(Featured Image: Minsk, Belarus by Anton Rusetsky)

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Editorial: Pollution and Translation

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I have been thinking about the importance of translation during the Environmental Justice: Looking Back, Looking Forward conference in Sydney, Australia, 6-8 November 2017. This exciting interdisciplinary conference marks the 20th anniversary of the first environmental justice conference in Australia, held at the University of Melbourne in 1997. It brings together leading figures in the field of environmental justice from around the world. I feel honoured and privileged to be invited to give a keynote conversation with Julian Agyeman and David Pellow on "environmental justice: looking forward", following the opening keynote conversation with Robert Bullard, the "father of environmental justice", Nick Low, and Petra Tschakert. The conference features cutting-edge research and scholar-activism on diverse themes including decolonizing environmental justice, "just" storytelling, food justice, climate justice and governance, multispecies and intergenerational justice, indigenous cultures, cities, health, and community action.

As I engage in conversations and listen to a range of different perspectives, I can see how translation across different cultures, languages, and contexts is crucial for the concept of environmental justice to be able to resonate beyond its origins in the 1980s United States civil rights and anti-toxic movements. Although the conference does not employ translators, due to its size and audience, speakers regularly quote and translate passages of indigenous languages, reflecting on different values, meanings, and understandings of justice and the world. These conversations feel important, even as participants recognize the irony of people flying from around the world to discuss the challenges of environmental justice.

The idea of translation, between and across different cultures, languages, geographies, and experiences, and perspectives, is also crucial for thinking about global and local problems of pollution.

In this issue of Toxic News, all of the authors address issues related to pollution and environmental (in)justice: conflicts over industrial pollution in petrochemical and mining areas; and uneven exposures to air and noise pollution in cities. Whether explicitly or implicitly, each of the contributions in this issue of Toxic News also speaks to different forms of translation: cultural, political, scientific, subjective, and linguistic.

Thom Davies reflects on his recent ethnographic research in the rural community of Freetown in St James Parish in Louisiana, where people living with pollution poignantly describe the destruction of their land, plants, trees, and wildlife. He reports on an environmental struggle against the controversial planned Bayou Bridge Pipeline, which will terminate near Freetown, involving a coalition of indigenous campaigners, environmental activists, craw fishermen inspired by the campaign at Standing Rock.

Erik Kojola highlights the importance of emotions and identities in conflicts over environmental risks from mining near the Iron Range in northeastern Minnesota. In particular, he examines how the prospect of both jobs and water pollution mobilize different place-based identities and competing visions of the future. Tensions between industrial and natural heritage are exemplified by the local identities of the Iron Range miner and the canoe enthusiast.

Thomas Verbeek draws attention to the environmental impacts of our transportation infrastructure, particularly air and noise pollution. He discusses findings from a quantitative case study of a neighbourhood in Ghent, Belgium with (relatively) high air and noise pollution from highway viaducts. The article reveals that objective and subjective exposure to environmental impacts differed: poorer people in temporary housing suffered greater exposure to pollution, but more affluent people with semi-detached homes complained more about pollution.

Finally, we are very pleased at the opportunity to publish our first article in translation: Gwen Ottinger's *Lessons in Infrastructuring* (first published in May 2017) into Chinese, translated by Chia-Liang Shih and Wen-Ling Tu. This translation emerged following research collaborations between Gwen Ottinger and Wen-Ling Tu, who both work with frontline petrochemical communities (in the United States and Taiwan respectively) on air pollution and citizen science. Through publishing this excellent article in translation, we hope to reach a wider audience. This is a first step towards our collaborative aims of international and intercultural dialogue on "toxic" issues.

In the future, we hope to include more translations in *Toxic News* – across language as well as culture and politics.

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Toxic Geographies: chemical plants, plantations, and plants that will not grow

Dr Thom Davies, Research Fellow at the Department of Sociology, University of Warwick @ThomDavies

In September 2017, I returned to Louisiana to continue ethnographic research about lived experiences in a region infamously nicknamed 'Cancer Alley' – home to the highest concentration of refineries and chemical plants in the United States.

I landed in New Orleans airport and spent a jetlagged night at a drab and ordinary hotel. It was just like other shabby hotels, complete with fake-plastic plants, vomit-friendly carpets, and cigarette-burnt bathtubs. That was until I noticed the wall decorations: lining the corridors were watercolor paintings of old white buildings. Not just any old white buildings, but Plantation houses. It was the first of many reminders that the Louisiana landscape is thickly layered with a complex, violent, and ever-present past. As this short article about the Freetown community in Cancer Alley will explore, it is a past that also intersects with the everyday lives of those exposed to toxic pollution today.

Figure 1: Paintings of plantations hanging on the walls of the airport hotel in New Orleans. Photograph by Thom Davies

Freetown is a small rural community hugging the west bank of the Mississippi River, half way between New Orleans and Baton Rouge. Just like the airport hotel, at first sight Freetown is a rather ordinary place. It hosts unremarkable houses and trailer homes, lapped on each side by sugarcane fields that grow tall in the late September sunshine. From the top of the grass-covered levee, it looks like many other pastoral settlements that line the banks of *'The almighty Miss'*. Yet Freetown also has a profound history. Founded soon after the Civil War, it was the first settlement in Louisiana in which freed slaves could own land.

As the historic marker on the adjacent River Road proudly proclaims, since its establishment in 1872, this antebellum community quickly 'carved up and cultivated the land' for themselves. Being able to survive independently on the soil, despite years of

discrimination, sharecropping, and Jim Crow laws, was an important marker of community resilience. Many residents still fondly recall their forefathers growing a variety of foods, from butterbeans to pecan trees. During ethnographic research in the area, many shared childhood memories of eating homegrown produce, and netting dinner down by the muddy banks of the Mississippi. That was until industry arrived.

Living intimately with chemicals

Residents spoke about sludge-like residue that hangs around the bottom of trees, and of plants flowering out of season, or not at all.

