Democratization of environmental information and monitoring science from, to and with citizens in local contexts:

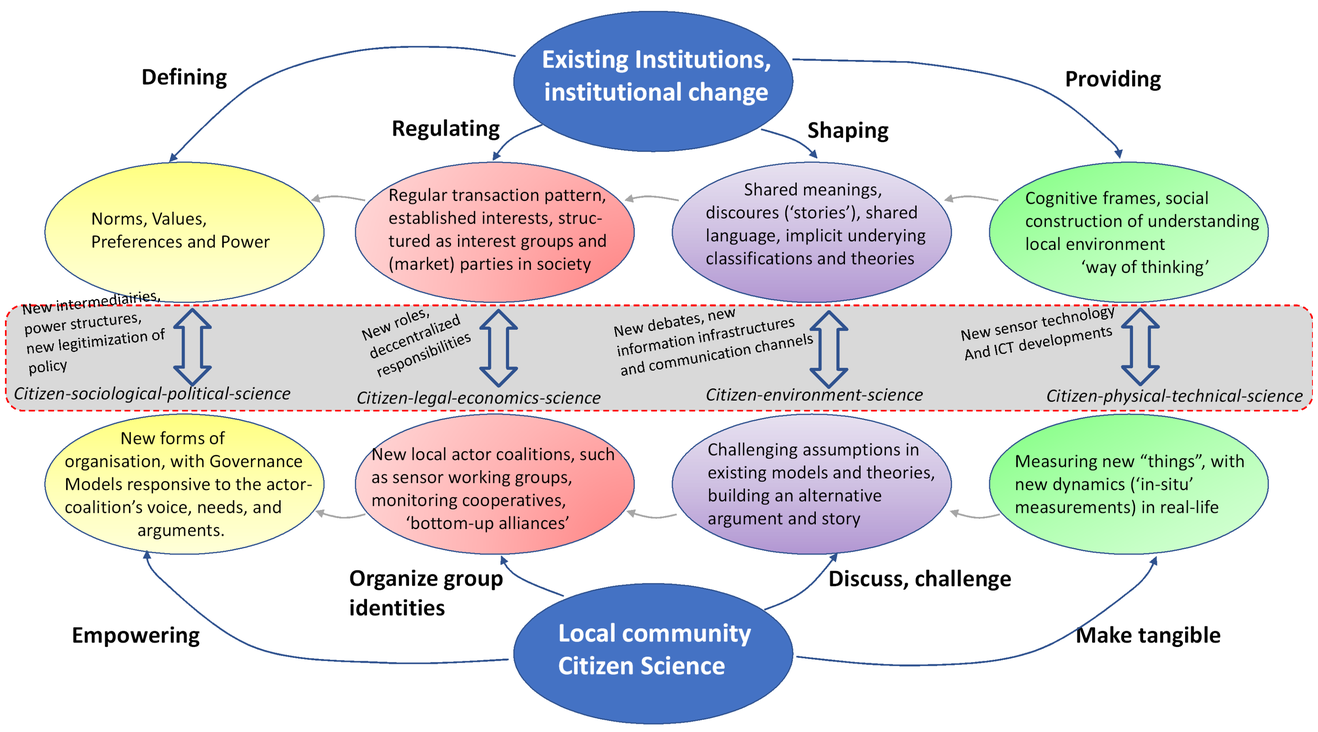
Supporting citizen science in the Netherlands with an Open Sensor Data Infrastructure

Authors: Linda Carton[1]; Hester Volten[2]; and the project members, experts and citizen scientists[3] whom we had the opportunity to work with in doing urban/rural sensing of air quality and noise monitoring

Results from Smart Emission Pilot Project:
The Smart Emission pilot project has finished. The objective was to monitor, visualize and communicate a real-time, fine-grained 'environmental footprint' of the city. Simultaneously, a participatory process has been organized to collaborate with citizens and consortium professionals with the shared purpose of *'collective sense-making'*. By creating an *urban laboratory* setting, its project members pioneered in practice, innovating and learning about low-cost sensing, shared citizen science in urban settings, Open Data apps, dataflows and sense-making. The project has led to the following results:

