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Air Pollution, State Anxiety, and Unethical Behavior: A Meta-Analytic Review

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In Lu, Lee, Gino, and Galinsky (2018), we reported four studies demonstrating that air pollution predicted unethical behavior and that one mediating mechanism was *state anxiety*. In contrast, Heck, Thielmann, Klein, and Hilbig (2020) reported one null-effect study on air pollution and unethical behavior and one null-effect study on *trait anxiety* and unethical behavior. Because any given study offers only pieces of evidence with limited generalizability, researchers faced with conflicting findings must consider the theoretical reasoning and all available empirical studies in the larger literature. To this end, we conducted two meta-analyses, which found that the links among air pollution, state anxiety, and unethical behavior are overall positive and significant. Moreover, we detail five recent papers that provide quasiexperimental evidence for the link between air pollution and unethical behavior.

Theoretical Basis of the Links Among Air Pollution, State Anxiety, and Unethical Behavior

In response to Heck and colleagues' Commentary, we first clarify the constructs and the theoretical links among them. As detailed in the Method section, the inclusion criteria of our meta-analyses closely followed these conceptualizations.

Conceptualizations of theoretical constructs

Air pollution. According to the Environmental Protection Agency, the six criteria air pollutants are: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter with aerodynamic diameter less than or equal to 2.5 μm and 10 μm ($PM_{2.5}$ and PM_{10}, respectively), and sulfur dioxide (www.epa.gov/criteria-air-pollutants). These pollutants tend to be positively associated with one another and form composite measures such as the Air Quality Index.

State anxiety. Following Brooks and Schweitzer (2011), we defined state anxiety as "a state of distress or physiological arousal in reaction to the potential for undesirable outcomes" (Lu, Lee, et al., 2018, p. 340). State anxiety can be induced by stressful situations such as exam pressure, economic difficulties, and job insecurity (Kouchaki & Desai, 2015).

Unethical behavior. Unethical behavior is defined as behavior that is "illegal or morally unacceptable to the larger community" (Jones, 1991, p. 367), which includes violent and nonviolent crime, delinquency, cheating, and other behaviors that violate ethical principles.

Theoretical links

Air pollution and state anxiety. Much research suggests that air pollution can increase state anxiety, both psychologically and physiologically (for a review, see Lu, 2020). Psychologically, the subjective experience of air pollution (e.g., visually, olfactorily) can make people anxious and distressed about their health, future, and life in general (Gong et al., 2020; Sass et al., 2017). Physiologically, air pollutants can trigger anxiety by increasing oxidative stress and systemic inflammation (Brook et al., 2010; Power et al., 2015). Notably, research has found that both short-term and long-term exposure to air pollution can increase anxiety symptoms (Power et al., 2015; Pun, Manjourides, & Suh, 2017).

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State anxiety and unethical behavior. State anxiety signals the presence of a potential threat and activates a self-protective mode to cope with the threat (Mathews, 1990). In anxiety-inducing situations, the brain concentrates its cognitive resources on the threatened self (Hermans et al., 2011). State anxiety leads individuals "to focus narrowly on their own basic needs and self-interest, which can cause them to be less mindful of principles that guide ethical and moral reasoning, thus leading them to behave unethically" (Kouchaki & Desai, 2015, p. 360; supported by five experiments). Similarly, Zhang, Shi, Zhou, Ma, and Tang (2020) theorized that "anxiety might increase unethical behavior because individuals who feel anxious are more likely to engage in intuitive automatic processing that shifts attention from moral standards to self-interest, and thus to behave unethically" (p. 720; supported by two experiments). Moreover, resisting unethical behaviors often requires self-control resources, which can be depleted by state anxiety (Fehr, Yam, He, Chiang, & Wei, 2017). Thus, individuals feeling anxious may be less attentive to ethical principles such as "Thou shalt not kill" (violent unethical behavior) and "Thou shalt not steal" (nonviolent unethical behavior)—especially because unethical behaviors themselves (e.g., stealing, vandalism) often serve to mitigate the anxiety-inducing situations by providing material resources and psychological relief (Lu, Zhang, Rucker, & Galinsky, 2018).

Building off these theoretical perspectives and empirical findings, we hypothesized that air pollution can increase unethical behavior by inducing state anxiety. While we have precisely defined these constructs and theorized the links among them, it would be imprudent if we asserted that only a *specific* pollutant *X* will predict a *specific* unethical behavior *Y*, especially given the high correlations among the criteria pollutants. Instead, our theoretical perspective is that unethical behavior may increase when a given air pollutant induces state anxiety—psychologically or physiologically.

In light of the conflicting findings between our research and Heck et al.'s, we conducted a meta-analytic review of the links among air pollution, state anxiety, and unethical behavior. We followed standard reporting guidelines for meta-analyses outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009). The literature search was conducted in the following databases: PsycINFO, PubMed, Scopus, and Web of Science. Moreover, we searched for additional studies in ProQuest and Google Scholar, issued a call for unpublished studies through the LISTSERV and research forum of the Society for Personality and Social Psychology, and contacted researchers active in the field.

