

We Thought It Was Fog, We Thought It Was Just Some Weather

Sensing, Datafication, and Governance of Urban Air Pollution

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1. DO YOU EVER THINK ABOUT AIR?

If you do, how do you come to notice it? Is it material, spatial, sensorial, digital, relational, spiritual, chemical or other?

Do you live in Beijing?

Do you think there is something such as “urban air”?

I heard there's a word “wumai” which didn't exist before. Do you remember when fog became smog in China?

How do you think it became perceptible? Do you think air is governable?

These open-ended questions served as an entry point to collect embodied experiences and imaginaries of air in Beijing during an artist residency at the Institute for Provocation (IFP) in autumn 2016. Whereas many other cities in China, India, and elsewhere face even worse air pollution levels, Beijing has over the last decades become notorious for its health-hazardous smog. Since the 2010s (and in particular after the January 2013 Airpocalypse event), a new term for smog, wumai, was adopted by the Chinese general public. In China, this shift in terminology coincided with a spread of technoscientific concepts, such as the National Air Quality Index or AQI (providing an assessment of the estimated health risks in relation to air pollution exposure) as well as PM_{2.5} (minute particulate matter emitted from cars, industries, fires, etc.) often referred to as the most health-threatening element of the AQI index. Because they can be automatically sensed by digital sensors, both AQI and PM_{2.5} are readily distributable, and in 2013 when air pollution was finally recognized in China, and official access to air pollution levels in many major cities was granted by China's Ministry of Environmental Protection, several smart-phone apps giving access to

real-time air quality index values soon appeared. As a result, Beijingers became early adopters of historically novel, real-time modes of sharing environmental data. This technological shift was made possible thanks to digitalization and automation technologies that transformed all aspects of the air pollution monitoring apparatus. In a short period, ubiquitous automated environmental sensors, automated real-time data transitions, and smart real-time social networks entered the lives of millions of people affecting the ways they receive information about pollution, and in extension, how they go about their everyday lives.

Figure 1: A screenshot of the air quality data from a smartphone application. Different colors indicate different levels of health risk and the infographics illustrates recommended actions.

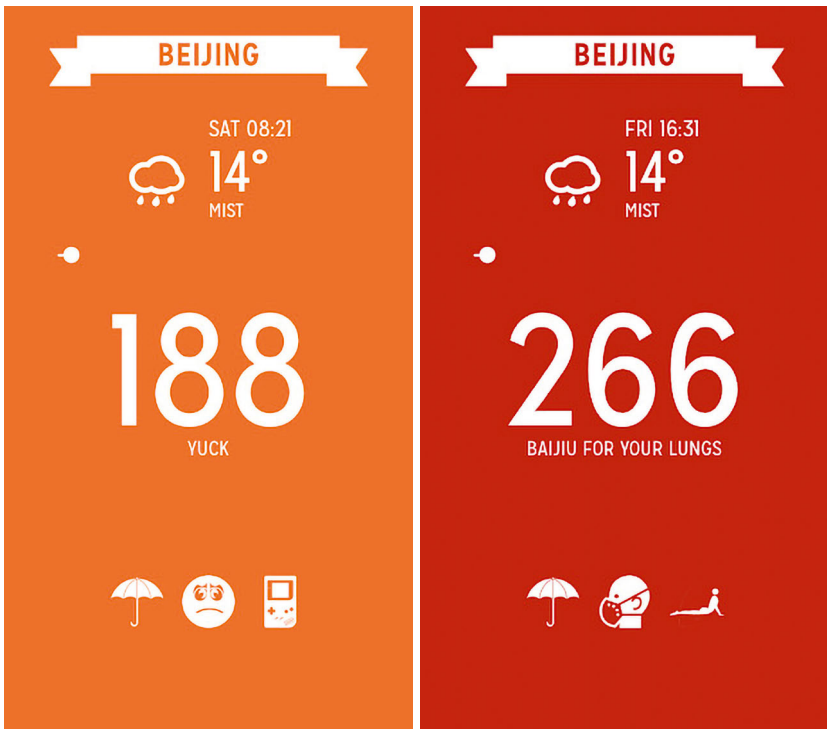
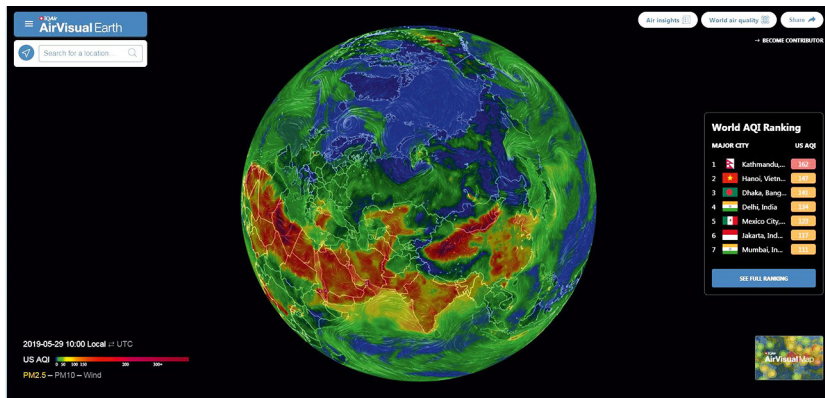