Today however, the picture is very different. '*You can't eat nothing off the ground anymore'* explained one local resident, who like many in this area, has seen the local ecology slowly degenerate over the years. Residents spoke about sludge-like residue that hangs around the bottom of trees, and of plants flowering out of season, or not at all. Others described fruit not ripening, leaves changing color, and verdant trees that were planted by their grandparents suddenly dying. '*The trees grow at different times…'* described one resident, as we walked around her garden, *'…They come out, then they go back in, they come out and then go back in*', she recalled. Just as Rachel Carson described in her 1962 book *Silent Spring*, the Freetown community has been forced to 'live so intimately with these chemicals'. Part of this enforced chemical-intimacy has meant witnessing the seasonal rhythms of natural life become upended, interrupted and replaced by uncertainty.

According to many residents, the reason for their mutating environment can be seen when you peer through the gaps in the neighboring sugarcane field: massive white chemical storage tanks. These tanks are just some of the 118 storage tanks that have been built within a two-mile radius. They hold a variety of toxic liquids deriving from crude oil, and are often placed just a stone's throw from people's homes. A growing and leaky assemblage of petrochemical facilities and pipelines are redefining the area, providing well-paid jobs for some, but also inundating local communities with air pollution and toxic releases. No less than nine major industrial facilities are located nearby, with a further $1.8 billion methanol plant currently under construction, and another plant in the final permitting stages.

Figure 2: A resident of St James Parish holds at a pecan nut while we discuss the local environment. Photograph by Thom Davies

Figure 3: South of Freetown, residents sign a wooden cross in protest against further chemical expansion in the area. Photograph by Thom Davies

The story of pollution in Freetown is far from exceptional. Freetown is at the heart of a region infamously nicknamed 'Cancer Alley'. A concoction of cheap feedstock, lucrative tax exemptions, and riverside access to deep-water ports has made this region an important site for the global petrochemical industry. According to many residents, this concentration of heavy industry is causing increased illness and premature death. It is a region exposed to what Rob Nixon calls the 'slow violence' of pollution.

The region's plantation past has been transposed onto the toxic geographies of today.

However, the 'River Region' – as industry prefers to call it – has an even more violent past. As visualized by the watercolour paintings in the hotel, this part of Louisiana was at the heart of the South's slave economy. By the 19th Century, around 300 sugar plantations existed between New Orleans and Baton Rouge, divvying up the lower Mississippi and creating what Frantz Fanon called 'a world divided into compartments' (1963, 37). Today's petrochemical plants are intimately linked to this historical geography, as inheritors of a landscape shaped by racial violence. In the post-bellum 20thcentury, former plantations were sold to nascent oil companies, who were keen to secure a convenient slice of riverside territory. But by setting up polluting industry on the colonial footprint of former plantations, the people who became the most exposed to toxic emissions were the descendants of slaves. In this way, the region's plantation past has been transposed onto the toxic geographies of today. As veteran environmental justice campaigner Darryl Maley-Wiley explained in an interview at the Sierra Club in New Orleans, the transfer from Plantation to Chemical Plant was effectively '*exchanging one plantation master for another*'.

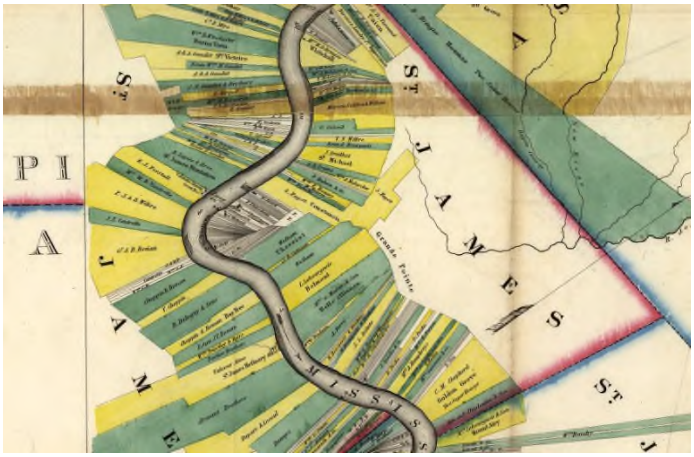

Figure 4: Slave plantations in St James, from Norman's chart of the lower Mississippi River (1858). Source: Library of Congress

Noxious Residues

Freetown, which was built on land that once belonged to the Landry-Pedesclaux slave plantation, is one such example. In this sense, the toxic pollution, which is slowly killing plants and disrupting lives along Cancer Alley, can be interpreted as 'the noxious residue of American racial history' (Carl Zimring 2016, 77). This noxious residue is alive and well in St James Parish, where Freetown sits. This summer, the St James Parish Council narrowly approved the controversial Bayou Bridge Pipeline, which will terminate near Freetown, and have the capacity transport up to 480,000 barrels of light and heavy crude everyday. If it is given state approval, this 24 inch wide and 163-mile long pipeline will transfer oil from Lake Charles to St James' Fifth District, a community that is 95% African American. At the Parish meeting on the 23rd of August 2017, the vote went along racial lines (4-3), with the four white councilmen voting in favor of the pipeline, and three African American councilmen voting against.
The operating company, which holds a 60% ownership in the pipeline, is Energy Transfer Partners – the same company responsible for the controversial Dakota Access Pipeline, which enflamed indigenous activism at Standing Rock. If the Bayou Bridge Pipeline gets the go-ahead, it will form the tail end of a continual network of pipes, running from North Dakota to the Deep South. However, a coalition of indigenous campaigners, environmental activists, craw fishermen, and local St James residents are pooling their resources and expertise, and are at the forefront of a growing grassroots movement in Louisiana. Water Protectors, including Cherri Foytlin who runs BOLD Louisiana, refer to the proposed pipeline as '*the two headed black snake'*, and anti-pipeline protestors are forming protest camps, adapting techniques witnessed at Standing Rock.

