and inquire with building security, cleaning staff, and lost-and-found offices. Items that could not be recovered after these steps were confirmed as lost.

3.3 Results and Analysis

(1) Overall Analysis of Honest Behavior: Among the total 407 cases, 21 were lost (5.2% loss rate), indicating that students at the three schools had relatively low dishonest behavior and high overall honest behavior. Notably, Chinese participants' honesty levels differed significantly between the two studies (dishonest behavior: 85.8% vs. 5.2%). On one hand, environmental and participant differences may account for this discrepancy. For example: (a) Influence of others. Unlike other real-life scenarios, classrooms typically involve the presence of others, who likely serve a supervisory function, limiting dishonest behavior (Doleac & Sanders, 2015). Additionally, classrooms often have cameras, and students may reduce dishonest behavior out of self-image management concerns (Grant & Mayer, 2009). (b) The monetary amount used was relatively small (20 yuan), which may not have constituted an effective temptation. (c) The three schools are all top-tier universities in China, and students may have relatively higher moral standards, thus exhibiting lower probabilities of dishonest behavior.

On the other hand, methodological differences may also explain the honesty level discrepancy between studies. First, the two studies did not measure "honest behavior" identically. In Cohn' s study, they used whether participants proactively emailed the owner as the honesty measure, without researchers returning to the experimental site to check if they could retrieve the "lost" wallet. In Study 2, we used direct loss of money or cards as the honesty measure, only considering participants to have engaged in "dishonest behavior" when experimenters confirmed that the campus card or money could not be recovered from the placement location. We believe that although Cohn' s method can test honest behavior to some extent, Study 2' s method is more appropriate for defining honest behavior. Even if participants did not contact researchers via email to return the wallet, researchers could not be certain that participants kept the wallet for themselves. Similarly, among proactively returned wallets, since researchers did not actually retrieve them, they could not confirm whether monetary amounts had been reduced through dishonest behavior—issues that Study 2' s experimental paradigm resolves.

Moreover, the use of "email" may have contributed to increased dishonest behavior in Study 1, particularly evident in the Chinese data. In Cohn et al.' s study, China had the lowest wallet return rate at only 14.2%. However, to what extent was this low rate due to the unpopularity of email use? In Study 2, researchers provided a phone number, and even without explicitly asking participants to call, over 24% of participants proactively called to return the lost campus card. Therefore, email use in Cohn' s study may have been one reason for increased dishonest behavior.

In fact, neither Study 2' s results nor Cohn et al.' s results can represent Chinese people' s actual honesty levels. The "lost wallet" paradigm has been applied in numerous classic studies, but through literature review we find that honesty

behavior in the same country often shows different results across studies. For example, Stoop (2012) conducted a "lost wallet" experiment in the Netherlands and found an average return rate of 50%, which rose to about 75% in Cohn et al.' s study. Such differences indicate that honest behavior is influenced by various factors including experimental participants and contexts, and possesses inherent instability.

(2) The Influence of Weather on Dishonest Behavior: In this experiment, 163 cases occurred under sunny conditions, with 4 not recovered (2.5% loss rate). Under non-sunny conditions, there were 244 cases, with 17 not recovered (7.0% loss rate). Whether the weather was sunny was statistically significantly correlated with card recovery ($^2(1, N=407) = 4.07$, $p = 0.044$, $\Phi = 0.10$). Participants were significantly more likely to take others' lost campus cards or money under non-sunny conditions than under sunny conditions. In other words, people are more likely to engage in dishonest behavior in non-sunny weather.

Therefore, Hypothesis 1 was supported: Sunny weather affects participants' honest behavior, with participants exhibiting significantly more dishonest behavior under non-sunny weather. See Figure 2 [Figure 2: see original paper].

(3) The Influence of Air Pollution on Honest Behavior: Among the 407 cases in this experiment, 354 occurred under non-polluted conditions (87%), and 53 occurred under polluted conditions (13%). Among these, 6 were lost under air pollution conditions (11.3% loss rate), while 15 were lost under non-polluted conditions (4.2% loss rate).

