

Exploring the effects of air pollution on urban life in China using social media data

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Researchers at the MIT Senseable City Lab (SCL), along with the MIT China Future City Lab (CFC), utilized a unique approach to study the impact of air pollution on urban activity in Chinese cities. They used geotagged social media data to explore how urban behavior is affected by air pollution, and to better understand which people and activities are most susceptible to the social stresses that pollution can precipitate.

The research was motivated by concerns about the impact of air pollution on health in China, and how it reduces the value of urban density by limiting the activities that make urban life desirable. “By evaluating the relationship between air quality and urban activity, we aim to assess a broader range of air pollution’s social costs, which could ultimately lead to more effective cost reduction measures,” says Siqi Zheng, Faculty Director of CFC.

Air pollution in China is calculated to cause 1.6 million deaths per year. It is particularly acute in Chinese cities, where pollution levels are more than six to 20 times higher than what the World Health Organization air quality guidelines recommend. Recent urbanization has only exacerbated the problem, even though air pollution impedes the very kinds of social interactions that people seek out in urban areas.

To facilitate their study, MIT researchers used data from Weibo, the Chinese micro-blogging platform that is similar to Twitter, to analyze over 50 million geotagged records (i.e., records identified by location) from about 640,000 unique users. Each record was associated with one of seven different activity categories, including work, leisure, public transportation, and residential life. Researchers then correlated this data with 24-hour air pollution records for 251 Chinese cities, taken over a period of 22 months, provided by China’s Ministry of Environmental Protection. These included daily records for six major pollutants, including NO₂ (nitrogen dioxide) and SO₂ (sulfur dioxide).

“In essence, we used geotagged social media to construct a vast dataset that served as a virtual representation of urban activity,” said Carlo Ratti, director of SCL. “We then examined this data in the context of air quality and pollution levels, trying to ascertain which of these activities perform better or worse when pollution levels are at their highest or lowest.”

The results of this research, “Exploring the effect of air pollution on social activity in China using geotagged social media check-in data”, published in the journal *Cities*, offer clear proof that air pollution causes a general and significant decline in total urban activity in China. In particular, researchers found that leisure activities are four to six times more susceptible to air pollution than work-related activities. Locals are at least four times more sensitive to air pollution than tourists (which could be explained by the expense of getting to a particular location in China, and the limited duration of visits). SO₂ (sulfur dioxide) has the largest impact on urban activity, while CO (carbon monoxide) and O₃ (ozone) appear to have little impact at all.

Researchers also found that wealthy people are better able to protect themselves from pollution’s affects by avoiding certain activities, which poor people may not be able to do.

This touches on the complicated issue of environmental injustice in China, which the researchers believe is central to their work: “Our research illustrates some of the disparities between how the wealthy and the poor respond to air pollution,” said Longxu Yang, researcher at SCL and first author of the paper, published in the journal *Cities*. “It also highlights the need for public health policies that address the consequences of pollution in China’s many large cities, and in underdeveloped areas of the country where manufacturing is just beginning to infiltrate.”

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ABOUT THE MIT SENSEABLE CITY LAB

The Senseable City Lab at the Massachusetts Institute of Technology is a transdisciplinary research group that studies the interface between cities, people and technologies. Not bound by the methodologies of a single field, the Lab is characterized by an omni-disciplinary approach, and speaks the language of designers, planners, engineers, physicists, biologists and social scientists. Senseable is as fluent with industry partners as it is with metropolitan governments, individual citizens and disadvantaged communities. Through design and science, the Lab develops and deploys tools to learn about cities—so that cities can learn about us.

ABOUT THE MIT CHINA FUTURE CITY LAB

The MIT China Future City Lab is a research and entrepreneurship program that focuses on the challenges of urban development in China. The China Future City Lab addresses challenges and issues related to urbanization in China; they mobilize the vision, research expertise, experience, talent, creativity, and other resources of MIT to identify innovative concepts and develop novel tools, technologies, and solutions that are applicable to the obstacles and opportunities in China's growing cities. The China Future City Lab is hosted at the MIT Department of Urban Studies and Planning, and Center for Real Estate.