Despite assurances from Energy Transfer Partners that they '*will incorporate state of the art protection systems*' and monitor the pipeline around the clock, concerned environmental activists believe the drinking water of thousands of people in south Louisiana will be put at risk by the pipeline. Activists also point to the erosion of sensitive wetland ecosystems, such as the Atchafalaya Basin, which is already crisscrossed with pipelines and manmade spoil banks that can halt the natural flow of water. This growing environmental coalition of citizens regularly protests at the State Capital Building in Baton Rouge, petitioning Governor John Bel Edwards to produce an Environmental Impact Statement.

Figure 5:Environmental activist Cherry Foytlin from BOLD Louisiana in Governor John Bel Edwards' office in Baton Rouge. Photograph by Thom Davies

Figure 6: Environmental activist Cherry Foytlin from BOLD Louisiana in Governor John Bel Edwards' office in Baton Rouge. Photograph by Thom Davies

A growing coalition of environmental activists are collaborating in their efforts to prevent further petrochemical expansion. Photograph by Thom Davies

For many people in Freetown and the wider Fifth District of St James Parish, this pipeline is the last straw. Many feel inundated by industrial expansion: '*Its like we are surrounded…*' explained one resident during a focus group, *'we are penned in on all sides!*' Having spent time with this community, it is easy to see why people are frustrated. Unlike other toxic places I have researched, such as nuclear landscapes in Fukushima and Chernobyl, where contamination is beyond the reach of human senses, here the pollution is vivid, thick, and profoundly palpable. It gets caught in your nose and throat, and can make your eyes run and your skin sore. It is odorous and invasive, entering homes at night when the air becomes thick with petrochemical trespass. It is also present in the stories of illness that people share.

Interviewees described a spectrum of attritional health complaints, from headaches, skin irritations, sinus infections, dizziness and rashes, to reported increases in cancers and other terminal illnesses. '*Everyone round here knows someone with cancer*', explained Catlynne*, who lives near Freetown in the fenceline community of Burton Lane. In the neighboring Parish of St John, the Environmental Protection Agency have recently declared it the highest risk in the country for developing cancer, from 5 to 20 times higher. But it is not just death and cancer that defines the lived experience of pollution. As I sat on Catlynne's veranda, overlooking giant storage tanks on the other side the fence, she pointed to the various trees and plants in her garden, which she said would no longer grow. '*It's the air'*, she explained.

Figure 7: The view from the back of properties on Burton Lane, south of Freetown. There are 118 storage tanks in the local area. Photograph by Thom Davies

Interviewees described a spectrum of attritional health complaints, from headaches, skin irritations, sinus infections, dizziness and rashes, to reported increases in cancers.

Plantations and chemical plants share a divisive and ongoing history, each one reproducing its own kind of attritional violence. Curiously, the words 'plant', 'plantation', and 'chemical plant' share an etymological link: they stem from the old-English word [*plante*] for something you 'put in the ground to grow' and the Latin [*plantare*], meaning 'to fix in place'. Fittingly, with each new petrochemical facility that gets approved in Louisiana, a 'groundbreaking ceremony' takes place. Local dignitaries, politicians, business insiders and the press are invited to assemble around piles of carefully placed dirt. Golden shovels, often tied with celebratory ribbons are used, as businessmen pose for cameras and act out the ritual of 'planting'. It's a symbolic act: digging the soil and planting a new petrochemical future. The methanol plant currently being constructed just south of Freetown received this ritualistic treatment in 2015 (see photo), and the proposed Bayou Bridge Pipeline – if it gets the go ahead – will doubtless receive the same corporate performance. For the community in Freetown however, who are attuned to their own soil, plants, and environment, another image comes to mind. As the petrochemical assemblage of pipelines, storage tanks and chemical plants continue to grow near Freetown, the plant life here may also continue to die.

Figure 8A planting ritual: corporate executives and government officials hold golden spades and throw soil during a ritual 'groundbreaking ceremony' near Freetown in St James Parish in 2015, for the Yuhuang Chemical Inc. Methanol Plant. (Source: The Advocate)

***some participants names have been changed to protect identities**

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For Love of the Place: Emotions and Identities in Conflicts over Environmental Risks from Mining in Minnesota

Erik Kojola, PhD Candidate, Department of Sociology, University of Minnesota

Near the Iron Range of rural Northeastern Minnesota—historically one of the largest iron-ore producing regions in the U.S.—mining companies, investors, state politicians, and some residents envision a new resource boom based on untapped "world-class" copper and nickel reserves. Multiple mining companies backed by multinational investors are exploring underground reserves and several have proposed new mining projects. For decades, industry and government have known of these deposits, but they have not been developed because the low-grade ores were not economically viable. The combination of high global commodities prices and new more efficient technologies have now made the deposits economically attractive.

Figure 1: View of the Hull–Rust–Mahoning iron mine in Hibbing, Minnesota that is one of largest open-pit mines in the world (Credit: Erik Kojola)

The projects have sparked controversy over the potential environmental and economic impacts, and the proposals are embroiled in long environmental review processes. The prospect of both jobs and water pollution has created a rupture between two core Minnesotan identities—mining as a way of life and being the land of 10,000 lakes. There are no copper-nickel mines in the state and they raise new environmental and public health risks compared to the existing iron-ore mines. Some of the proposed sites are also near the Boundary Waters Canoe Area Wilderness(BWCA)—one of the most visited wilderness areas in the U.S. On the other hand, the Iron Range is struggling with a lack of good jobs and population loss as employment in the iron-ore mines has decreased, largely due to increased mechanization and changes in the global steel industry.

The conflicts over copper-nickel mines in Minnesota are emblematic of contentious resource extraction development going on across the globe. New sites and technologies for mining are generating tensions over uncertain future impacts to climate change, public health, and clean water. Decisions about development also raise complex challenges of how to sustainably and equitably supply society's increasing resource demands and promote economic development in rural areas.