Air pollution was statistically significantly correlated with card and money recovery ($^2(1, N=407) = 4.73$, $p = 0.03$, $\Phi = 0.11$). Participants were significantly more likely to take others' lost campus cards or money under air pollution conditions than under non-polluted conditions. In other words, people are more likely to engage in dishonest behavior in non-sunny weather. Hypothesis 2 was supported: Air pollution affects honest behavior, with people exhibiting significantly more dishonest behavior under air pollution conditions.

Considering that the main pollutants differed across the three universities' locations, we recorded the day' s AQI during the experiment and used it as an independent variable in regression analysis of participants' honest behavior. Results showed that AQI had a marginally significant negative effect on honest behavior ($b = -0.01$, Wald = 3.04, $p = 0.081$, 95% Exp(B) [0.98, 1.00]), meaning that poorer air quality increased the likelihood of dishonest behavior. See Figure 3 [Figure 3: see original paper].

(4) Robustness Checks: To further test the robustness of weather and air pollution effects on honest behavior, we conducted robustness analyses. Beyond sunny conditions, air pollution, and honest behavior, we recorded the university where the experiment was conducted, course type, classroom size (measured by number of seat rows), relative placement of the card (front, middle, back), and data collection time period (morning, afternoon, evening). Additionally, since

Study 1 showed temperature had a significant negative effect on honest behavior, to further determine temperature and other meteorological factors' influence, we controlled for perceived temperature, maximum wind speed, cloud cover, and humidity in the robustness analysis. Robustness checks primarily used logistic regression to control these potentially influential factors, further testing weather conditions and air pollution' s effects on honest behavior while providing a more comprehensive explanation of participants' honest behavior.

Logistic regression results showed that even after controlling for other variables, sunny conditions positively influenced honest behavior. Under sunny conditions, people were more likely to engage in honest behavior (b = 1.63, Wald = 5.49, p = 0.019, 95% Exp(B) [1.31, 20.08]). Conversely, air pollution negatively affected honest behavior, with people being more likely to exhibit dishonest behavior by taking campus cards or money when air pollution was severe (b = -1.91, Wald = 5.87, p = 0.015, 95% Exp(B) [0.03, 0.70]). See Table 2 .

Although the above results controlled for data collection time period, considering that lighting conditions and air pollution differ significantly across time periods, we also used other methods to exclude time period effects on results. First, we tested in logistic regression whether time period interacted with air pollution and sunny conditions to affect honest behavior. Results showed no significant interaction between class time and either pollution or sunny conditions (p_sunny×time = 0.695; b = 0.87, p_pollution×time = 0.229).

Second, in further data analysis, we retained only daytime data (morning and afternoon; N = 276) to test weather and air pollution effects on honest behavior. Results were consistent with previous analyses (b_sunny = 1.96, Wald = 4.52, p = 0.033, 95% Exp(B) [1.17, 43.52]; b_pollution = -1.75, Wald = 3.23, p = 0.072, 95% Exp(B) [0.03, 1.17]). Specifically, people engaged in more honest behavior under sunny conditions, but more dishonest behavior under severe air pollution.

(5) The Influence of Other Variables on Honest Behavior: In Study 1, regression analysis showed temperature negatively affected honest behavior. However, in Study 2, we found no significant temperature effect on students' honest behavior. Regarding this inconsistency between studies, we believe: first, temperature' s negative effect in Study 1 likely occurred because data were collected during summer and early autumn when higher temperatures affected mood and honest behavior, whereas Study 2 data were collected during autumn and winter, eliminating summer heat's negative effect. Second, previous research has not reached unified conclusions about temperature' s effect on behavior (Fay & Maner, 2012; Griffit & Veitch, 1971), so inconsistent temperature results across our two studies are not exceptional.