Figure 2: An example of scaling up air quality (AQI) maps from city to planetary level with the commercial AirVisual Earth application which covers pollution airflows across the world by combining data from public government air quality stations, satellite data and the community.



Informed by conversations with local inhabitants, embodied experience, field notes of daily air pollution data collected during a three-month period in Beijing, interviews with experts on atmospheric particulate pollution as well as our long-term transdisciplinary dialogue, this chapter examines the entanglements between the aesthetics and politics of making the toxic but invisible particulate air pollution perceptible to human senses. More specifically, using the Beijing air as a starting point, we focus on the emergence of digital practices for sensing and communicating about air quality, which have become indispensable tools for managing and surviving in the particle-filled urban atmospheres of many metropolitan areas worldwide. As the fluxes of data generated by automated air quality indexes and new practices of digital environmental sensing open new spaces of perception, we observe how this contributes to novel imaginaries of a datafied urban air, which risks suppressing the heterogeneous but incalculable realities from which the numbers were inferred, while at the same time reconceptualizing the urban air and our relation to it as a “new arena of care and calculation” (cf. Liu, 2017; Whitehead, 2011; Husberg and Marzecová, 2021). In other words, we notice that the aesthetics (the doing of sensorial perception) of new collective ways of sensing urban air in the digital era is generative of a new ‘sensing’ mode of governance, and thereby inherently political as it radically shapes collective subjectivity and agency.

To support our argument, we will first share excerpts from field notes—kept by Husberg throughout her three-month sojourn—that accompanied daily measurements of PM_{2.5} collected every morning, evening, and during movements within

the city, and provide some insights into the practice of monitoring air quality data using an AirBeam (the U.S. produced open-source portable monitoring device), as well as available apps using Chinese air quality data. Bearing witness to the tediousness of data collection, and incorporating annotations on the embodied and felt experience of spending time in the dense Beijing air, the field notes shed some light on the context in which the dialogues with Beijingers that inform this chapter were collected. To denote them from other people (and also not to foreclose the full names of people expressing what may be perceived as sensitive opinions), the discussants are assigned initials, rather than their full names. Second, we provide an outline of the starting points and conceptual framing that have informed this technoeological investigation into the sensing of urban air pollution. Third, we share three vignettes from a broader selection of thirty-five transcribed dialogues or aerial accounts, which illustrate the broader material and highlight the life-structuring effects of air pollution on city inhabitants. These are then followed by a discussion on the technoeological sensing of air and pollution, and the wider impacts of a new ‘sensing’ mode of governance. Finally, the conclusion highlights the irreducibility of sensing into the singular form of data-sensing, exemplified by real-time air quality data, not only because the effects of pollution cannot be reduced to numerical representation—but, more specifically, because the digital sensing of air pollution does not merely inform of pollution but significantly provides a new (political) terrain for the distribution of governance.

2. THE BEIJING FIELD NOTES, AUTUMN, 2016 (excerpt)

29.8 Arrival. First view of the North China Plain from the plane—clusters of high rises interwoven with lower constructions, next to small sections of fields in different tones, all surrounded by mountains.

My first breaths felt somewhat coarse—acidity in the air, not too much humidity.

30.8 PM_{2.5} measurement 35 in my room.

Took a walk north of the residency, along the hutongs, and towards the towers, PM_{2.5} values between 50 and 70. It jumped to 120 as I entered a bar. A girl was smoking.

1.9 PM_{2.5} 12 in the room.

First metro trip. Above ground the air is good—a bit cloudy, and pleasant with cooler weather—entering the tunnels PM_{2.5} levels went up to 100, ten times higher than outside. The app crashed, so I might have lost the data.

