TOWN +GOWN: NYC

Sounds of New York City: Construction Noise

DYCD Auditorium
@2 Lafayette Street, 14th Floor
August 16, 2019, 9:00 a.m. to 11:00 a.m.

AGENDA

9:00 a.m. – 9:15 a.m.	**Registration, Introduction and Welcome**
9:15 a.m. – 10:15 a.m.	**Setting the Stage**
	Graham Dove and Charlie Mydlarz, NYU/CUSP
10:15 a.m. – 11:00 a.m.	**Co-creating Knowledge Q and A**

Background. Construction noise in New York City, the country's largest, densest and noisiest city, is a thing. High levels of noise, which can be defined as unwanted or harmful sound from environmental sources such as traffic, construction and other activities, are associated with negative externalities in health, the environment and the economy. As the City's local economic and business cycles support high levels of construction activity, it is not surprising that construction-related complaints consist of one of the largest types of 311 complaints.[1]

The City has a modern noise code, a robust 311 system to support citizen-based noise reporting, and history of data-driven governance. Reliance, however, on of 311 system data, which contains biases, make it a cautionary tale for data analytics and it also imposes operational challenges for agencies, which makes other science-based methodologies such as large-scale noise monitoring paired with machine learning technology and big data analysis to complement the existing citizen science reporting methodology of data creation and help government more effectively monitor, analyze, and develop policy options to mitigate urban noise pollution caused by construction.

Yet, most cities lack the resources for continuously monitoring noise, analyzing patterns of noise pollution at city-scale, and empowering city agencies to take data-driven action for noise mitigation. SONYC is a $4.6 million National Science Foundation-funded "smart cities" initiative[2] focused on developing an acoustic sensor network for the monitoring and analysis of urban noise pollution, which includes construction-related noise. The SONYC network is particularly suited to monitoring and quantifying the positive acoustic effects of mitigation efforts undertaken by City agencies, through focused studies, and can help advance novel technological and socio-technical solutions that help address evaluation needs.

SONYC is an academic collaboration between researchers at New York University and Ohio State University and it presently works closely with key New York City agencies, in particular, the New York City Department of Environmental Protection, but also the New York City Department of Health and Mental Hygiene, the New York Department of Parks and Recreation, the New York City Department of Transportation, and the Mayor's Office of Technology and Innovation. This event is aimed at bringing other construction-related public agencies into SONYC's work to support focused studies into the viability of large-scale smart noise monitoring at the city scale

SONYC Details. The elements of the SONYC network that are suited to monitoring and quantifying the positive acoustic effects of mitigation efforts undertaken by the City are described in greater detail below. Currently in a deployment phase with 55 acoustic sensors installed across locations in

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[1] Construction demand is considered a derived demand,". . . in as much as the goods are not necessarily demanded in their own right but for what they can add to the final good or service being produced." Danny Myers *Construction Economics: A New Approach* (London: Spon Press, 2004)*.,* p. 60. General economic conditions determine the demand for construction services, and fluctuations in the performance of both the general economy and the construction industry share a similar pattern, with lags between general economy, business demand and construction cycle. *Ibid.*, pp. 7, 190. Changes in the building cycle—both expansion and contraction—are, however, more volatile than those in the general business cycle. *Ibid.*, pp. 190-191. One hopes that decreased economic activity is not the only way to control construction noise.

[2] See https://www.nsf.gov/awardsearch/showAward?AWD_ID=1544753.

Manhattan, Queens and Brooklyn, SONYC aims to deploy over 100 deployed nodes across the five boroughs by the end of 2019.

SONYC sensors contain a quad-core 900 MHz CPU with 1 GB RAM and 16 GB of local storage. They continuously monitor sound pressure level (decibel) data, which is transmitted to back-end servers *via* Wi-Fi or Ethernet. They also generate acoustic data at or above the accuracy required by city agencies. The sensors record 10s snippets of encrypted audio, randomly spaced in time to ensure privacy is maintained, and the deployment includes a small street-level sign, close by to the sensor, explaining that it is part of a research project.