Meta-Analysis on Air Pollution and Unethical Behavior

Method

Search strategy and inclusion criteria. On the basis of the definitions of air pollution and unethical behavior, we used the search term ("air pollution") AND ("unethical" OR "crime" OR "criminal" OR "cheat*" OR "dishonest*"). As mentioned, the six criteria air pollutants were carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter ($PM_{2.5}$, PM_{10}), and sulfur dioxide. Thus, our meta-analysis included studies that involved objective measures of any of these six air pollutants or their composite measures; we did not include noncriteria air pollutants (e.g., manganese).

Screening. We closely followed standard meta-analysis practices in the screening process (e.g., Friese, Frankenbach, Job, & Loschelder, 2017; Melby-Lervåg & Lervåg, 2014). Titles and abstracts of 135 articles were screened by two trained research assistants for relevance. Of these, 110 were excluded because they were irrelevant to the present research, and 25 were assessed for eligibility. We further excluded 4 articles on pollutants that were not airborne. Ultimately, 15 published and 6 unpublished articles (22 quantitative studies) were included for the meta-analysis on the link between air pollution and unethical behavior. For detailed steps, see the PRISMA flow chart in Figure S1 in the Supplemental Material available online.

Coding. As detailed in Table S1 in the Supplemental Material, for each study, we coded for location (country, state, city), sample size, research design (correlational or quasiexperimental), pollutants, and unethical behavior (violent, nonviolent, or mixed).

Analytical approach. We used the random-effects approach of meta-analysis, which is more conservative and appropriate when the goal is to generalize beyond the available studies without assuming that there is only one true, "fixed" effect size (Goh, Hall, & Rosenthal, 2016, p. 539). If a paper contained insufficient information about effect size, we contacted its authors. Because the studies used different analytical strategies, we converted all effect sizes to the same metric, Pearson's r, and applied Fisher's z transformation. When r was unavailable but the standardized regression coefficient (β) was available, we followed the commonly used β-to-r imputation formula: $r = \beta + .05\lambda$, where λ equals 1 when β is nonnegative, and λ equals 0 when β is negative (Peterson & Brown, 2005; for a recent meta-analysis example, see Agadullina & Lovakov, 2018, p. 711). For comparison purposes, we present effect sizes that account for population as a key covariate (e.g., crime rate = number of crimes divided by population).