4.9 PM2.5 124 in the morning, at the lunch place PM2.5 190, PM2.5 54 in the eve. High PM2.5 levels. Have been coughing since morning. I followed Corinna to 798 art district, a 40-minute bike ride along some highways. The pollution was quite bad, I felt it in the throat. Still not that bad values, peaking around PM2.5 70. Some issues with the AirBeam, I had to reinstall the VPN on the phone.

6.9 PM2.5 20 in the morning, during the evening PM2.5 levels rose from 50 to 90. Still very hot, I'm told it's nothing compared to a few weeks ago, however. Humidity is low, not as in the summer. Coughing a lot although the air has been "good" since I arrived.

10.10 PM2.5 70 in the morning. A bit hazy again, the pollution is back after a short break. Often quite big variations even in the room, the levels climb up and down. Went with CSY and Kyo Lee to meet a Daoist master and his wife at Fragrant hills.

11.10 PM2.5 levels between 90 and 165, a bit better in the evening. I'm getting more sensitive to pollution, I can feel how it gets into the respiratory system. It is enveloping, like a blanket. I met XG at Chaochangdi. I managed to engage her in a discussion on air, and finally got my first aerial account.

13.10 Very hazy, a bit of a sore throat. Biked to the visa center with DL, then to Qi master with Corinna, CSY and XL. Had a long discussion with XL after. Her father used to complain about how the water was no longer sweet. She also told me they issued a red alert warning for three days. Air quality apps are showing much higher PM2.5 levels than my device is.

14.10 The Airpocalypse app is showing PM2.5 271 and "Baijiu for your lungs," my Air-Beam device is still stuck at 182. My throat feels stuffy, and there's like a numbing sensation around the head. Yellow heavy fog and haze warning for Beijing. The color codes were apparently revisited in spring 2016. Visited the urban planning museum in the morning. Then biked to Sanlitun and back to meet VN. Got some air masks on my way back.

15.10 The air is a little better, water drops in the air already in the morning. Other air quality apps are at PM2.5 250, my device 100 below that... Impossible to wear the air mask if I wear my glasses, the exhaled air that slips through the little holes, dimming

the glasses at each breath.

I transcribed the discussions with VN and WG, an artist who uses air ventilation fans to build large installations, and sent them to Agata.

Got a response from the AirBeam developers: “Hi Hanna. Thanks for reaching out. The fact that you’re topping out at around 190 is due to limitations in both the sensor and the firmware.”

8.11 Good air. Beautiful weather, rather cold, but sunny and blue sky.

Skyped with Agata. She asked whether pollution was a Western concept and if they used it in China.

AA mentioned an object yesterday, a container, that is supposed to protect you from pollution. He talked about food, how it’s much more than food, like medicine. There’s an idea that if you survive Beijing you build up your immune system, at least when it comes to food scams.

DXY helped me pose my air questions to TGB, a theater director who was visiting.

9.11 American elections.

The pollution is up again, around PM_{2.5} 300.

There’s a strong smell of coal.

Visited Renmin University, passed by XMF’s office for a short discussion as he wasn’t very comfortable in English. Followed a seminar in order to catch another professor, HS, with whom I had a good discussion.

The air is very hazy. Although it’s dark, it produces a shimmer as the light is reflected on all the particulates.

10.11 Grey and dull atmosphere, the city is covered by thick layers of floating particles.

Took a taxi to Caochangdi to meet KK.

Air got a bit better towards the evening. I’m still coughing, though.

16.11 Coughing and quite tired. Orange alert.

Lunch meeting with Prof. ZG, an urban planner working on urban air quality, at a vegetarian place (not like the lifestyle ones) at her university. She mentioned that there used to be a public website where you could download free air quality data, but it shut down, and how now only current levels are communicated, so they buy data on Taobao instead.

Met LLL at the gated community in Sanlitun where she works. She mentioned an app one can use to predict pollution based on how it feels, and how it’s actually very accurate if a large number of people participate.

18.11 Strong smog all day. PM2.5 levels over 300.

Very obvious pollution, even in the studio the air felt coarse, full of particles.

The glow effect was there again, softening the outlines of objects and buildings.

Grayness, but a magical light.

Long chat with DXY. Huo Wei stayed in, ordered food, didn't want to face the weather.