SONYC sensors can be mounted on locations such as window ledges, low roof-tops, street furniture, and, ideally, light poles, at around 15' above the ground. Sensors are mounted to vertical or horizontal surfaces, using removable industrial adhesive or clamped to poles at any orientation. The sensor's secure metal housing measures 5" x 4" x 1.5", with an 8" windshield extending from it. They require a constant power source to operate, consuming less power than a standard phone charger (2W @ 5V), which can be supplied via a 5V feed, regular 120V outlet or power-over-ethernet (POE). The devices are not bandwidth intensive at 25 kB/s upload and <1 kB/s download.

SONYC research is developing machine learning at the edge technology run on the sensor processor to automatically identify the sources of noise being monitored. This will provide sound-source identification data to augment simple sound pressure level (SPL) measurements, which can help city agencies evaluate any particular noise mitigation interventions, provide a detailed sound profile of selected sites, and help facilitate a fine-grained understanding of the impact of construction noise. SONYC can also support collaboration between NYC DEP noise code enforcement operations and city construction agency construction project and site managers, working closely on mitigation strategies. Longitudinal deployment of SONYC sensors at any construction site would allow SONYC to monitor and analyze the particular profile and impact of noise before construction starts, during construction, and after construction has been completed.

Knowledge Co-Creation. As discussed above, while most cities, like New York, have a legal framework for regulating noise, they lack the resources for its continuous monitoring at city-scale, the technology for understanding how individual sources contribute to noise pollution, the tools to broaden citizen participation in noise reporting and regulation, and the means to empower city agencies to take effective, information-driven action for noise mitigation. SONYC's novel cyber-physical system aims at addressing these gaps. The system includes a distributed network of sensors that can make use of cutting-edge machine listening methods to obtain a rich description of their acoustic environment and an information flow from the network through a cyber-infrastructure that analyzes, retrieves and visualizes data to facilitate the identification of important patterns of noise pollution. This research is intended to assist decision-makers at city agencies to strategically deploy the human resources at their disposal to mitigate noise through law enforcement. Additionally, since SONYC sensors can constantly monitor noise pollution, they can also be used by city agencies to validate the effect of any mitigating

actions in both time and space, information that can be used to understand and maximize the impact of future mitigation actions.

The efficacy of SONYC as a tool for city agencies focused on controlling and/or reducing construction noise requires deployment of sensors on active construction projects across the city. The participants at this event can discuss the following ideas to help SONYC with such deployment so that the system and the data it produces will be useful to the city.

- Providing data on previous agency construction projects to enable an initial analysis of the impact different types of construction project have on 311 noise complaints directed to NYC DEP.

- Identifying upcoming outdoor agency construction projects that would be suitable for sensor deployments and cover a range of project types. Examples include:

    - Public squares and plazas, e.g. similar to Astor Place and Frederick Douglas Plaza projects
    - Major infrastructure improvements that include road openings similar to work around
    - Washington Square Park with respect to water main connection
    - New build construction projects similar to Hunters Point Library and EMS 50
    - Redevelopment of public buildings similar to the Elmhurst Library
    - Installation of accessibility infrastructure such as pedestrian ramps
    - Green space developments at parks and community gardens

- Identifying operational issues with placing sensors at construction projects in general and public construction projects in particular. Examples include:

    - Providing a point of contact at identified sites to facilitate deployment, including arranging for a bucket lift to enable sensor mounting, and to arrange ongoing access.

    - Facilitating relationships with key officers at relevant city agencies, in particular NYC DOT but also NYC DOB and NYC Parks, to help with deployment of sensors on street furniture and agency property.

    - Helping facilitate research interviews with key stakeholders at different projects, for evaluation of SONYC's research and in order to better understand how SONYC sensors and data might be used.

    - Providing introductions to external organizations to bring in private construction projects for placing sensors