On the surface, much of the public and policy debate in Minnesota has focused on competing factual and scientific claims, such as whether the mines would contaminate water or if proposed engineering controls are adequate. Environmental groups highlight how the ores contain sulfides that generate acid and leach heavy metals when exposed to air and water. On the other hand, pro-mining groups claim that the companies will use effective state-of-the-art technologies and meet rigorous environmental standards.

Figure 2: Chapman Street in downtown Ely, Minnesota – a town near a proposed copper mine and the Boundary Waters Canoe Area Wilderness (Credit: Erik Kojola)

I have interviewed groups on both sides of the issue and spent a summer living in a town in Northeastern Minnesota getting to know the area and attending public hearings and events. I find that public mobilization is driven not only by objective scientific reality, but by emotional connections to the place, and class and cultural identities, such as being an Iron Range miner or a canoe enthusiast. The proposed mines have become controversial because of how they threaten culturally and emotionally meaningfully lakes and forests, and resonate with ideas about mining as a way of life. Both sides claim their opponents use emotion and not fact, but they all appeal to sentiments and nostalgia, evoking a family canoe trip or the heyday of mining when men made good money working in the mines.

The conflict has become about what different groups and communities think mining would mean for the future—a vision of a brighter economic future or a vision of a future with water contaminated and forests destroyed.

The conflict has become about what different groups and communities think mining would mean for the future—a vision of a brighter economic future or a vision of a future with water contaminated and forests destroyed. Supporters claim that the mines will provide a domestic source of metals necessary for the modern global economy and breathe life into rural mining towns struggling with unemployment and population loss. Opponents argue that the mines would contaminate the cherished sky-blue lakes of Northern Minnesota and degrade the wilderness experience of the BWCA for future generations.

People assess the potential impacts of mining through different social and class identities, and emotional connections to Northern Minnesota. Some rural white and working-class people who support the mines discount claims about potential environmental risk as the opinions of outsiders who do not really know the land. Pro-mining groups contend that mining has existed alongside clean water in Northern Minnesota for over a hundred years, and that the new mines will be no different. One local community leader told me that it was “bullshit” when people claimed the proposed mines would not be safe, maintaining the anti-mine campaign was a “public relations hoax.” He said the science was not that difficult and there is “no doubt that mining can be done right.” Working class mine supporters emphasize experiences with existing mines, such as catching fish in an old mine pit lake, to claim that the new mines would be safe—regardless of what scientific experts for environmental groups say. For mine supporters, the possibility of bringing prosperity to the region and a renewal of mining is worth what they see as minimal risks that can be managed with technology.

Environmentalists, many who have college and graduate degrees, often place greater trust in scientific experts’ assessment of environmental damages. These groups regularly claim that the science will support their position and advocate for science-based decision-making. Volunteers and staff members of environmental organizations talk about reading the science and realizing that the proposed mines are a risk to clean water, ecosystems, and wildlife. They often refer to the science being unequivocal that copper-nickel mining would pollute. One representative told me, “There’s no science that excuses, justifies, or supports putting a sulfide or copper mine in the watershed of the Boundary Waters.” Many scientists do support the position of environmental groups and provide supporting research. However, I also spoke with some scientific and governmental experts who challenged some of the dire claims about water pollution from acid mine drainage made by environmental groups. Science is often more complex than presented in the public, and the issues that make for good public relations are not always the most scientifically certain.

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Yet, how environmental groups appeal to the public and what seems to motivate people's involvement is also driven by an emotional connect to the place, such as transformative experiences as a child on a summer camp canoe trip. A young environmental organizer who moved to Minnesota a few years ago described how he got involved with the issue once he visited the area. "I was like 'what are the Boundary Waters? What is this magical place?' So, I ended up going up there and falling in love with it," For mine opponents, the threat of environmental pollution is clearly supported by science, and the risks to a cherished place are too great.

Figure 3: Pro-mining rally in Virginia, Minnesota on July 25, 2017 before a U.S. Forest Service hearing on a proposed mining project (Credit: Erik Kojola)

Environmental policy is typically conceived as a rational process of evaluating facts in which competing stakeholders assert their authority through science in an informed rational public debate. I find that on the Iron Range, all stakeholders frame their positions in ways shaped by local cultures and place-based identities. This suggests that environmental policy-making is not merely an exercise of rationality but is also intertwined with culture, emotion, and politics, and how natural resources are made socially meaningful.

The environmental impacts of transportation infrastructure: Towards a new relationship between government and citizens

Dr Thomas Verbeek, Department of Sociology, University of Warwick @thverbeek

Air pollution is an increasingly urgent matter of public concern in cities and regions around the world. Air pollution was linked to 9 million deaths around the world in 2015, with 92% of deaths occurring in low- and middle-income countries. While poorer countries are the worst affected, air pollution is also a major health problem for countries in the global North. In the UK, where I have recently joined the European Research Council-funded Toxic Expertise postdoctoral research team, 44 cities and towns are breaching WHO air quality guidelines.

One of the major contributors to air pollution in cities is transportation. My doctoral research in Ghent, Belgium focused on the environmental impacts of our transportation infrastructure. In comparison with the impacts of petrochemical pollution that we are studying for Toxic Expertise, these impacts appear less extreme or symbolic. However, because of the scale of the transportation network and the amount of people being affected, the increased pollution levels can also have significant effects at population level, especially in the long term with prolonged exposure. In that sense it can be seen as a form of "slow violence" as defined by Nixon (2011): "*a violence that occurs gradually and out of sight, a violence of delayed destruction dispersed across time and space*".

…slow violence is a… violence that occurs gradually and out of sight, a violence of delayed destruction dispersed across time and space".

What adds complexity is that it is generally difficult to determine who is to blame for the situation, since it is not the road, railway or airport in itself that causes the pollution but everyone who uses it, which is almost all of us – to different degrees. However, in general, the government is in charge of transportation infrastructure. In these environmental conflicts, citizens are thus opposed to the government, in contrast with cases of toxic pollution caused by industries, where citizens are opposed to major companies. Still, the struggles of citizens are comparable in both cases and the aspect of expertise plays a similar role. This will become clear when we address the topic in more detail.