Additionally, Study 2 results showed that campus card placement location affected students' honest behavior, with cards placed in the back rows more likely to be taken (b = -1.01, Wald = 6.20, p = 0.013, 95% Exp(B) [0.16, 0.81]; coding: front = 0; middle = 1; back = 2). Classroom size also affected hon-

est behavior, with students in larger classrooms more likely to exhibit honest behavior (b = 0.30, Wald = 5.74, p = 0.013, 95% Exp(B) [1.06, 1.72]). These variables likely affect honest behavior through different levels of supervision. Regarding front/back placement effects: students sitting in front are closer to the teacher and more supervised by classmates behind them, whereas students in back rows experience weaker supervision from teachers and surrounding classmates. Regarding classroom size effects: we observed during data collection that public elective courses in larger classrooms often had more students and higher density, meaning students in larger classrooms experienced more obvious supervision from nearby classmates, thus exhibiting more honest behavior.

(6) Summary and Discussion: Through quasi-experimental methods, this study verified Hypothesis 1, finding that sunny weather significantly influenced honest behavior, with students at the three schools more likely to take cards or money under non-sunny weather conditions. Hypothesis 2 was also supported, with air pollution significantly affecting honest behavior, as participants were more likely to engage in dishonest behavior by not returning found cards and cash in polluted environments.

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4. General Discussion

4.1 Overall Conclusions

This study reveals the influence of weather conditions and air pollution on honest behavior through secondary data analysis and quasi-experimental methods. Results support our hypotheses: sunny weather conditions affect honest behavior, with participants less likely to take cards and money without returning them under sunny conditions. Second, air pollution affects individual honest behavior, with participants more likely to engage in dishonest behavior by not returning cards or money under air pollution conditions.

4.2 Theoretical Contributions

This study' s theoretical contributions are mainly reflected in several aspects:

First, it addresses research gaps in domestic literature. In recent years, as climate change and air pollution have become increasingly serious, more scholars have begun using big data analysis and text mining to study how weather and environmental pollution affect behavior, with related research increasingly published in top psychology journals (Zheng et al., 2019). However, such research has focused more on prosocial behavior than honest behavior. Against the backdrop of increasingly important integrity construction, this study is the first to explore how weather conditions and air pollution affect honest behavior. More importantly, compared to international emphasis on weather and air pollution' s effects on human behavior, domestic research in this area is clearly insufficient. Therefore, this study provides important theoretical and empirical supplements

to psychological research on how environmental issues like weather and air pollution affect behavior, which is of great significance for more systematically and deeply understanding weather and air pollution issues, especially for China where environmental problems are increasingly concerning.

Second, this study achieves methodological innovation. Since weather and air pollution are difficult to manipulate experimentally, they are basically impossible to control in laboratory research. Previous studies have continuously explored and innovated methodologically. For example, Lu et al. (2018) manipulated air pollution by only showing participants photos containing air pollution elements to observe their behavior. Obviously, showing participants pollution photos differs enormously from actually exposing them to air pollution, and Lu et al. acknowledged that using photos to evoke perceived pollution differs significantly from actual air pollution, identifying this as an important direction for future research. In this context, quasi-experimental research is undoubtedly the closest to real scenarios. Therefore, methodologically, this paper addresses previous methodological limitations in studying weather and air pollution, discovering environmental effects on honest behavior in real situations.

4.3 Practical Implications

This study also has important practical significance and value for policy formulation. Although the international community increasingly focuses on climate change, extreme weather, and air pollution, and China continues to work hard to address these issues, domestic and international research mainly targets the physiological health effects of climate change and air pollution, with relatively less attention to mental health. From a psychological research perspective, this paper provides more compelling evidence for China and the world to jointly combat air pollution and prevent climate deterioration. Air pollution and climate change not only threaten people' s physical health but also constitute important factors for mental health and social stability. For policymakers and government management departments, could different approaches to social order maintenance be adopted under different weather and air pollution conditions? Of course, this paper' s greatest practical significance should lie in encouraging more people to engage in environmental protection behaviors to reduce air pollution and slow climate change, as this not only makes people healthier but is also crucial for overall social harmony.

