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Article

Studying Surveillance AI-cologies in Public Safety: How AI Is in the World and the World in AI

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Abstract

Technological surveillance for the sake of safeguarding public safety (e.g., cameras, sensors, mobile phones, OSINT) pervades the lives of individuals on many levels. In this article, we advance the idea that the addition of AI changes the way surveillance ecologies function and thus deserves to spawn its own concept: the surveillance AI-cology. Surveillance AI-cologies are made up of interconnected collections of disparate actors (technological, human, more-than-human, organisational, etc.), all implicated in AI-aided surveillance tasks. They contain not only the usual complexities of any technological ecosystem but also the added complexity of AI, with emergent characteristics, both technically and socially. We argue for the utility of multi-faceted perspectives in doing work within AI-cologies, and we describe (anthropologically inspired) methodology for understanding and unpacking AI surveillance ecosystems. The development of democratically controlled AI surveillance requires the systematic consideration of ethical, legal, and social aspects (ELSA) within the quintuple helix (public, private, civil society, academia, nature). We stress the relevance of clearly defining which perspectives of the quintuple helix are considered in AI surveillance, and which not, to achieve a transparent set of (ELSA) values that guide AI surveillance development and implementation. We provide an example of the way we have developed and applied (some of) these methodologies in the context of a test-site for the development and application of smart city technology, a so-called "Living Lab." Here we take the stance of active involvement of academics as "critical friends" into complex innovation and assessment processes. Together with our conversation partners in the field, we tease out and reflect upon the (public safety) values embedded in the setup of the Living Lab we explore. We end with a call to understand surveillance AI-cologies not as a problem to be solved, but as a continuing process to be discussed among highly diverse stakeholders.

Public Safety and AI

Technological solutions to complex public safety issues are often treated as a quick fix, with so called "smart cities" as a prime protagonist (Kitchin 2014; Murakami Wood and Steeves 2021). The original optimism concerning the role of artificial intelligence (AI) for human and social flourishing has by now been tempered in the face of the multiple disruptive (side) effects of AI innovation that have become visible in the lifeworld of individuals and on the level of organisations and institutions (Amnesty International 2021; Banaissa 2021).

In the academic and public discourse on the use of AI for public safety, there is justifiable controversy. Proponents stress the benefits of AI-driven surveillance, which they argue can make functions like crowd

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management more privacy-friendly and safer for everyone (Mehr 2017; Rajendran and Shankaran 2021; Zhang et al. 2019). Opponents point to the risks of mass surveillance, discriminatory practices produced by predictive policing (Duke 2023), and the redefinition of the public space towards implicit desirability norms defined by the people and organisations creating smart cities (Engelbert, van Zoonen and Hirzalla 2019; Mosco 2019; Shelton and Lodato 2019). They consider the search for ethical surveillance as an impossible "mirage" with dangerous implications (Monahan 2023). Furthermore, the perception of public safety depends on positionality (Butot et al. 2020). While some (especially physical) facets of public safety are considered by each player, they might matter in their salience or significance to varying degrees—especially the more subjective elements of public safety (Jacobs et al. 2021). For members of the public, socio-demographic factors play a role: depending on age, ethnicity, employment status, or other factors, needs and desires relating to safety can differ widely (St. Louis and Greene 2020). Not only that, but there are also the specific safety needs of more-than-human actors in urban spaces such as animals, plants, or the sea to consider as well (Haraway 2016; Smith, Bardzell, and Bardzell 2017). These complexifying components reinforce the need for instruments of study that match the complexity of the AI-driven surveillance under study.