Figure 1. Highway viaduct cutting through a residential neighbourhood in Ghent, Belgium.

When we are talking about the environmental impacts of our transportation infrastructure often also traffic noise is considered next to air pollution. In Europe, it is the second largest environmental impact in terms of annual burden of disease, with at least one million healthy life years lost every year in the western part of Europe. In some countries, especially in the European Union, at first glance we seem to have these pollution problems quite under control. Following the EU Environmental Noise Directive 2002/49/EC and the EU Air Quality Directive 2008/50/EC it is obligatory to monitor and model noise and air quality, set up action plans and inform the population. For air pollution even legally enforceable standards exist that should be met, under penalty of fines, putting pressure on governments to implement an effective environmental policy. However, this environmental legislation – also the air pollution standards – might give a false feeling of safety.

There are three main reasons for this. First of all, these standards are the result of a long political process that lags behind progress in scientific knowledge and – more importantly – does not only reflect health concerns. It is primarily due to political concerns that no enforceable noise standards for traffic noise exist. If severe annoyance and public health would be central, some densely populated countries would pay an unbearably high cost to comply with such standards. Secondly, while we have an increasing knowledge about the health effects of environmental impacts, there are still many uncertainties and impacts we cannot grasp or predict. With regard to the impacts of traffic-related air pollution and noise, the harmful effect on health is not contested any longer, but uncertainty about the details of the relationship and the size of the effects remains. This also means that it is impossible to define safe levels of exposure. Thirdly, using generic standards also means that the specific context of local pollution is not taken into account. Some people are more vulnerable than others, or have less means to protect themselves or to choose where to live. These remarks are in line with the criticism of social scientists towards existing expertise and regulatory systems. In their introductory book chapter on "Powerless Science", Boudia and Jas (2014) refer to various works that show the limits of scientific knowledge in resolving the issues raised by toxicants and the often political nature of decisions and regulations regarding these substances.

These deficiencies are part of a contradiction at a larger scale that also applies to other policy domains: one between a government that is largely institutionalized and follows a command-and-control policy, and a world that is increasingly complex, volatile and unpredictable. Although this contradiction has existed for some time now, it is only quite recently that citizens are becoming aware of it, particularly with regard to the environmental institutional framework. Due to growing education, dissemination of scientific knowledge, higher expectations of the environment and a distrust of the government, environmental protest is rising in many developed countries. At least in Europe, there are several recent cases where awareness on potential environmental health threats has had a big impact on policy and infrastructure projects.

At least in Europe, there are several recent cases where awareness on potential environmental health threats has had a big impact on policy and infrastructure projects.

An emblematic case in my home country Belgium is the completion of the Ring Road around the city of Antwerp. Some ten years ago, when the plans for a combination of tunnels and viaducts were published in the media, the potential adverse health effects of such infrastructural project were widely covered for the first time, with popular contributions of environmental health researchers. This marked the beginning of years of struggle over the project (Wolf & Van Dooren, 2017). The prospect of potential harm to public health raised awareness and empowerment among citizens. They started to organize, collect information, set up measurement campaigns, consult experts and design alternative solutions. An important pressure group that emerged was the citizen initiative Ademloos (in English: *Breathless*), which focused on collecting state-of-the-art scientific evidence and disseminating it to the public in an understandable and appealing way. They cooperated with Straten-Generaal (in English: *States General for Streets*), another community action group which was fighting the project by conducting studies and resorting to legal challenges.

Figure 2 and 3. Protest actions of Ademloos focusing on environmental pollution caused by traffic on the Antwerp Ring Road.

Straten-Generaal stressed the deficiencies in the planning process, which had not involved citizens and had left environmental health concerns to the environmental impact assessment. This assessment process was denounced for its narrow “specialist” view. It relied on norms and procedures that were generic and static, not taking into account the specific context of the project area. By their joint efforts, both groups raised concern about the potential environmental health effects of noise and air pollution and the fairness of the planning process. As such, they could enforce a non-binding referendum in which the project was voted down by a majority of citizens. Another initiative, the Ringland citizen project, was born some years later and developed an alternative plan aiming to convert the existing Ring Road into a tunnel before any new infrastructure was built. This would ensure a better traffic flow, reclaim land for urban use and reduce pollution for thousands of citizens living along the Ring Road. By detailed and clever solutions and a professional campaign they soon gained support of a substantial part of the urban population, again putting pressure on the government to change plans.

Figure 4. Visionary plans of the Ringland citizen initiative to convert the Antwerp Ring Road into a tunnel, leading to better traffic flow, space for urban development and a reduction of environmental pollution.

However, the government was hesitant and unsure in dealing with this new powerful activism and tried to stick to the policy decisions that were taken. After ten years of discussions and delay, the major stakeholders finally came to an agreement, with the final plan being a combination of the different alternatives. What is most interesting in this case is not the final solution, but how citizens have managed to change the plans of the government because of public health concerns. They did this by not merely sticking to protest actions, but by actively engaging in the discussions, conducting research and devising alternatives. This kind of engagement is very similar to how communities organize to battle the toxic pollution caused by petrochemical industries and fits within the sociology literature on this topic, such as 'Uneasy Alchemy' by Barbara Allen. Also in the Antwerp Ring Road case citizens have collected data themselves ("citizen science"); pleaded for recognition of their lay knowledge next to scientific knowledge; and blamed the institutional framework for being too generic and not addressing the situational character of pollution.

Since these conflicts on the environmental impacts of transportation infrastructure generally revolve around a struggle between government and citizens, it seems easier to solve them compared to conflicts where multinational companies are involved. It might sound an appealing idea to just give more power to citizens, to listen to their concerns and ideas and adapt policy accordingly. However, this might be a dangerous option as well.