Research Questions (ECSA 2016) and Answers (ECSA 2018) of Smart Emission pilot:
1. Do low-cost sensors add to the fine-grained picture of air quality indicators?
Answer: Yes, in particular to the local scale in both time & space.
2. Does the concept work?
Answer: Yes, pilot project delivered a proof of concept. With relative measurements, for indicative purposes. A physical-technical approach.
3. Does sense-making with citizens work?
Answer: Yes, but it is a complex endeavour to measure intangible environmental phenomena like air quality and noise. Citizens' expectations, motivations, curiosity, issues, and trust in government differ, creating a dynamic debate and lively interactions.
4. Does this open up opportunities for environmentally-informed city governance?
Answer: In the future, yes, but this was still a pilot experiment. Upscaling needed.
5. Reflective: (How) do roles of government and citizen change?
Answer: In pilot project, increase mutual trust was noted in this relation, in an ongoing, constructive, content-focused dialogue.
Noteworthy were the acceptance of what was impossible during the pilot, and from there, many citizens and government actors showed a collaborative solving-problems-attitude.
More information can be found on http://smartemission.ruhosting.nl/visitors/

Figure 2. Connection between institutional change and citizen science



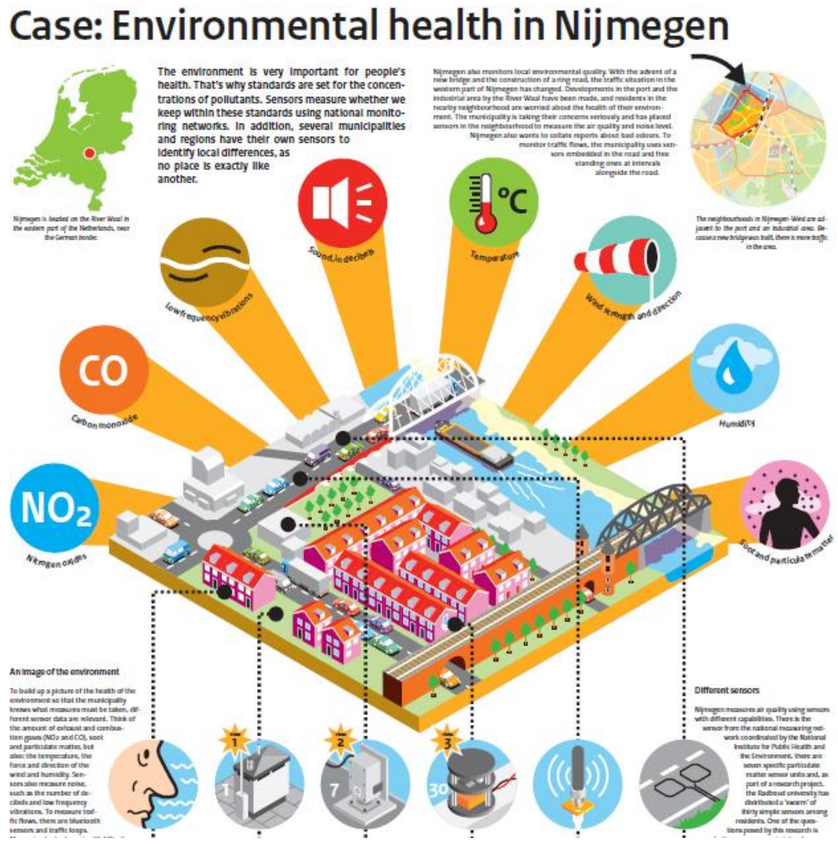
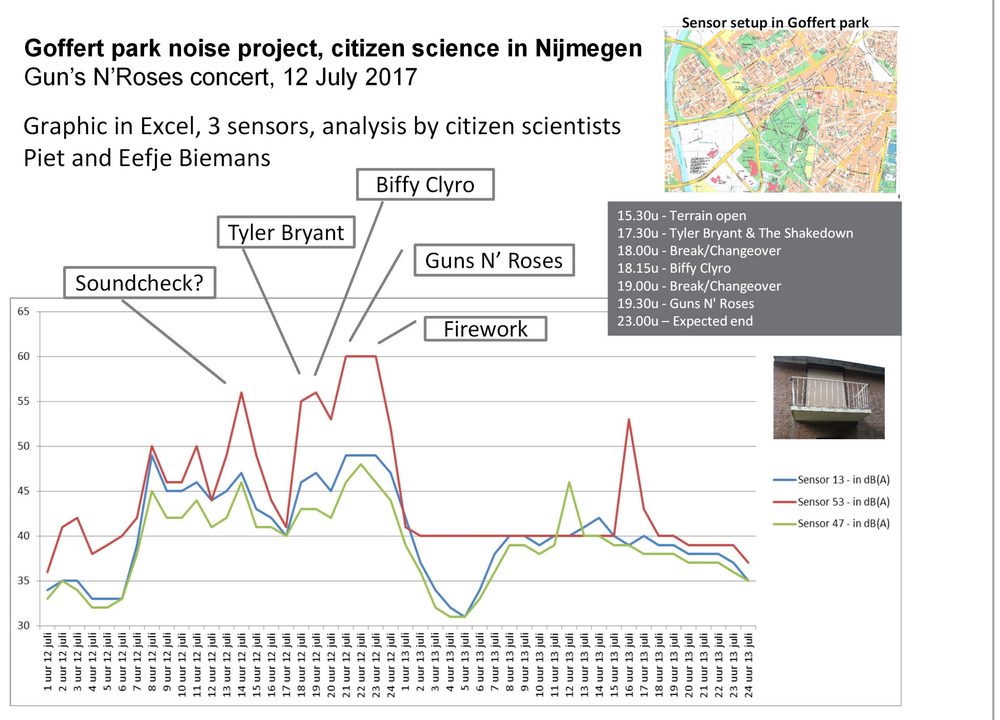