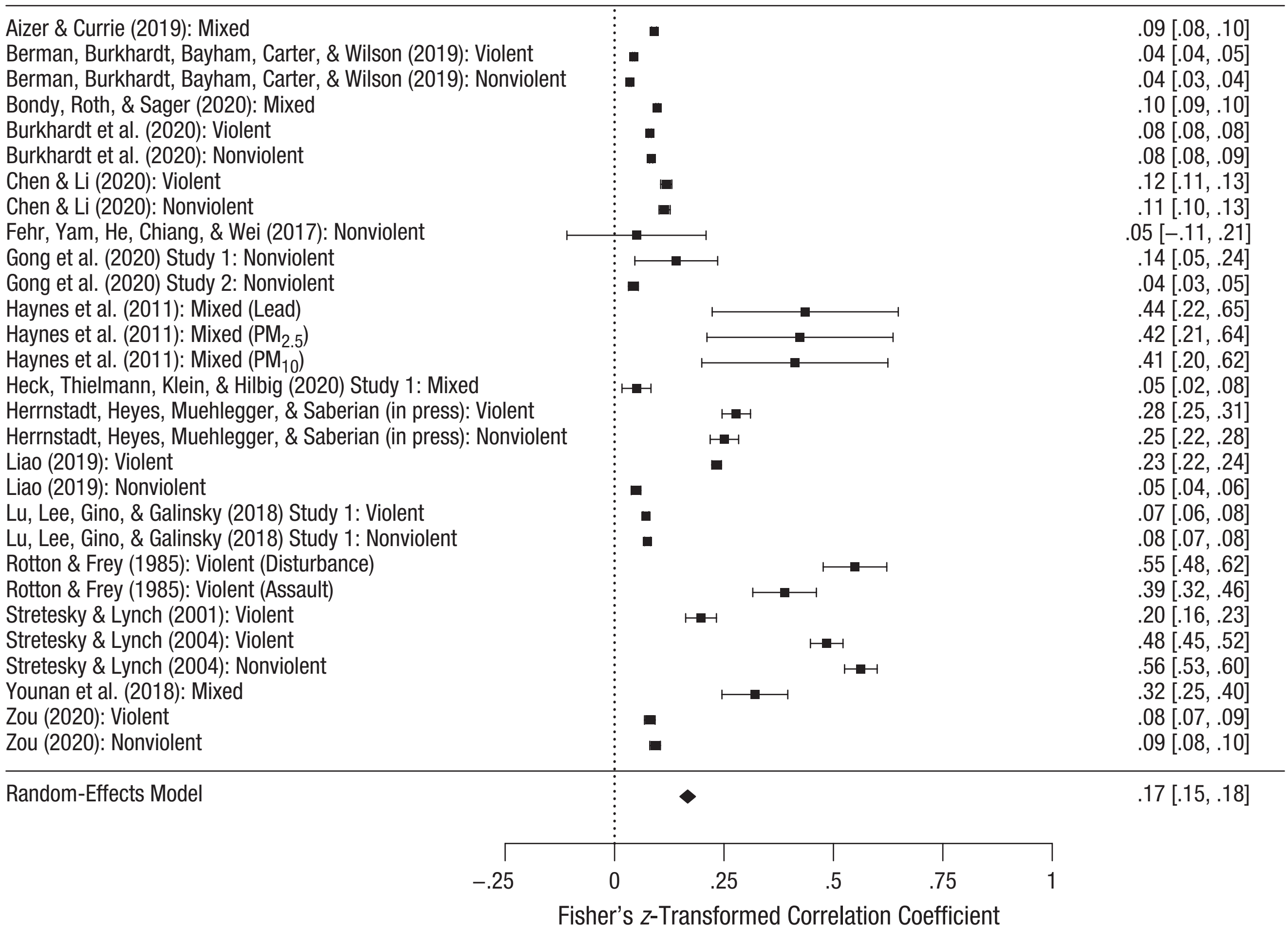

Fig. 1. Forest plot of random-effects meta-analysis for the link between air pollution and unethical behavior. Error bars and values in brackets indicate 95% confidence intervals. PM = particulate matter.

If a study has multiple effect sizes (e.g., the relationships between multiple pollutants and unethical behaviors), one common approach is to calculate a composite effect size that averages and adjusts effect sizes on the basis of the correlation of the combined effect sizes. However, this approach results in a loss of information and fails to account for statistical dependency across effect sizes (Friese et al., 2017). Therefore, we used robust variance estimation (RVE; Hedges, Tipton, & Johnson, 2010) in the R package *robumeta* (Fisher, Tipton, & Hou, 2016), which has been used in recent meta-analyses (Agadullina & Lovakov, 2018; Bediou et al., 2018; Friese et al., 2017; Kurdi et al., 2019).

Results

The distribution of effect sizes is presented in Figure 1. The random-effects mean effect size was .17, SE = .009, 95% confidence interval (CI) = [.15, .18], z = 18.61, p < .001, and the RVE random-effects mean effect size was .16, SE = .03, 95% CI = [.09, .23], $t(15.1)$ = 4.73, p < .001, suggesting an overall positive link between air pollution and unethical behavior.[1] In addition, we examined whether the relationship between air pollution and unethical behavior was statistically significant at a p value of .05 in the most conservative model of each study (e.g., the model with the most comprehensive control variables, fixed effects, robust standard errors). In 72.2% of the effect sizes in the meta-analysis, the most conservative model yielded a significant relationship (see Table S1). Overall, our meta-analysis, which included studies from different geographic regions, revealed a positive and significant link between air pollution and unethical behavior.

Publication bias occurs when studies with statistically significant results are more likely to be published than studies with null results. To examine potential publication bias, we conducted Egger's regression test (Sterne & Egger, 2005), precision-effect test (PET), and precision-effect estimate with standard error (PEESE) meta-regression with RVE (Fisher et al., 2016; Stanley & Doucouliagos, 2014). Egger's regression test examines whether there is a statistically significant relationship between effect size and study precision (as indicated by the study standard error; Friese et al., 2017). Egger's regression test for funnel-plot asymmetry was significant, $b = 4.81$, $SE = 0.46$, $z = 10.52$, $p < .001$. To account for statistical dependencies, we further conducted PET and PEESE meta-regression with RVE using the R package *robumeta* (Fisher et al., 2016). "Because PET underestimates nonzero effects and PEESE overestimates null effects" (Agadullina & Lovakov, 2018, p. 712), a two-step conditional PET-PEESE procedure is recommended: If PET finds a significant effect, then the PEESE estimate is preferred; if PET does not find a significant effect, then the PET estimate is preferred (Agadullina & Lovakov, 2018; Stanley & Doucouliagos, 2014). Analyses revealed that both PET, $b = 3.98$, $SE = 1.86$, $t(5.32) = 2.14$, $p = .08$, and PEESE, $b = 25.64$, $SE = 15.64$, $t(1.69) = 1.64$, $p = .26$, were not significant.