It might sound an appealing idea to just give more power to citizens, to listen to their concerns and ideas and adapt policy accordingly. However, this might be a dangerous option as well.

I illustrate this clearly in a case study in my PhD research, focusing on a neighbourhood in Ghent, Belgium, that is (relatively) highly polluted by traffic noise and air pollution, caused by two highway viaducts cutting through it. In recent years both viaducts were at the heart of political debate and the focus of environmental pressure groups, with public health concern being an important driver. The debate has emerged quite spontaneously but the local action group Viadukaduk quickly received the full support of the city council, leading to a united front against the Flemish government, administering the road. In this area I carried out data analysis on environmental inequalities and a survey among residents to gain insight into their perception of the situation and their ideas on the existing citizen initiative.

Figure 5: Viadukaduk explaining traffic-related air pollution on its website (in Dutch)

One of the interesting results was that objective and subjective exposure to environmental impacts had a different relation with socio-economic and housing variables. While poorer, less educated people and temporary residents in rented apartments and small houses generally experienced the highest exposures to air pollution and noise according to the models, socio-economically stronger groups and permanent residents owning a (semi-) detached house were generally more annoyed. In addition, the survey showed that it is also this group of people with a higher education, higher income, a full-time job and often owning a (semi-) detached house that rather takes additional protective measures, actively participates in policy and engages in citizen initiatives to raise their concerns. This socio-economically strong and active group is not representative of the whole population, questioning the unequivocal support of the city council for their complaints and initiatives. If a government too blindly adapts its way of addressing environmental health to changing awareness and perception of a certain part of the population, fair outcomes are not necessarily reached.

This does not mean all spontaneous bottom-up initiatives should be counteracted. Their engagement can be very useful in revealing environmental health issues, collecting bottom-up contextual information, raising awareness among citizens and producing novel approaches to (spatial) conflicts. However, we still need a strong government to take up an intermediate role, counterbalancing the local initiative and caring for the equal representation of all citizens. The survey also confirmed that the majority of people do not question the role of the government in these environmental issues, but advocate for *additional* collaborative approaches. With regard to the case study, the city government could extend the debate, now focusing on the complaints of the protest group, to nearby areas where citizens are less worried (and informed) but environmental problems are at least as severe. At best, we would evolve to a new relation between government and citizens with regard to the environmental impacts of transportation infrastructure, in which both parties are on an equal footing and both scientific and lay knowledge and ideas are taken into account. This would also mean that justice and a

"socially acceptable" solution are at the heart of the debate and not science per se, an argument also made by Boudia and Jas (2014).

The survey also confirmed that the majority of people do not question the role of the government in these environmental issues, but advocate for additional collaborative approaches.

A final aspect to touch upon is the crucial role of knowledge and data when we want to achieve a more just decision process with an equal voice for all actors. Because of the complexity of environment and health, it is impossible for planners, policymakers or citizens to have complete information on environmental health effects nor understand all available information. Today environmental justice discussions are often for a large part on the evidence of exposure, on what constitutes reliable information. In the case study in Ghent the citizen movement Viadukaduk does not agree with the methodology of the official noise and air pollution maps, and contests the noise measurements of the Flemish government. The Flemish government in turn does not consider the local subjective concerns and measurements valid. This is in line with the idea of Walker (2010) that gathering evidence should be seen as a claim for knowledge, authority and power, because evidence is always problematic, not a matter of simple fact and truth, but produced through social processes. To avoid discussions about evidence as much as possible and to focus the debate on normative aspects with correctly substantiated claims, a shared knowledge base is needed at project level. It should constantly be updated with available information, both top-down expert knowledge and bottom-up local and subjective knowledge.

Such a collective knowledge base could also change attitudes, raise awareness among planners, policymakers and citizens, and remove the distrust between different actors. At best, a shared knowledge base would banish misinformation and lead to fair and transparent discussions on ethical and normative aspects of policy choices. It would allow the government to take better decisions and citizens to be well-informed participants in planning processes. This recognition of the (questionable) role of expertise and the urge for publicly available and understandable information might be the most important connection between cases on environmental pollution caused by transportation infrastructure and the toxic effects of the petrochemical industry we work on in the "Toxic Expertise" project.

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從基礎設施實驗中學到的課題 Lessons Learned from an Experiment in Infrastructuring

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大約兩年前，我和同事開始進行基礎建設(infrastructuring)的實驗。我們的工作小組成員有社會科學學者、程式工程師、環境正義運動者以及周界(frontline)社區居民。這個工作小組開始創建網路基礎工具(web-based tools)，以幫助社會大眾了解及運用已經大量公開的環境空氣品質數據。在與工作小組的共事中，我學習到第一手有關資訊科技及其日常生活運用的四個課題，確認了社會科學研究者的發現，不僅為創造新的資訊技術而努力，並確保這樣的技術能確實將資訊事實帶入環境正義運動中運作。

[有意義的監測] 計畫(Meaning from Monitoring project) 是受到來自於居住在舊金山灣區煉油廠周界社區的運動者的啟發。在1995年，加州克羅克特（Crockett）和羅迪歐（Rodeo）的居民對他們的煉油廠鄰居(過去是Unocal, 現在是 Phillips 66)施壓，要求煉油廠針對有毒氣體的監測，安裝最先進(state-of-the-art)的環境空氣監測系統。這是第一個採納社區成員重要技術意見而發展的系統，並且成為鄰近的貝尼西亞(Benicia，靠近瓦萊羅煉油廠)、里奇蒙(Richmond，雪佛龍煉油廠所在地)等地的模範。隨後這兩個城鎮都贏得自己的周界監測計畫。貝尼西亞在2008年到2012年之間發展出來；里奇蒙在2013年對雪佛龍也建立起類似於Phillips 66的監測系統，運作至今。這些社區的共同努力，促使北加州的灣區空氣品質管理區（BAAQMD）在2016年通過一項規定，要求其轄區內的所有 5家煉油廠都需要設立周界監控計劃。

“我們的基礎建設計畫回應了我們從監測資料生產中所看到未開發的潛力。這些資料是公開存在的，卻很少被使用。“

"Our infrastructuring project responded to what we saw as untapped potential in the data generated by these monitors. The data are publicly available, yet little used."