Small droplets towards the evening

3. STARTING POINTS

Air pollution is classified as one of the deadliest environmental health risks. Even so, because it is largely imperceptible to human senses, and because it operates as slow violence with impacts that are “pervasive but elusive” and mostly surface slowly over the course of years, even decades (Nixon, 2011), its critical analysis has to a large extent been limited to scientific expertise. Air pollution is, however, not merely a scientific phenomenon, but a life-death defining and thus political concern. Therefore, our approach to air pollution argues for more-than-scientific exploration and methodologies. In extension, accessing and making accessible the predominantly technoscientifically defined atmospheric terrain calls for a critical consideration of how pollution is sensed and thus understood. However, how can one study (and make sense of) sensing? Especially such an elusive and evasive element as air? As social theorist Andreas Reckwitz has argued, whereas sensible orders or sense regimes are inherent to any social order, the forgetting of sense is still widespread in social theory (Reckwitz, 2016). Moreover, considerations of sensing often have recourse to optical metaphors that are largely inadequate, not least in the big data paradigm (Agostinho, 2019; Chandler, 2018).

Arguably sensorial engagements with polluted air, which is mostly invisible, ask for a different, technoecological approach that acknowledges the immanent relationality between body, technology, and ecology (see, for example, Liu, 2017; Murphy, 2017). Similar to praxeological approaches, practice-based artistic research allows for sensuous or sense-driven and material approaches and inquiries in which the senses and the body are valid sources of research (Hannula et al. 2014). In line with this, this chapter makes use of excerpts of field notes and transcribed dialogues gathered during an artist residency in Beijing, positioning them not only as an affective and aesthetic reference but equally as valid sources of knowledge. Acknowledging that the bodily sensing of polluted air requires time, Husberg set out with the intention to gather experiences of Beijingers who have a long-term practice of breathing what they have recently come to realize is toxic air. For this, she adopted dialogue as the main practice and central methodology for gathering insights into local imaginaries of air (and its pollution) producing, as a result, a rich set of sound recordings

and transcriptions providing wide-ranging and varied perspectives about the experiences of living in the hazy Beijing air. The thirty-five discussants include both people who had a specific interest in the topic through their profession (urban planners, healthcare workers, environmental policymakers, academics, cultural workers), and locals, who had a long-standing relationship with the Beijing air.

While attesting to a diversity of ways through which the air and its pollution was sensed and experienced, all interlocutors emphasized the importance of technoscientific indexes, numbers, and data in navigating the toxic air, both at an individual and societal scale. And yet, while broadly circulated and used, the numbers or indexes retained a level of opacity contrasting with their ubiquitous presence and social importance. Here, it is important to stress that this lack of transparency is not limited to Beijing but represents an integral characteristic of the reliance on technoscientific and corporate modes of sensing pollution that, in the words of feminist science and technology studies (STS) scholar Michelle Murphy, externalize the complex bundles of extensive relations, rendering chemicals as disconnected functionalist molecules (Murphy, 2017). As a result, the chemicals and chemical relations that surround and make us largely reside in the “realm of the imperceptible” thereby remaining inaccessible to non-experts (Murphy, 2006). To make sense of this prevalent, yet exclusionary approach of registering (or sensing) pollution, this chapter developed through art-science dialogue, productively combines artistic research and scientific-epistemological perspectives, to highlight the tensions, entanglement, and uneven coexistence of different forms of sensing aerial pollution. Specifically, by approaching the doing of sensorial perception as a technoeological practice between body, technology, and ecology, this chapter foregrounds the embodied use of numbers and data or, in other words, the entanglement of the technoscientific modes of pollution sensing with human perception, more broadly. The role that air pollution and its sensing through digital sensors and data play in structuring people’s lives is emphasized—however not in order to naturalize technoeological entanglements (by treating technology as a natural extension of the embodied sensorium). Rather, drawing on critical analysis of the digital sense and the datafication of governance emerging at the interception of geography (Gabrys, 2016), media theory (Parisi, 2009; Hörl, 2017) and governance analysis (Chandler, 2018; Rouvroy, 2013) helps us to identify the realm of novel air sensing as a critical terrain of the (sensory) politics, not only of air pollution but of urban life more broadly.

4. SENSING POLLUTED AIR (excerpts from aerial accounts)

Air is part of my memory. It's a very important ingredient of my memory. We breathe in and out; we collect things, emotions, that linger in our realities, we take it in. We breathe all the time, in and out, but we don't notice it. It's almost as how we take in reality and transform it to memories that we recall sometimes.

Of course, for the worst days, if I'm not wearing a mask I can already feel something after so many years. My lungs and my throat are really telling me something is not all right. It's just like people who have pain in their ankles during rainy days.

The thing is that it has become such an issue that it influences everyone's life and health, and people's decisions whether to stay here or not. From this issue, you can definitely see the layers of the city. Even if we are trying to avoid saying middle class in China, I do think it's a very big social class that has the proper education and young children with a future and security in life. I think these people are the most stressed group in this city, they are more aware of the environmental condition than some other Beijingers. Also, because the middle class has the ability to change their lives, a lot of them are thinking about moving out of China or moving out of Beijing. But actually, it is not very easy to do that.