4.4 Limitations and Future Directions

This study has several limitations. On one hand, quasi-experimental research indeed allows us to better observe weather and air pollution effects on honest behavior in natural environments, but precisely because of this, the mechanisms underlying honest behavior remain insufficiently explained. We tend to believe that weather conditions and air pollution affect honest behavior primarily through emotional mechanisms (Keller et al., 2005; Lu et al., 2018). However, many other psychological and sociological mechanisms may provide alternative

explanations. Air pollution has long been associated with the impression of "dirty and messy," and broken windows theory suggests that environmental disorder itself can cause more immoral behavior and even social disorder (Keizer et al., 2008). In real life, we can indeed observe that people engage in more immoral behaviors such as littering or stealing in dirty environments (Keizer et al., 2008). Beyond environmental messiness, insufficient lighting and air pollution reduce environmental visibility. As is well known, criminal activities are much more frequent at night than during the day (Doleac & Sanders, 2015), and reduced visibility caused by insufficient lighting and air pollution also increases environmental concealment, making it easier for people to reduce self-constraint and engage in immoral behavior (Zhong et al., 2010). Additionally, cognitive ability may be an important reason for dishonest behavior, as research shows that long-term exposure to air pollution negatively affects cognitive performance on language and math tests (Zhang, Chen, & Zhang, 2018). In summary, future research needs to explore through more scientifically rigorous experimental designs what mechanisms cause people to engage in dishonest behavior under the influence of weather and air pollution in real situations.

Additionally, this study has other issues requiring further examination. For example, the two studies did not reach consistent conclusions regarding temperature' s effect on honest behavior. Although this aligns with previous research, temperature as a typical meteorological factor requires more research to determine whether and how it affects honest behavior. Besides, Study 2 focused on honest behavior among students at three key Chinese universities, and results showed many other variables may affect students' honest behavior, whose underlying mechanisms require more future research.

On the other hand, although this study found negative effects of non-sunny weather and air pollution on honest behavior, the overall effect sizes were relatively small. Regarding this, we first compared our effect sizes with previous research, finding that previous studies on weather and air pollution also reported small effect sizes (Lu et al., 2018), which is why such research often uses large sample sizes to test weather and air pollution effects on behavior. Second, we analyzed reasons for the small effect sizes in this study: (1) Many factors influence behavior, and weather is only one of them. Our quasi-experimental research, while ensuring natural and realistic scenarios, also included many confounding factors, and the complex environmental context likely reduced effect sizes. (2) Both studies' indoor settings may also have contributed to lower effect sizes. Study 1' s experimental settings were at various institutional front desks, and Study 2's in classrooms; indoor settings may have weakened weather and air pollution effects on honest behavior (Keller et al., 2005). Nevertheless, we believe small effect sizes do not diminish this study' s significance. Although the effects of weather and air pollution on honest behavior found in this study are small, considering honest behavior' s importance for socio-economic development and social harmony, small effects can produce very large impacts in the long run (Funder & Ozer, 2019). In any case, the robustness of weather and air pollution effects on honest behavior still requires further testing and exploration.

Finally, Cohn et al.' s research on honesty published in *Science* attracted widespread attention, including the finding that China had the lowest honesty level among all countries studied. Although comparing honesty levels across countries was not Cohn et al.' s original intention, the reasons behind this finding have attracted Chinese scholars' attention. Comparing Study 2' s quasi-experimental results with Cohn et al.' s results reveals very large differences. Although we analyzed this in Study 2, many questions remain worthy of research and consideration. What factors cause such huge differences in Chinese honesty levels across studies? What is our actual honesty level? And what factors influence Chinese honest behavior? These questions await further research.

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