我們的基礎建設計畫回應了我們從監測資料生產中所看到未開發的潛力。這些資料是公開存在的，卻很少被使用。當居民看到或聞到異狀時，他們可能去查閱監測網站，但是他們並沒有運用這些資料來反對煉油廠許可證發放或要求新的管制。研究人員也沒有使用這些數據來更多地了解區域內的空氣品質或環境健康狀態。

為何周界監控數據被相對的忽視？一個明顯基礎設施的因素是:資料不容易下載，監測網站強調即時情況，卻沒有長期走向的觀點。因此，這正是 [有意義的監測] 計畫的目標所在，創建一個基礎設施，讓資料數據更易於使用，並對擔憂毒物暴露的社區提供策略性的助益。

自2016年4月份我們開始參與式設計工作坊以來，我們創建了一個新的網站，幫助使用者能夠搜尋當前與過去的數據，並且建立一個郵件清單，讓居民可以在不尋常的高汙染事件發生時回報。同時，也設計了一款應用程式APP，讓在地居民可以回報有害氣味，並且顯示在網站上與監測資料並列。(對於這個創置行動，首先要歸功於 Amy Gottsegen。她是卓克索大學 (Drexel University) 電腦資訊科學系的大學生，其在卡內基美隆大學CREATE實驗室資深系統科學家Randy Sargent的監督下，對這些工具進行程式編輯。)

現在我們有了一套工具，但它的侷限性也正變得明顯。例如，潛在使用者往往被網站與應用程式APP之間的關係所困惑。尤有甚者，我們也發現網站並沒有被使用，意味著數據資料的潛力尚未被開發。

我們的工具當然還是新的，而且目前也只在與煉油廠相關的積極環保行動者中宣傳。然而，這些最有可能的使用者仍低度利用這些工具，表示「使用」(usage)將會是我們未來幾個月的關鍵挑戰。因此，當我們致力想要解決使用率低下的問題，以及制定擴大使用客群的策略時，我的第一個意圖就是重新審視設計決策與參與過程，試圖去尋找出問題的環節：是在哪個地方出了錯？是在哪個地方沒有做到傾聽或對社區意見（community input）給予適切的重視？是在哪裡我們錯過了機會，去創造一個對使用者而言，切身（relevant）、直觀（intuitive）、與有助益（useful）的網站？

“值得檢視的是我最初的期望，即是想要創建一套工具，能滿足潛在使用者對空氣監測數據的複雜需求。”

“What deserves scrutiny is my initial expectation that we could create a suite of tools that was capable, in itself, of meeting the complex needs of potential users of air monitoring data.”

但事實上，我想更應值得檢視的是我們的初衷，而非過程。我最初的期望是我們能夠-乃至可以-去創建一個網站或應用程式APP，甚至是創建能夠滿足潛在使用者對於空氣監測複雜需求的一套工具。我的期望源自於一個天真的觀點，那是對於技術（特別是資訊的基礎建設）應如何製作，以及它如何成為社會實踐的一部分。

第一課：基礎設施並非從頭創建。

在我們開始以前，我曾想像我們將要從頭建構一個網站，但基於兩個重要理由，實際運作並非如此。第一個理由，從既有程式碼調整而來的程式編碼較容易且快速的被創造，而且我的經費-來自國家科學基金會的資助撥款，雖然充足但並非無限制-程式開發人員必須重度仰賴既有的網站設計與資訊架構（information architectures）。

第二個理由，對設計過程的參與者來說，既有網站是協助他們去構想一個有用的網站應該長什麼樣子的重要資源。透過各樣的打樣（mock-ups）與潛在設計，工作小組召集一個設計工作坊，社區參與者強烈偏好參考一個完全實現的案例，賓州的「希南戈頻道」（The Shenango Channel）網站，主要是因為網站強而有力的視覺化呈現，其結合了監測數據、地圖與（現已關閉的）希南戈焦炭廠（Shenango Coke Works）的縮時攝影。「希南戈頻道」網站是由 CREATE 實驗室與賓州阿利根尼縣乾淨空氣組織（Allegheny County Clean Air Now, ACCAN）所共同開發。這也是我們的網站的重要參考。

第二課：新的基礎設施同時繼承了老設施的優點與侷限。

在帶領設計工作坊的這幾個月裡，與我一同工作的有卓克索大學大學生 Nicholas Brooks、英特爾實驗室的同事 Dawn Nafus 與 Richard Beckwith，我們共同分析當前收集與展示周界社區空氣品質狀況數據的網路基礎設施。Nick 發現現有的網站可以概分成兩大類。第一類網站是僅單向地向社會大眾提供量化資訊（如空氣監測數據），而無提供社會大眾回饋他們觀察所得的功能。例如 Rodeo 和

Richmond 周界監控資料最初顯示的網站（Fenceline.org），以及美國環保署所維護的網站（如AirNow）皆屬之。第二類網站則允許人們能夠回報他們對污染的觀察與經驗，卻未與量化數據進行整合。如路易斯安那州空氣桶隊智慧地圖（Louisiana Bucket Brigade's iWitness Map）與加州IVAN回報網（California-based IVAN reporting network）皆屬之。而確實進行量化數據與質化資料的整合，或從另一面向思考，允許從監測者到受影響之居民、以及從受影響居民到主責機關（responsible authority）等雙向溝通這樣的網站，既不尋常，也通常未能在其中一面向（one dimension or the other）充分實現。我們確實發現兩個案例：「希南戈頻道」網站與 LACEEN。（在當時，「希南戈頻道」網站的回報功能仍需要一些手工活（manual labor）來將社區回報整合進網站當中；而 LACEEN 的監測數據則尚未整合進其「更好的發展」（better-developed）報告中。）