There's this word "Sharing the faith, breathing the air together." It comes from political propaganda. It means if you breathe air together you share the same destiny, the same faith. You are heart-to-heart connected, and you should fight for the same purpose. So that's a very ironic expression now. If we're breathing the same bad air now, what future will we then share together? —CSY, architect and curator working at IFP

The first thing I do, like the routine, is usually to check my email, my WeChat, everything, but the second thing is: what's the air quality today? Can I still see out through the window? What does it look like? And then I check the weather report. It's kind of like a routine for me, sometimes it makes me feel really, really bad, but you have to know because it impacts how you live. It's just the way I feel. It should be very natural, you know, breathe in, breathe out, but you have to think about it all the time.

When we were children there was already some smog like this, but we didn't know it's smog. We thought it was fog, we thought it was just some weather. Because when we talk about wumai we use this thing PM_{2.5}. It's very, very technical, not a normal word, and it's really bad for your health.

Maybe because it's the season now, it's November, it makes me really, really scared. Because it's the beginning of pollution, it's the beginning of the smog. So maybe because it's November, I'm

really worried about that... It's coming, it's coming, it's coming. Like every day, I have to check it.

We don't even need a weather report, you can just see if there is a big event or something, and you know if the weather is good or not. For the national golden week, for example, the weather is definitely beautiful. If there is some important international meeting, and presidents come from all over the world, of course, the weather is beautiful, but when they go... Some of my friends have a joke, maybe the government has big fans outside the city to blow away the bad air. So, for big events, they control the weather, but it doesn't last, afterward it all comes back.

—JJO, marketing officer met at a Halloween party by I-project art space

We're basically all living with machines at home, cleaning machines that run more or less the whole day.

Since three-four years I've been very affected by this weather. I was not in the beginning. I was more thinking it's a moral issue and a health issue. My kids are under control all the time, they have check-ups, and we try to go to Japan three-four times a year, to fly them away for holiday. As soon as it's beautiful, when the weather is good we bring them out. But lately, I've also taken it to myself. When there's a whole week like that I feel there's something really affecting my mind and my perceptual reality. There's a sense of depression, heaviness. This was not so clear before, but lately, I've started feeling a bit disturbed by this aspect.

The level of smog was already high around 2006,7,8, but it was not so visible. There were white skies, it was not this fog or smog you can see. I would say it became visible with technology with the apps. Because, all of a sudden, you're being introduced to this mechanism. Then the apps are measuring this and telling you it has already been three years that you've been exposed to very high standards. You called them white skies, but actually it is pollution. Now the pollution is getting bad and you see people around always checking these apps and comparing the numbers of the Chinese government with the numbers of the American embassy.

Even if the internet is controlled, Weishin, WeChat, and things have become very important tools for the government, especially because it's not a very democratic government, so you need to have feedback, you need to have big data. One of the strategies the government uses dealing with a billion and six hundred people is that whatever you throw at them you have big data. Because of how people react to a problem. Do they all migrate, do they remain? It's the same as if you block Google, what do they do? It seems that the government is very attentive to this kind of feedback and data.

—AR, artist and writer met through IFP network

5. FROM SENSING TO (SENSING AS) GOVERNANCE

While heavy smog is indeed perceptible, minute and toxic airborne particles are mostly imperceptible to human senses. Corporeal sensations such as smell, taste, or the shimmering of light hitting small particulates, as well as respiratory and pulmonary reactions, headaches and other bodily responses mostly occur only when PM_{2.5} concentrations significantly trespass levels deemed safe by the WHO. A foul smell is not necessarily indicative of hazard, and even if it was, exposure to air pollution affects the health of people over time and in various ways. Moreover, sensing and feeling cannot be disentangled from cognitive and mental states. As the vignettes above attest, the realm of the sensual and the social are connected; how the senses are mobilized, what is perceived or dismissed, and in what way things, people, and environments are sensed and perceived are related to socio-cultural practice (Reckwitz, 2017).

