Underground fiber optic sensors record sounds of COVID lockdown, reopening

June 28 2021

Students walk on Penn State's University Park campus. Credit: Patrick Mansell, Penn State

In March 2020, daily life in the United States changed in an instant as the country locked down to deal with the initial wave of the COVID-19 pandemic. New research reveals how residents in one community returned to their routines as the restrictions lifted, according to a team of Penn State scientists.

"We used sound signals captured by underground fiber-optic sensors to understand how COVID measures impacted human activities," said Junzhu Shen, a graduate student in geosciences at Penn State. "These sensors provide very accurate, high-resolution data that can help us understand what's happening in our communities."

The scientists analyzed sound data recorded from March through June 2020 in and around the Penn State University Park campus and State College, Pennsylvania. They observed a quiet period that coincided with the lockdown followed by a recovery of activity as the area moved from red to less-restrictive yellow and green phases.

By listening to small changes in vibrations at the surface, the scientists found construction activity and vehicle traffic recovered sooner than pedestrian traffic. They reported their findings in the open-access journal *The Seismic Record*.

"Footsteps disappeared and really did not recover after business re-opening in late May," said Tieyuan Zhu, assistant professor of geosciences at Penn State. "But if you look at car traffic, it shows a different pattern. It decreased and recovered. This may give us a hint that people were conservative, working remotely and driving when they had to go outside for things like groceries."

Other work to measure the impacts of COVID shutdowns on human activity has used seismic sensors or Google mobility data—GPS information collected from devices like cellphones. But using the fiber-optic network allows for higher-resolution data, with measurements collected about every six-and-a-half feet, the scientists said.

"With Google mobility data, we are limited to looking at one data point for the whole county," Zhu said. "It's hard to separate one community from another. With our high-density network, we can understand noise variation from one block to another."

The scientists analyzed data from March, when the lockdown began and Penn State students left campus, through June, when the area entered Pennsylvania's green phase of reopening.

The results provide a useful assessment tool for decision-makers faced with implementing such measures and could result in a better understanding of how pandemics impact human activities, the scientists said.

To conduct the study, the scientists tapped into miles of continuous telecommunication fiber-optic cables under the University and nearby community. These networks are often found in cities and provide phone and internet service to home and businesses.

A new technology called a distributed acoustic sensing (DAS) array allowed the researchers to send a laser down one of the hair-thin glass fibers contained inside the cables and detect small changes caused by pressure. By taking measurements every six-and-a-half feet, the scientists essentially can create a network of 2,000 sensors.

"Even if there is a small change in the external energy on the ground above, that will stretch or compress the fiber, and we can detect those changes," Zhu said. "And in the case of COVID, we can provide some indicators to understand whether measures being put in place are effective or not."

Provided by Pennsylvania State University

Citation: Underground fiber optic sensors record sounds of COVID lockdown, reopening (2021, June 28) retrieved 23 May 2024 from https://phys.org/news/2021-06-underground-fiber-optic-sensors-covid.html