

One Country, Two Lungs

MIT researchers as 'urban probes' traverse Shenzhen and Hong-Kong to detect urban air pollution

Over the past weeks, MIT researchers and LAAB Studio have deployed a system of human-borne sensors to assess and compare air pollution in Hong Kong and Shenzhen. Results are presented as a dynamic map called 'One Country, Two Lungs,' currently on show at the Hong Kong / Shenzhen Bi-City Biennale of Urbanism and Architecture (until the end of February 2014). The installation highlights an asymmetric exposure to pollution between the inhabitants of Hong Kong and Shenzhen, showing how air quality across one of the world's largest metropolitan areas changes step by step. One Country Two Lungs also provides a glimpse into how new applications of sensor and tracking technology can be used for monitoring air pollution in cities on a personal, human scale.

Urban air quality is becoming an increasing concern in cities across the globe: the World Health Organization estimates its effects at over one million deaths per year (REF). The situation is particularly critical in the Hong Kong and Shenzhen region, a metropolitan area with over 17 million inhabitants and one of one of the world's largest and most densely populated urban spaces. Emissions from traffic and coal-powered electricity plants on mainland China create pollution, while Hong Kong's tall buildings sequester stagnant air. Researchers estimate the financial burden of air pollution to Hong Kong at about HK\$21.2 billion (USD\$2.7 billion) a year due to hospital admissions and lost productivity (REF).

"Traditional approaches to monitoring air pollution in cities are largely based on a small number of fixed ground measuring stations, which do not give us a good picture of human exposure. Thanks to the development of miniature, networked sensors, today we can finally zoom into the individual level" – says Carlo Ratti, director of the MIT Senseable City Lab. "This has major implications in researching and ultimately impacting public health."

The team gathered data by outfitting researchers with an array of sophisticated sensors, and having them traverse Hong Kong and Shenzhen for several days, collecting data on air and noise pollution, temperature, and humidity, in addition to gathering personal travel data such as spatial position, pace and heart rate. Researchers monitored key parameters of individual exposure to pollutants such as Particulate Matter (PM10), Carbon Monoxide (CO) and Nitrogen Dioxide (NO2). "Our prototypical commuters are like an 'urban tracer' moving through the streets of the two cities," explains Marguerite Nyhan, a researcher at the Senseable City Lab. "They allow us to make very fine-grained measurements."

"While very close in terms of distance, Hong Kong and Shenzhen are a world apart," says Hong Kong resident Otto Ng, director and founder of LAAB. "The two cities are split by the border between China and its Special Administrative Region – a border that is, however, porous to the thousands of citizens who commute from one side to the other every day." The Chinese central government in Beijing formulated the constitutional principle 'One Country, Two Systems' during the 1980s, ahead of Hong Kong's sovereignty transfer. Today, 'One country, Two Lungs' explores how this divide still persists in one of the less visible dimensions of urban life: distinct but interconnected atmospheres.

"Initial results show that measurements in Shenzhen - in particular the levels of small aerosol particles called PM10 (which have the most adverse effect on human health) - are higher than in Hong Kong," explains Davide Zilli, a researcher at the Senseable City Lab. "We want to reveal the invisible inequality between these two cities and make it public, so that citizens can take action - politically, or with their feet, by changing their daily travel patterns. Atmospheric boundaries exist over physical ones, and create very real divisions... made of nothing but air."

The project is a collaboration between the MIT Senseable City Lab and the LAAB design office in Hong Kong. MIT Researchers include Carlo Ratti, Davide Zilli, Rex Britter, Marguerite Nyhan, Yaniv Jacob Turgeman, Matthew Claudel and Mike Xia. LAAB's team was led by Otto Ng, Yip Chun Hang and Kenneth Cheung. The team also includes Tim Tsui, Lewis Hung, Kinmo Ng, Jason Choi, Angel Li, Joe Lam, Geoff Chan and Ricci Wong.

The video 'One Country, Two Lungs' is on display at the Hong Kong / Shenzhen Bi-City Biennale this month, and available online at xx

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