However, as the Beijing accounts indicate, new sensibilities about invisible but toxic particulate air pollution are not only a matter of different attunement by the bodily senses. Indeed, we learned from our interlocutors that while Beijing's air was long troubled by other sources of pollution (such as dust storms) and never deemed good in the first place, the reconceptualization of fog as smog, or wumai, was largely reliant on novel modes of sensing. Significantly, along with the material presented above, our larger pool of discussants echoed the importance of air quality data communicated through the increasingly prevalent digital technologies. They pointed at how Beijingers in the last few years learned a lot of new "technical" and "chemical" words, like wumai, AQI, and PM_{2.5}; at the emergence of a "new air," "the one we talk about a lot" and which is communicated through the "numbers" and air quality indexes of apps; and at how these new datafied imaginaries of air has triggered new patterns of behavior, influencing choices such as where to live (for those who have the options and means) and where to meet. However, air pollution is not one thing, neither is it perceived as a gradient of exposures. For some, it is barely noticeable, either because they are not sensitive or because they are occupied by more urgent things. For others, atmospheric pollution is paralyzing, affecting their body ("my lungs and my throat is really telling me something is not alright," CSY), their sensing apparatus ("the second thing is: what's the air quality today? Can I still see out through the window? What does it look like?" JJO), and their mental states ("there's a sense of depression, heaviness," AR).

These complexities of embodied sensing enmesh with the unprecedented ways of sensing air enabled through technoscientific modes of observation and digital infrastructures of sharing information. While representing only one of the multiple ways in which citizens and governing bodies have gained awareness of the air's toxicity, the indexes have played a critical (and authoritative) role in determining both the personal but also societal sense of pollution. Air quality data have become om-

nipresent but still remain opaque and difficult to engage with. In Beijing, as well as in other smog-ridden cities across the world, people have learned to use and rely on continuously updated air quality data streams and their supporting technologies which together reveal new spaces of perceptibility. People have accepted, refused, or repurposed the indexes for their ends. Still, the numbers and data have become firmly established as the dominant means for communicating and making sense of air pollution. In effect, by making the invisible, yet toxic, air pollution perceptible and experienceable through interfaces, such as smartphone apps, screens, and smart sensors installed on air cleansing equipment or air monitoring devices, the data and its technologies seem to become naturalized extensions of the human senses.

Crucially, we argue, the data-informed and technological experience of making sense and responding to pollution events through air quality indexes and data constitutes an entirely new arena of (technoecological) sensing. In *Technoecologies of Sensation* Luciana Parisi discusses the formation of a technoecology of information sensing in cyber capitalist culture, arguing that “changes in technical machines are inseparable from changes in the material, cognitive, and affective capacities of a body to feel” (Parisi, 2009:182). Taking the example of bionic (biologically inspired electromechanical implants) sensors she describes the interaction between environment, body, and machine not as simple transmission between separate entities but as an entire ecology of information sensing, indicating not only an extension of sensory perception but “a mutation in sensations all together” (Parisi, 2009:182). Sensors of air pollutants are external to human bodies, however, thanks to automation and digitalization, air quality data are delivered to personal devices in near real-time, generating a novel digital sense (of air) that resonates with Parisi’s analysis. Moreover, the trend of digitalization and automation of sensing is not limited to air. In recent years, cities, ecosystems, even the whole planetary environment, as well as human bodies, movements, and responses have been instrumented with sensors that capture, analyze (and also modulate) their processes and behaviors (see, for e.g., Gabrys, 2016). Increasingly, the data-intensive monitoring of Earth processes (and human behavior) is understood as one of the core areas of scientific research, the governance of environmental change, and a necessary means for the survival of humanity.

Significantly, as summed up by media theorist Erich Hörl, digital environmental technologies do not merely inform us about the environment we inhabit. Rather, cybernetics and the spread of digital technologies have been essential for the 20th-century ecologization of thinking that appeared simultaneously with a new apparatus of capture (Hörl, 2017). Hörl’s analysis highlights that the resulting logic of capture and control unfolds through “managing and modulating behavior, affects, relationships, intensities, and forces” (Hörl, 2018) and is indicative of a new mode of governing by structuring the milieu of individuals in order to obtain specific conduct

(Gabrys, 2014). In line with this, reflecting on the effects of technological advances (driven by big data technologies, algorithmic machine learning and ubiquitous sensing) in a postmodern world framed as complex and thus essentially unknowable, media scholar David Chandler (2018) formulates “sensing” as becoming one of the prevalent modes of governance. Following Chandler, under the sensing paradigm, governance employs big data technologies to detect disturbance or change in its emergence and to minimize the impact by facilitating real-time responses, rather than focusing on the prevention of always emergent problems and their complex permutation. In other words, this approach to (environmental and societal) governance sees the ubiquitous data from sensors of all kinds as a means to make subjects respond to and become sensitive to the world and its environment. Effectively, however, this mode of combining technology and governance aims at dynamic stabilization of the status quo rather than offering venues for acting upon the world to change it (Chandler, 2018). Once again using an optical metaphor for the essentially post-optical processes of datafication (Agostinho, 2019), sensing as governance uses data to make the unseen “seeable.” In opposition to abstractions and representation—produced through fallible interpretation—data is taken as reality itself.