Quasiexperimental Studies on Air Pollution and Unethical Behavior

Because both Heck et al.'s Study 1 and our Study 1 were correlational, we detail five recent papers that provided quasiexperimental evidence for the link between air pollution and unethical behavior (Bondy, Roth, & Sager, 2020; Chen & Li, 2020; Gong et al., 2020; Herrnstadt, Heyes, Muehlegger, & Saberian, in press; Zou, 2020). Like Heck et al., Bondy et al. (2020) also used data from the United Kingdom. Whereas Heck et al. used monthly data, Bondy et al. used more precise daily data. More importantly, Bondy et al. exploited daily wind direction as an exogenous source of random variation in air pollution: On some days, wind blows air pollution to an area, and on other days, wind blows air pollution away from the area. Bondy et al. found that "air pollution has a positive and statistically significant impact on overall crime and on several major crime categories, including those with economic motives" (p. 555). Similarly, Herrnstadt and colleagues (in press) exploited daily wind direction as an exogenous source of random variation in air pollution and provided quasiexperimental evidence for the link between air pollution and violent crime. By employing a triple-difference estimator and instrumental-variable analysis, Chen and Li (2020) found that the NO_x Budget Trading Program "significantly reduced violent and property crimes in participating states by roughly 3.7% and 2.9%, respectively" (abstract). Zou (2020) leveraged the Environmental Protection Agency's pollution-monitoring policy experiment as an exogenous source of random variation in daily air pollution and revealed that air pollution significantly predicted both violent and nonviolent crimes. Finally, via a regression-discontinuity design, Gong and colleagues (2020) provided quasiexperimental evidence for the effect of air pollution on unethical behaviors in the workplace. Taken together, these quasiexperimental studies underscore the reliable link between air pollution and unethical behavior.

Meta-Analysis on State Anxiety and Unethical Behavior

Method

Search strategy and inclusion criteria. Because state anxiety is defined as "a state of distress or physiological arousal in reaction to the potential for undesirable outcomes" (Brooks & Schweitzer, 2011, p. 44), we used the search term ("anxiety" OR "anxious" OR "stress" OR "distress") AND ("unethical" OR "crime" OR "criminal" OR "cheat*" OR "dishonest*"). Because our theory is limited to state anxiety, the meta-analysis focused on studies about state anxiety but not trait anxiety. Moreover, only studies with a direct measure of state anxiety were included.

Screening. In line with standard meta-analysis practices (Friese et al., 2017; Melby-Lervåg & Lervåg, 2014), titles and abstracts of 8,139 articles were screened by two trained research assistants for relevance. Of these, 8,106 were excluded because they were irrelevant to the present research, and 33 were assessed for eligibility. We further excluded 25 articles according to the aforementioned inclusion criteria. Ultimately, 7 published articles and 1 unpublished article (14 quantitative studies) were included for the meta-analysis on the link between state anxiety and unethical behavior. For detailed steps, see the PRISMA flow chart in Figure S2 in the Supplemental Material.

Coding. As detailed in Table S2 in the Supplemental Material, we coded for study subjects, sample size, research design (correlational or experimental), whether state anxiety was measured or manipulated, how state anxiety was measured, and how unethical behavior was measured.

Analytical approach. We again used the more conservative random-effects approach (Goh et al., 2016) to meta-analyze the link between state anxiety and unethical behavior. As before, we converted all effect sizes to the same metric, Pearson's r, and applied Fisher's z transformation. The R package *robumeta* was not used because each study had only one effect size.