因為注意到這個斷裂，我們的網站從開始就希望能更好地整合這些功能。但我們要在既有的基礎設施上進行整合，這是過去未解的挑戰，我們也陷入了相同的處境。在創建類似「希南戈頻道」網站的介面以顯現周界即時監測資料之後，我們也面臨了合併一些回報功能的挑戰。借用 iWitness地圖或類似 的 Ushahidi-based 平台，是一種可能性。創設灣區版的 SmellPGH 應用APP程式（「希南戈頻道」網站的後繼者，也是CREATE 實驗室所發展出來的應用軟體），也是另一個可行方法。但對使用者而言，沒有一個方法可以無縫地與我們的網站接軌，核心的問題也沒有解決：如何不僅收集居民關於當地污染影響的回報，還要將其轉交給BAAQMD和其他地方機關？

第三課：配置開源軟體需要默會知識

我們的計畫選擇去適應 SmellPGH 應用程式APP，主要因為它為我們伙伴社區居民提供回報能力的最快路徑。這個權宜之計來自於我們所接觸的原始應用程式設計師：因為 Amy曾在CREATE實驗室參與[有意義的監測]計畫，因此她能夠從程序員習得的專業知識，注入哪些需要修改、如何使用、如何創造等，以使 APP 能夠在其他地區使用的了解。我們還從CREATE實驗室後端的基礎設施中受益（並繼續受益），用於儲放應用程式APP收集而來的回報。

雖然 iWitness Map及其建立的平台也是開源的，但是我們沒有類似的機會去接觸到具有實踐經驗的人，並且可以建議我們更精細的部署點。選擇這條路徑，就類似於嘗試以閱讀食譜的方式來學習做麵包烘培，而不是讓一個麵包師傅站在你旁邊來指導你，提點你的麵糰何時可以變得「光滑與彈性」，以及告訴你發酵與過度發酵的差別。最終我們能得到較好的麵包，也就是說一個功能完整的應用程式

APP，能夠將回報轉發到網站去，這樣的部署大約花費一個月的時間，以沮喪的居民在多個平台之間（網站與應用程式APP）穿梭為代價。

第四課：新技術的採用取決於跟每日持續操作的連結。

當我們開始進行工作時，所有的社區團體與運動組織，設法想要用即時監測數據，卻無法用到或只能變通利用，因為數據是如此難以取得。我們的目標即是在於希望讓數據更具可近性，並同時整併進其他資料來源，這樣他們不用在沒有資料的環境下持續運作。然而，他們成功地設法處理問題，也意味著他們對於我們工具所能提供的資訊，並沒有預先存在的需求。因此我認為「有意義的監控」計畫，最大的挑戰並不在於創造出完美的設計（儘管我們仍在目前的設計當中解決明顯的問題。）相反的，我認為最大的挑戰在於與保護社區免受石化污染的個人或團體合作，一起發想如何使周界監測數據，以及我們一般的工具套件，可以幫助他們實現目標？與工作小組成員，包括 Constance Beutel, Janet Callaghan, Kathy Kerridge, 和 Nancy Rieser 等人，共同針對潛在使用案例進行思考，已促使我們設計出「每日概要」以利列印，並預計他們成為在公開會議上的講義。在灣區與環境、健康、社會正義組織等團體進行廣泛的對話，我希望，這不僅能為我們的網站和應用程式創造客群基礎，更可以指導我們未來的發展決策。

“為了參與設計和落實網站的使用，我不得不拋開我的分析帽子，並接受一個樂觀的思考方式來為環境健康與正義運動建立資源與基礎設施。”

“To participate in designing and implementing the website, I had to set aside my analyst hat and accept an optimistic way of thinking about building resources and infrastructure for environmental health and justice campaigns.”

同樣重要的是，這四課是我對於如何推進[有意義的監測]計畫的理解，這對於具有STS背景的人來說，並不是什麼新鮮事。作為一名STS學者，這些是我早該知道的一切，且事實上，某種程度上來說是事先知道。第一課與第二課詮釋 Leigh Star 和 Karen Ruhleder ‘在基礎建設方面的具有影響力的研究工作。第四課則不僅與 Star 和 Ruhleder 的調查結果產生共鳴，也可以被視為重述了Bruno Latour在“行動中的科學”所描述的“事實建設者的困境”（“quandary of the fact-builder”）。而第三課只是STS長期傳統的簡短延伸，揭示了默會知識的重要性，特別是在實驗室中的實作，作為知識創造的重要元素，而且，當然我並非第一個將此概念應用於開源軟件的人。

為何這些在[有意義的監測]計畫的脈絡當中像是個啟示呢？為了參與設計和落實網站的使用和其他工具，我不得不放棄我的分析帽一陣子，並相對不加批判地接受一個樂觀的方式來思考為環境健康與正義運動建立資源與基礎設施。順著這思考路徑，新科技對生活在石化污染前線的社區是有好處的。毫無疑問地，這些居民甚少得到科技的服務：那裡缺乏監測設備、大部分網站的設計不符合居民的思維，而大多便宜的智慧型手機，因缺少足夠的儲存空間與記憶體，而阻礙了安裝額外應用程式APP的使用。為接觸適當的技術而進行的抗爭是環境正義鬥爭的一部分，例如尋求資金創造新的監視器，甚至嘗試進行參與式的設計計畫本身就是勝利。

既然有一個原型，STS的洞見就可以再次出現。這有助於了解計畫項目所處的位置以及為什麼進行，並且將重點聚焦這個微妙點：如何確保我們所創造的技術在社區脈絡當中是確實有效的？當我們向前邁進時，挑戰將是轉向到提高意識，意識到新科技總是受限在舊式的策略設計修改當中，而且技術如何被使用的相關知識，也是有賴於設計的屬性如何在實踐中被賦予意義，並與潛在使用者在透過監測數據豐富其實踐行動的新視野上共同合作。