The sensing of urban air pollution represents only a small part of the ‘sensing as governance’ paradigm, which operates with data from every arena of the urban realm, including human behavior, health data, online habits, and much more, at regional and planetary scale. Nevertheless, highlighting these digital practices of air quality sensing as consistent with the logic of sensing (and algorithmic) governance is important, precisely because it underscores that the data-driven sense of air pollution it has generated is not merely a technological extension of the human sensorium but, rather, a terrain for the distribution of governance mechanisms.

The sensing mode of governance promises efficiency and actionability in a complex world. However, cautioning against the consequences of subsuming policy decision under big data and algorithm automation, legal scholar Antoinette Rouvroy has argued that the computational turn, and what she calls algorithmic governmentality “does not address individuals through their reflexive capacities, nor their inscription within collective structures, but merely through their ‘profiles’” (Rouvroy, 2013:2). Instead, using automated, a-semiotic, pre-political and always emergent big data to construct models of behaviors and patterns, human actors are spared the burden and responsibility to transcribe, interpret and evaluate, and consider cause or intention. Importantly this erodes the possibility of critique and dissensus, as well as the legal construction of norms through laws, regulations, and due process, thereby leaving the distribution of power and domination unexamined (Rouvroy, 2013). Whereas Foucauldian notions of biopower and biopolitics operated on the lives of real populations—governing bodies by norms—algorithmic governmentality operates on virtual populations, constructed for the capture by algorithms (Rouvroy and Stiegler, 2016). Rouvroy’s critical analysis focuses primarily

on data produced from human behavior. However, it is also relevant for the arena of atmospheric sensing. This is because the technoscientific approach to defining the scale of exposures is based on a reductive understanding of pollution (focusing mainly on particulates but less so on other substances and their interactions) and, especially, a debatable notion of what constitutes human health, and who counts as human (as the idea of human body or population used in air quality indexing is inferred from epidemiological and medical studies). In other words, while situated in the historically and geopolitically specific context of Beijing, the life-structuring effects of air pollution data conveyed in the aerial accounts also reflect a broader epochal shift in how the sensing of environmental phenomena is organized and recognized.

Gathering different experiences of pollution, this chapter highlights the singular importance of conveniently capturable, digitizable and communicable modes of data-sensing, and asks: What are the impacts of this datafication of air pollution, that reduces the relations between city dwellers and urban air to a question of responding to pollution events in response to risk assessment? And what are the effects of its integration into the data-driven ecosystem and the managerial governance of the city? We argue that by bringing air into sense and sensibility, the data do not merely function as objective information but operate as a distinct technology of imagination—with concrete material consequences and political implications. In this context, it is crucial that the politics of air pollution critically engages with how air pollution is sensed (digitally), and asks what is at stake?

To some extent, the ubiquitous technological sensing of air has allowed for new levels of environmental awareness and public scrutiny. It has enabled (middle-class) citizens to minimize health risks, organize into communities and engage with the problem, predominantly to develop adaptation strategies. These strategies are, however, reflective of the neoliberal rationality, that instead of enforcing strict collective regulation of large polluters or complex calculations accounting for the real costs of prevailing modes of production, are equated with highly privatized individual choices in relation to exposure to toxic air. Thus, by framing agency as responsive capacity, sensing as governance evades questions of accountability and causation. And, pointedly, pollution risks losing its status as a problem to be resolved and instead becomes an event that needs to be sensed and responded to. As AR puts it, while the political agency is reduced to investment in privatized care (air monitoring and cleaning technologies, check-ups for the kids, travels abroad) and the comparison of numbers, the role of the state has shifted to governance through feedback from big data. As air quality data streams enable fast responsivity between toxic air and the citizens, eliciting their response (even if inadvertently), it contributes to the datafication not only of the atmosphere, but more broadly to data-driven (that is, digital sensing based) urban governance. In this move towards sensing as governance the ‘raw data’ of computation—used by different governing bodies in the mon-

itoring of environmental processes, logistics, smart city management and a range of other uses, and which is generally presented as always already there—might appear as more objective and impartial, in part because it disregards individual singularity of people, whereas humans inevitably perceive through categorical biases inscribed in singular lives. Data is, however, produced through sophisticated methods of ‘rawification’ (through reformatting, cleaning, and ungrounding) and dependent on material conditions of optimization that foreclose anything that escapes calculation (Denis and Goëta, 2014).