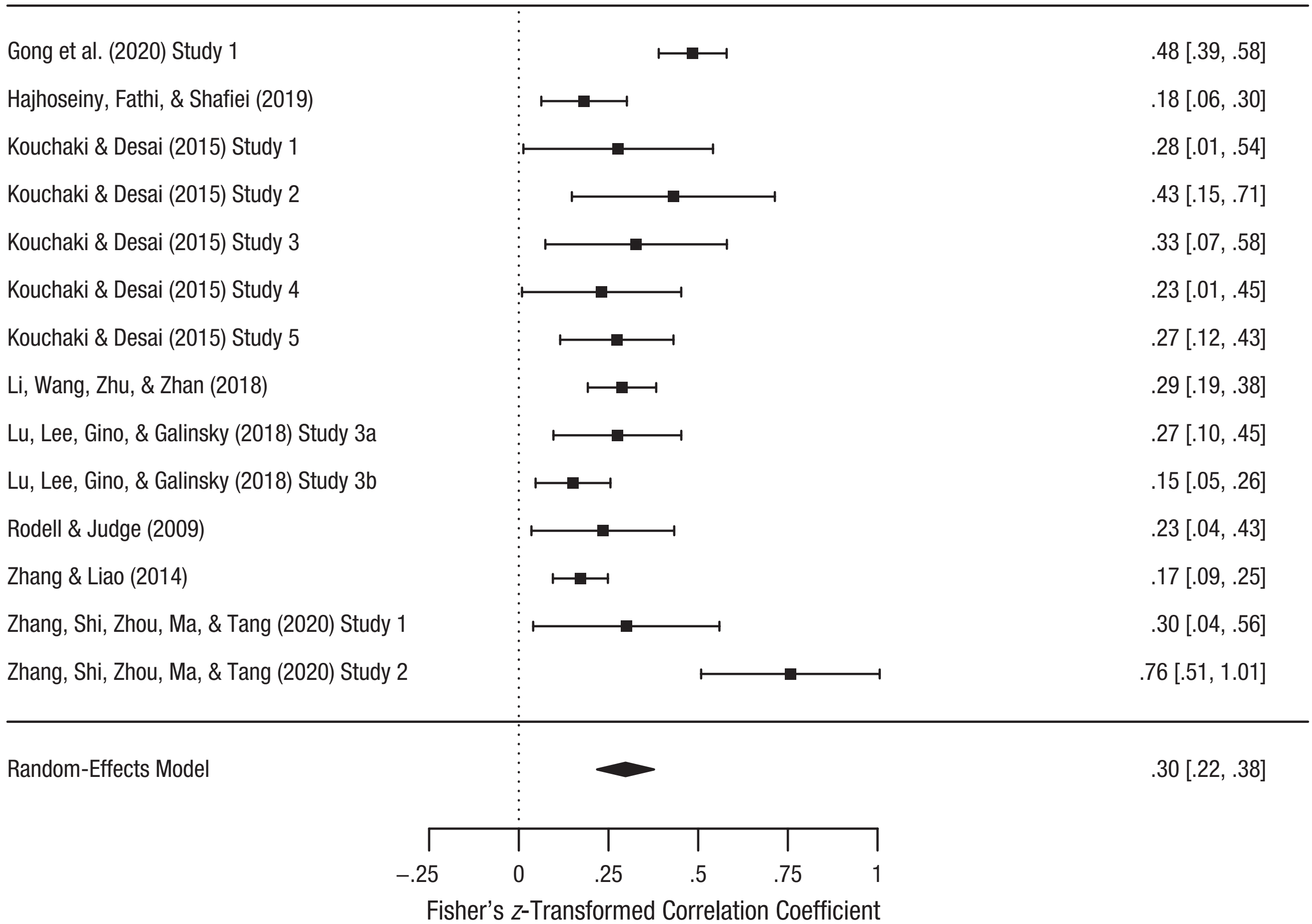

Fig. 2. Forest plot of random-effects meta-analysis for the link between state anxiety and unethical behavior. Error bars and values in brackets indicate 95% confidence intervals.

Results

The distribution of effect sizes is presented in Figure 2. The random-effects mean effect size was .30, SE = .04, 95% CI = [.22, .38], z = 7.35, p < .001, suggesting an overall positive link between state anxiety and unethical behavior.

To examine potential publication bias, we conducted Egger's regression test for funnel-plot asymmetry (Sterne & Egger, 2005), PET, and PEESE (Fisher et al., 2016; Stanley & Doucouliagos, 2014). Analyses revealed that Egger's regression test (b = 1.46, SE = 1.13, z = 1.29, p = .20), PET (b = 1.46, SE = 1.13, z = 1.29, p = .20), and PEESE (b = 8.62, SE = 6.25, z = 1.38, p = .17) were all not significant.

The Mediating Role of State Anxiety

In addition to Lu, Lee, et al.'s (2018) Studies 3a and 3b, other studies have shown that state anxiety mediates the link between air pollution and unethical behavior (e.g., Gong et al., 2020 Study 1). In another article, Fehr and colleagues (2017) also demonstrated the link between air pollution and unethical behavior.[2] Importantly, their mediating mechanism of self-control depletion is conceptually consistent with the mechanism of state anxiety. Indeed, Fehr et al. (2017) stated that "self-control resources are depleted by factors such as emotional labor . . . [and] feelings of anxiety" (p. 99). In short, the mediating role of state anxiety appears to be both theoretically cogent and empirically robust.

Assessment of Heck et al.'s Commentary

Heck et al.'s Study 1

Logical issues. When questioning the link between air pollution and unethical behavior, Heck and colleagues stated that "the hypothesis that air pollution directly causes crime conflicts with ample evidence that crime rates are higher in summer than in winter" (p. 741). The gist of their logic is that (a) air pollution is negatively related to temperature, (b) temperature is positively related to crime, and hence, (c) air pollution should not be positively related to crime. This logic is flawed because air pollution and temperature may have *independent* effects on crime (see the Supplemental Material for a simulation). Bondy et al. (2020), Gong et al. (2020), Herrnstadt et al. (in press), and Zou (2020) all found significant effects of air pollution on unethical behavior while controlling for temperature—consistent with our theoretical perspective that air pollution may have an incremental effect on unethical behavior (Lu, Lee, et al., 2018).

Empirical issues. Heck and colleagues collected data on air pollution and crimes for 103 districts in the United Kingdom. However, the United Kingdom has 391 districts. As Heck and colleagues acknowledged, pollution data were not available for all districts for their time period (2016–2018) because of the absence of active measurement stations. The correlational nature of Heck et al.'s Study 1 raises the possibility that the link between air pollution and crime might be significant if the data set were more complete and potential omitted variables were controlled for. Notably, in Heck et al.'s Table 1 (p. 744) the incremental effect of air pollution on total crime was significant (p = .015), suggesting that there might be a small but real effect of air pollution on crimes.

Heck et al.'s Study 2

Heck et al.'s Study 2 was a reanalysis of 16 studies from their earlier publication (Heck, Thielmann, Hilbig, & Moshagen, 2018). Critically, all of these studies were about *trait* anxiety rather than *state* anxiety. The distinction between trait anxiety and state anxiety is widely recognized in the literature (Endler & Kocovski, 2001; Spielberger, 1966). Although related, trait anxiety and state anxiety have been shown to have differential effects. For example, Pacheco-Unguetti, Acosta, Callejas, and Lupiáñez (2010) showed that "trait anxiety was related to deficiencies in the executive control network, but state anxiety was associated with an overfunctioning of the alerting and orienting networks" (p. 298). Moreover, physiological measures such as respiration rate and systolic blood pressure load heavily on state anxiety but not on trait anxiety (Zuckerman & Spielberger, 2015).