Figure 1. Smart Emission project in a nutshell

Figure 3. Citizen Science in action: 'Use Case' Festival Noise monitoring



Conclusion: With ongoing research we are seeking ways to support citizen science on environment sensing. Setting up and experimenting with a collaborative sensor data infrastructure is one way to advance knowledge. Another way is to facilitate collaborative learning in and among a growing network of citizen science initiatives. The National Institute for Public Health and the Environment and the Radboud University are involved in new Research Proposals for continued research in this field, such as the European "Fresh Air4 Us" initiative.

Open Sensor Data Infrastructures, from networks of citizen science and (local) government experiments.

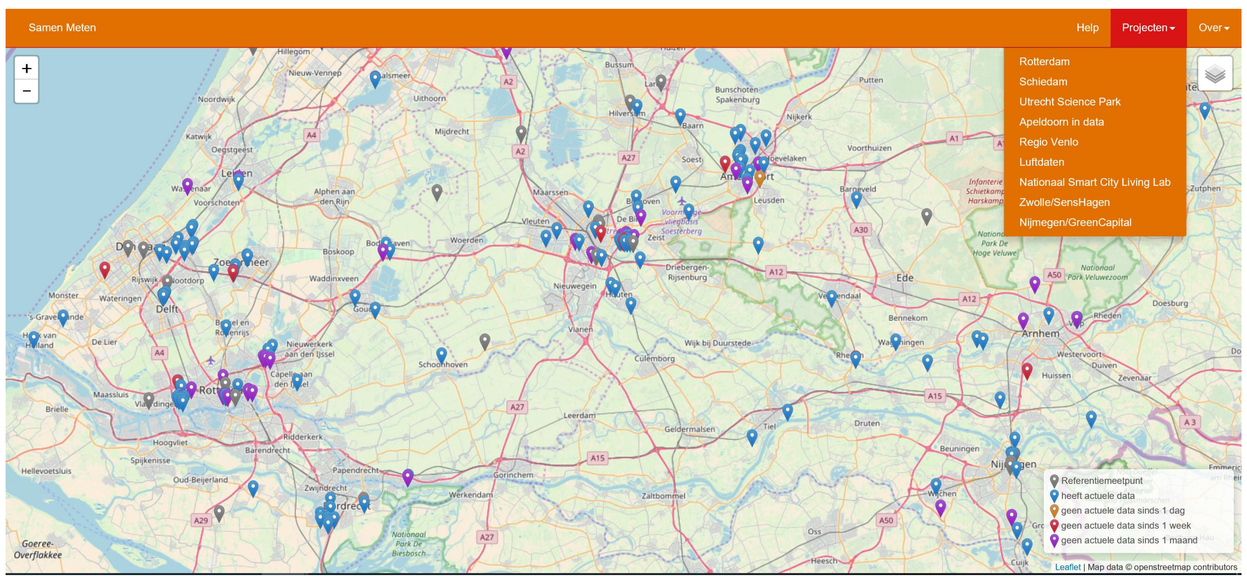


Figure 4. Experimental Sensor Data Infrastructure I: Samen Meten Dataportaal, made by RIVM, data based on API's and sensor data from various field projects. url: https://samenmeten.rivm.nl/dataportaal/

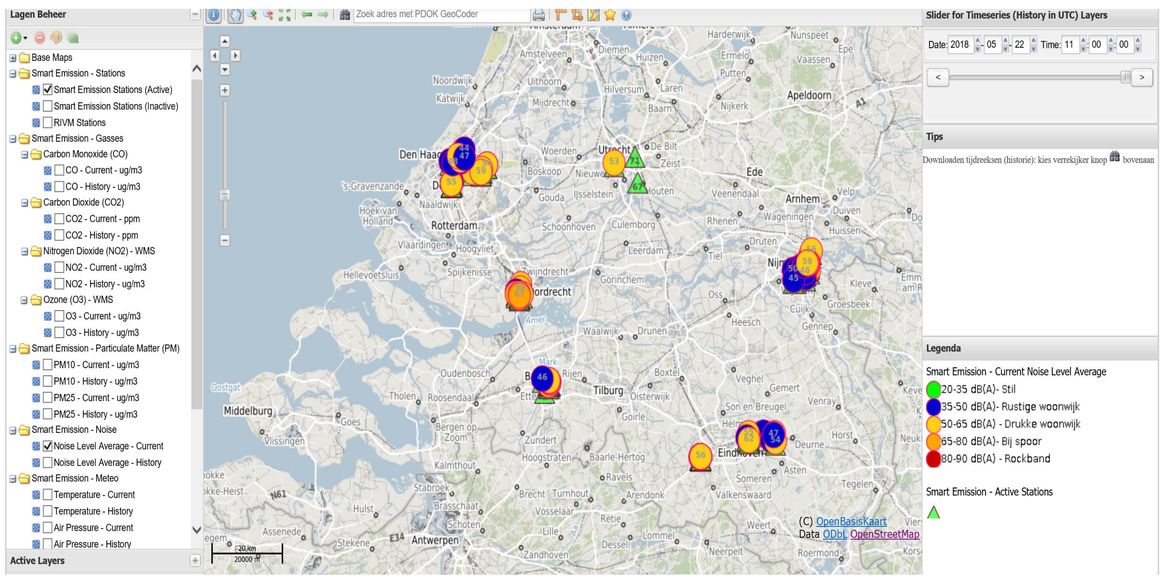


Figure 5. Experimental Sensor Data Infrastructure II: Smart Emission Data Platform, Heron Viewer, made by Geonovum, Intemo, Smart Emission, Smart City Living Lab, Kadaster. url: http://data.smartemission.nl/heron/

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