One of the main problems of sensing or algorithmic governance is the reduction performed in the automated equation of reality with data. This applies both in the case of pollutants (limiting pollution to what it can be measured) and to citizens (limiting citizenship to the activities of adaptation and response management). Indeed, while air pollution management includes citizen practices, the data-driven sensing mode of governance risks diminishing the agency of citizens (perceived as sensing individuals) to behavior that is capturable and predictable, and not subjectivity. In the process sensing as governance bypasses real (embodied and situated) subjects, replacing them by probabilistically constructed populations, thereby impoverishing subjects who are no longer inscribed in any collective context (Gabrys, 2014; Rouvroy, 2013). Indeed, sensing as governance doesn’t empower people in need of social change nor does it resolve environmental threats, instead it advances the responsabilization of individuals who need to monitor the continually emergent patterns of air pollution data and adapt, leaving no time to imagine collective political agency vis à vis pollution.

6. CONCLUSIONS

The different sections of this chapter trace the intrusion of a novel datafied sense of air. On the one hand, the Beijing accounts have made us aware that both the potentially empowering and problematic aspects of technoscientific air quality indexes stem from their ‘datafied’ nature. It is their volume, their velocity and their digital character that allows them to be integrated into algorithmic models of sensing, distribution, and forecasting. The simultaneously digital and environmental nature of air quality data (PM_{2.5} and AQI) connects two lines of inquiry: the critique of algorithmic governmentality, relating to the impacts of automation (including sensing) and algorithms on democracy, and the critique of governing through environmental distributions of power and cybernetization of environments (and the atmosphere). In line with a broader interdisciplinary concern about the impact of big data and sensing on governance, the Beijing accounts converged around the recent focus on numbers, highlighting air quality data and digital sensing as one of the critical terrains for contemporary environmental distribution of governance. This is perhaps

best exemplified by AQI, which reframes air quality as the expected health response of a population, attesting to the intricate intermingling of technological and neoliberal rationalities in the framing of air, and its pollution.

Scientific and technological formulations of pollutants are rightly considered efficient and evidentiary tools for addressing the problems of atmospheric toxicity. However, what if toxic air can be sensed in different, perhaps incommensurable, ways? And, what if sensing has multiple functions and effects, including the establishment of specific terrains for the distribution of governance? Originating in sense-driven artistic research around the technoecological imaginaries of air, and its pollution, this chapter retains references to other sensorial and perceptual entanglements with pollution posing the question of what information matters and what does not. It follows the researcher navigating the city using air monitoring devices, apps, and her own sensory apparatus; several divergent, yet also complementing, narratives of inhabitants coexisting with pollution over long periods, who have come to monitor air quality and structure their everyday lives accordingly (for those who have the means), or on the contrary, surrender to the consequences of exposure. Whereas usually deemed irrelevant, these perspectives highlight that sensorial perception by different people or through different sensorium is not the same, neither is it equal, by providing concrete everyday examples of the social and political implications of novel modes of data-sensing and the underlying rationality that, rather than addressing the causal relations of air pollution, positions it as an individual risk to be managed. In addition, giving attention to fragmentary and disparate narratives exposes how datafied conceptualizations of air not only normalize but also neutralize the actual world; the irreducibility of the corporeal experience of air (breathing, smelling, tasting, being touched and permeated by, or feeling the heat and humidity of air) that grounds most of our human senses as well as societal decision-making and discussion are sidelined by a computable data-world.

The doing of data-sensing is necessarily a reduction of the heterogeneous materiality of air. In no way do we want to imply that digital air quality sensing and automated data flows cannot be used for (radical) political ends and citizen empowerment. We also do not want to indicate that they have not contributed to improvements in air quality. Indeed, PM_{2.5} measurements have dropped significantly in the capital since the start of the *war on pollution* and the 5-year Air Pollution Action Plan of 2013. Even so, building on a critical reading of our case study and in solidarity with the legitimate concerns of citizens living in toxic air this chapter argues that radical political projects attending to air need to find means for addressing the prevailing condition of algorithmic forms of governance, precisely because it dematerializes urban bodies and their agency into quantified nodes of planet-scale digital infrastructure. Resonating with Haraway's call for an embodied, embedded, and situated reclaiming of the technologies of perception (and relatedly also sensing) this loss of political agency—which we argue is associated with the novel perceptual regimes of

capture and control and strongly shaped by neoliberal rationality—manifest an urgent need to reclaim more caring and politically aware technological modes of sensing (Haraway, 1988).

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