In addition, in only reanalyzing the studies from their previous publication, Heck et al. (2020) overlooked other studies directly testing the link between state anxiety and unethical behavior (e.g., five experiments from Kouchaki & Desai, 2015; two experiments from Zhang et al., 2020). Despite the many studies demonstrating the link between state anxiety and unethical behavior (see Fig. 2), Heck et al. never discussed why this link is theoretically implausible.

Conclusion

Because no effect in social-science research is generalizable to all situations, meta-analyses are critical to ascertaining the generalizability of a given effect. Our meta-analyses found reliable links among air pollution, state anxiety, and unethical behavior. In accordance with Simons, Shoda, and Lindsay (2017), we specify Constraints of Generality. First, our meta-analyses are limited to the six criteria air pollutants and agnostic about other pollutants (e.g., manganese). Second, although our meta-analyses covered studies from different geographic regions around the world, the observed relationships might not generalize to all regions given the complexities of pollution, climate, and culture. In conclusion, we call for future research to more precisely illuminate the relationships between specific air pollutants and specific forms of unethical behavior.

Transparency

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Author Contributions

J. G. Lu conducted the meta-analytic review. J. G. Lu drafted the manuscript, and J. J. Lee, F. Gino, and A. D. Galinsky provided critical revisions. All authors approved the final version of the manuscript for submission.

Declaration of Conflicting Interests

The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

Open Practices

All data and R code have been made publicly available via the Open Science Framework and can be accessed at https://osf.io/23ekf/. The design and analysis plans for this meta-analytic review were not preregistered. The complete Open Practices Disclosure for this article can be found at http://journals.sagepub.com/doi/suppl/10.1177/0956797620924765. This article has received the badges for Open Data and Open Materials. More information about the Open Practices badges can be found at http://www.psychologicalscience.org/publications/badges.

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Supplemental Material

Additional supporting information can be found at http://journals.sagepub.com/doi/suppl/10.1177/0956797620924765

Notes

1. Although lead is one of the six criteria air pollutants, Heck and colleagues questioned its inclusion in our meta-analysis during the review process. To address this query, we also conducted a version of the meta-analysis without the studies on lead. All results remained substantively unchanged: The random-effects mean effect size was .13, SE = .009, 95% CI = [.12, .15], z = 15.32, p < .001, and the RVE random-effects mean effect size was .13, SE = .03, 95% CI = [.07, .19], t(11.9) = 4.88, p < .001. Regarding publication bias, both PET, b = 3.44, SE = 1.70, t(4.89) = 2.03, p = .10, and PEESE, b = 27.53, SE = 15.12, t(1.73) = 1.82, p = .23, were not significant.
2. Although Fehr et al. (2017) referred to their outcome variable as "counterproductive work behavior" (CWB), they operationalized it as unethical behavior. As their study's first step, Fehr et al. (2017) "asked 129 full-time employees in China (M_{age} = 30.68; 52% male) to indicate the perceived *ethicality* of each item . . . (1 = Very Unethical; 4 = Neither Ethical Nor Unethical; 7 = Very Ethical) . . . [and] participants perceived the CWB items for the full and short scales to be unethical" (p. 103).

References

References marked with an asterisk indicate studies included in the meta-analyses.

Agadullina, E. R., & Lovakov, A. V. (2018). Are people more prejudiced towards groups that are perceived as coherent? A meta-analysis of the relationship between outgroup entitativity and prejudice. *British Journal of Social Psychology*, *57*, 703–731.

*Aizer, A., & Currie, J. (2019). Lead and juvenile delinquency: New evidence from linked birth, school, and juvenile detention records. *The Review of Economics and Statistics*, *101*, 575–587.

Bediou, B., Adams, D. M., Mayer, R. E., Tipton, E., Green, C. S., & Bavelier, D. (2018). Meta-analysis of action video game impact on perceptual, attentional, and cognitive skills. *Psychological Bulletin*, *144*, 77–110.

*Berman, J. D., Burkhardt, J., Bayham, J., Carter, E., & Wilson, A. (2019). Acute air pollution exposure and the risk of violent behavior in the United States. *Epidemiology*, *30*, 799–806.

*Bondy, M., Roth, S., & Sager, L. (2020). Crime is in the air: The contemporaneous relationship between air pollution and crime. *Journal of the Association of Environmental and Resource Economists*, *7*, 555–585.

Brook, R. D., Rajagopalan, S., Pope, C. A., Brook, J. R., Bhatnagar, A., Diez-Roux, A. V., . . . Kaufman, J. D. (2010). Particulate matter air pollution and cardiovascular disease: An update to the scientific statement from the American Heart Association. *Circulation*, *121*, 2331–2378.

Brooks, A. W., & Schweitzer, M. E. (2011). Can Nervous Nelly negotiate? How anxiety causes negotiators to make low first offers, exit early, and earn less profit. *Organizational Behavior and Human Decision Processes*, *115*, 43–54. doi:10.1016/j.obhdp.2011.01.008

*Burkhardt, J., Bayham, J., Wilson, A., Berman, J. D., O'Dell, K., Ford, B., . . . Pierce, J. R. (2020). The relationship between monthly air pollution and violent crime across the United States. *Journal of Environmental Economics and Policy*, *9*, 188–205. doi:10.1080/21606544.2019.1630014

*Chen, S., & Li, T. (2020). The effect of air pollution on criminal activities: Evidence from the NO_x Budget Trading Program. *Regional Science and Urban Economics*, *83*, Article 103528. doi:10.1016/j.regsciurbeco.2020.103528

Endler, N. S., & Kocovski, N. L. (2001). State and trait anxiety revisited. *Journal of Anxiety Disorders*, *15*, 231–245.

*Fehr, R., Yam, K. C., He, W., Chiang, J. T. J., & Wei, W. (2017). Polluted work: A self-control perspective on air pollution appraisals, organizational citizenship, and counterproductive work behavior. *Organizational Behavior and Human Decision Processes*, *143*, 98–110.

Fisher, Z., Tipton, E., & Hou, Z. (2016). *robumeta: Robust variance meta-regression*. (R package Version 2.0). Retrieved from https://cran.r-project.org/package=robumeta

Friese, M., Frankenbach, J., Job, V., & Loschelder, D. D. (2017). Does self-control training improve self-control? A meta-analysis. *Perspectives on Psychological Science*, *12*, 1077–1099.

Goh, J. X., Hall, J. A., & Rosenthal, R. (2016). Mini meta-analysis of your own studies: Some arguments on why and a primer on how. *Social and Personality Psychology Compass*, *10*, 535–549.

*Gong, S., Lu, J. G., Schaubroeck, J. M., Li, Q., Zhou, Q., & Qian, X. (2020). *Polluted psyche: Is the effect of air pollution on unethical behavior more physiological or psychological?* Manuscript submitted for publication.

*Hajhoseiny, S., Fathi, Z., & Shafiei, H. (2019). Are those with darker personality traits more willing to corrupt when they feel anxious? *Iranian Journal of Management Studies*, *12*, 451–479.

*Haynes, E. N., Chen, A., Ryan, P., Succop, P., Wright, J., & Dietrich, K. N. (2011). Exposure to airborne metals and particulate matter and risk for youth adjudicated for criminal activity. *Environmental Research*, *111*, 1243–1248.

Heck, D. W., Thielmann, I., Hilbig, B. E., & Moshagen, M. (2018). Who lies? A large-scale reanalysis linking basic personality traits to unethical decision making. *Judgment and Decision Making*, *13*, 356–371.

*Heck, D. W., Thielmann, I., Klein, S. A., & Hilbig, B. E. (2020). On the limited generality of air pollution and anxiety as causal determinants of unethical behavior: Commentary on Lu, Lee, Gino, and Galinsky (2018). *Psychological Science*, *31*, 741–747. doi:10.1177/0956797619866627

Hedges, L. V., Tipton, E., & Johnson, M. C. (2010). Robust variance estimation in meta-regression with dependent effect size estimates. *Research Synthesis Methods*, *1*, 39–65.

Hermans, E. J., Van Marle, H. J. F., Ossewaarde, L., Henckens, M. J. A. G., Qin, S., Van Kesteren, M. T. R., . . . Fernández, G. (2011). Stress-related noradrenergic activity prompts large-scale neural network reconfiguration. *Science*, *334*, 1151–1153.

*Herrnstadt, E., Heyes, A., Muehlegger, E., & Saberian, S. (in press). Air pollution and criminal activity: Microgeographic evidence from Chicago. *American Economic Journal: Applied Economics*.

Jones, T. M. (1991). Ethical decision making by individuals in organizations: An issue-contingent model. *Academy of Management Review*, *16*, 366–395. doi:10.5465/AMR.1991.4278958

*Kouchaki, M., & Desai, S. D. (2015). Anxious, threatened, and also unethical: How anxiety makes individuals feel threatened and commit unethical acts. *Journal of Applied Psychology*, *100*, 360–375.

Kurdi, B., Seitchik, A. E., Axt, J. R., Carroll, T. J., Karapetyan, A., Kaushik, N., . . . Banaji, M. R. (2019). Relationship between the Implicit Association Test and intergroup behavior: A meta-analysis. *American Psychologist*, *74*, 569–586.

*Li, Z., Wang, Z., Zhu, Z., & Zhan, X. (2018). Performance pressure and unethical pro-organizational behavior: Based on cognitive appraisal theory of emotion. *Chinese Journal of Management*, *15*, 358–365.

*Liao, S. X. (2019). *Bayesian causal inference for estimating impacts of air pollution exposure*. Unpublished doctoral dissertation, Harvard University.

Lu, J. G. (2020). Air pollution: A systematic review of its psychological, economic, and social effects. *Current Opinion in Psychology*, *32*, 52–65.

*Lu, J. G., Lee, J. J., Gino, F., & Galinsky, A. D. (2018). Polluted morality: Air pollution predicts criminal activity and unethical behavior. *Psychological Science*, *29*, 340–355. doi:10.1177/0956797617735807

Lu, J. G., Zhang, T., Rucker, D. D., & Galinsky, A. D. (2018). On the distinction between unethical and selfish behavior. In K. Gray & J. Graham (Eds.), *Atlas of moral psychology: Mapping good and evil in the mind* (pp. 465–474). New York, NY: Guilford Press.

Mathews, A. (1990). Why worry? The cognitive function of anxiety. *Behaviour Research and Therapy*, *28*, 455–468.

Melby-Lervåg, M., & Lervåg, A. (2014). Reading comprehension and its underlying components in second-language learners: A meta-analysis of studies comparing first- and second-language learners. *Psychological Bulletin*, *140*, 409–433.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine*, *151*, 264–269.

Pacheco-Unguetti, A. P., Acosta, A., Callejas, A., & Lupiáñez, J. (2010). Attention and anxiety: Different attentional functioning under state and trait anxiety. *Psychological Science*, *21*, 298–304.

Peterson, R. A., & Brown, S. P. (2005). On the use of beta coefficients in meta-analysis. *Journal of Applied Psychology*, *90*, 175–181.

Power, M. C., Kioumourtzoglou, M. A., Hart, J. E., Okereke, O. I., Laden, F., & Weisskopf, M. G. (2015). The relation between past exposure to fine particulate air pollution and prevalent anxiety: Observational cohort study. *BMJ*, *350*, Article h1111. doi:10.1136/bmj.h1111

Pun, V. C., Manjourides, J., & Suh, H. (2017). Association of ambient air pollution with depressive and anxiety symptoms in older adults: Results from the NSHAP study. *Environmental Health Perspectives*, *125*, 342–348.

*Rodell, J. B., & Judge, T. A. (2009). Can "good" stressors spark "bad" behaviors? The mediating role of emotions in links of challenge and hindrance stressors with citizenship and counterproductive behaviors. *Journal of Applied Psychology*, *94*, 1438–1451.

*Rotton, J., & Frey, J. (1985). Air pollution, weather, and violent crimes: Concomitant time-series analysis of archival data. *Journal of Personality and Social Psychology*, *49*, 1207–1220.

Sass, V., Kravitz-Wirtz, N., Karceski, S. M., Hajat, A., Crowder, K., & Takeuchi, D. (2017). The effects of air pollution on individual psychological distress. *Health and Place*, *48*, 72–79.

Simons, D. J., Shoda, Y., & Lindsay, D. S. (2017). Constraints on Generality (COG): A proposed addition to all empirical papers. *Perspectives on Psychological Science*, *12*, 1123–1128.

Spielberger, C. D. (1966). Theory and research on anxiety. In C. D. Spielberger (Ed.), *Anxiety and Behavior* (pp. 3–20). New York, NY: Academic Press. doi:10.1016/B978-1-4832-3131-0.50006-8

Stanley, T. D., & Doucouliagos, H. (2014). Meta-regression approximations to reduce publication selection bias. *Research Synthesis Methods*, *5*, 60–78.

Sterne, J. A. C., & Egger, M. (2005). Regression methods to detect publication and other bias in meta-analysis. In H. R. Rothstein, A. J. Sutton, & M. Borenstein (Eds.), *Publication bias in meta-analysis: Prevention, assessment and adjustments* (pp. 99–110). New York, NY: Wiley.

*Stretesky, P. B., & Lynch, M. J. (2001). The relationship between lead exposure and homicide. *Archives of Pediatrics and Adolescent Medicine*, *155*, 579–582.

*Stretesky, P. B., & Lynch, M. J. (2004). The relationship between lead and crime. *Journal of Health and Social Behavior*, *45*, 214–229.

*Younan, D., Tuvblad, C., Franklin, M., Lurmann, F., Li, L., Wu, J., . . . Chen, J. C. (2018). Longitudinal analysis of particulate air pollutants and adolescent delinquent behavior in Southern California. *Journal of Abnormal Child Psychology*, *46*, 1283–1293.

*Zhang, G., & Liao, J. (2014). Relationship between academic appraisal stressors and university teachers' unethical behaviors. *Chinese Journal of Management*, *11*, 360–366.

*Zhang, H., Shi, Y., Zhou, Z. E., Ma, H., & Tang, H. (2020). Good people do bad things: How anxiety promotes unethical behavior through intuitive and automatic processing. *Current Psychology*, *39*, 720–728. doi:10.1007/s12144-018-9789-7

Zou, E. (2020). *Unwatched pollution: The effect of intermittent monitoring on air quality*. Manuscript submitted for publication.

Zuckerman, M., & Spielberger, C. D. (2015). *Emotions and anxiety: New concepts, methods, and applications*. New York, NY: Psychology Press.