Artificial Intelligence is itself a complex topic, as it is a broad term that is used to refer to a collection of related technologies (Wang 2019). This leads to differing understandings, both within technical collaborations that may not be sufficiently well-bounded and within non-technical discourses that treat the general concept of AI rather than specific technical disciplines like machine learning (ML), neural networks, or computer vision (CV) (Wang 2019). Within public safety settings, the literature shows that AI (as a broad concept) possesses several features requiring specific attention. Machine learning, one of the more common subsets of AI in use at the moment, is very data-hungry, always needing more training data, and this shapes the way it is deployed, developed, and (re)trained. Such cycles are typical in ML, as the dynamics of data that were put into a system often change over time or data fed into an algorithm during its use differ from the data it was trained with (Babic et al. 2021). In many cases of ML-based public safety surveillance, training data are public data (though not all training sets are available for public scrutiny, so the full scope of such appropriation cannot be known). Commentators argue that, in some cases, the collection of such large public data sets might even be provoked by starting large surveillance operations (Duke 2023). Complex ethical, legal, or social questions might also arise when partnerships with private owners of data are entered (Duke 2023). The prevalence of concerns around private company involvement in AI and public safety, as we have seen in debates around Clearview AI (Hem 2022) or Palantir (Johnston and Pitel 2023), hint at another aspect of current technologies under the AI umbrella, namely, that they are highly capital-dependent and thus heavily involved in funding and profit-taking flows. This implies that the investment of taxpayers' money needs to be legitimised and that public agencies can in most cases not develop AI solutions with their own means and therefore engage in far-reaching public-private-partnerships. Another aspect that is of particular concern in public safety is that AI systems are at least discursively treated as possessing agency and judgement (Goodman 2023), more so than most other technologies, and this might also affect their relation to democratic governance in unique ways: "It's a way of depersonalising the decision to surveil" (Finch et al. 2023: 236). Using AI in public safety might carry the increased risk of contributing to opaque decision making, structural inequalities, and the further manifestation of systemic injustices (Zajko 2023).

We see widespread surveillance, especially when it includes AI, as highly problematic. Our intention in this article is to create conceptual and methodological space for surveillance scholars to actively engage with AI-based surveillance as a public issue. This approach fits well with a critique of smart cities and the formulation of democratic alternatives in terms of public engagement and citizen control of technology (Mosco 2019), as well as initiatives in the field of responsible research and innovation (Cohen and Gianni 2022).

In this article, we first outline conceptual and methodological tools to engage with AI surveillance practices ("surveillance AI-cologies"). Here we argue that, for a "vibrant democracy" (Mosco 2019), the ethical, legal and social aspects (ELSA) and perspectives of all public, private, academic, civil society, and nature

stakeholders of the quintuple helix (Carayannis, Barth, and Campbell 2012) should be an integral part of the full innovation cycle of surveillance AI-cologies. Based on methods inspired by anthropological engagement with science and technology (Dumit 2014; Haraway 2018), we then suggest how surveillance AI-cologies can be unpacked. Finally, we provide and reflect upon an example of the application of these tools in the context of a pilot case, the Living Lab Scheveningen, a beach-side location in The Hague that is used as test-site for the development and application of smart city technologies.

It seems fitting to us that, in a living lab, not just technologies but also methods of being critical towards those technologies should be tested. We feel researcher and activist "roles are conflated by design" (Delmestri 2022: 1) and thus position ourselves as active members of the public safety discourse, concerned members of a public, impact-oriented academics, and "critical friends" of private and public safety management actors. As such, we see this article as an invitation to surveillance scholars and members of local communities confronted with surveillance AI to actively engage and (re)design the surveillance AI-cology.

Surveillance AI-cologies

The monitoring of populations constitutes specific ecologies (Bowker and Star 1999; Schinkel 2023). This can be referred to as a "surveillance ecosystem" (Crawford 2021: 201) or the commonly deployed term, "surveillance ecology" (e.g., Sophus Lai and Flensburg 2020). The concept of ecology is relevant here because it emphasises co-creation, relationality, and co-constitution (Star 1995). The use of AI adds new dimensions, considerations, and relations to the configuration of surveillance ecosystems. The concept of surveillance AI-cologies considers that artificial intelligence might dramatically change the rules of the game, the players, and eventually the game itself. We see AI as part of an evolving ecology, as technology "reveals" a certain "relation to nature, mode of production, social relations, mental conceptions of the world and daily life," and all these elements hang together and can be studied and (re)imagined as an "ecological totality" (Harvey 2010: 196). Such a relational understanding suggests that a study of surveillance AI-cologies, including a focus on technology and different stakeholders from state, civil society, and business, benefits from a consideration of the relation to nature as well. Examples of considering nature include more-than-human approaches in urban and smart planning aiming to achieve multi-species justice for truly inclusive public safety (Fieuw, Foth, and Caldwell 2022).[1]

The complexity of surveillance AI-cologies should be matched by the complexity of the conceptual and methodological setup. We use a framing of AI drawn from the work of Kate Crawford (2021), namely that AI is not narrowly technical but is instead an assemblage of technicality, social practices, and infrastructures. It is not only the technology but also its contextualisation. If one studies AI in this way, then the study of AI should encompass social practices like training, the construction of values, and daily life, as well as the infrastructures like fibre optic cables, light posts, and cleaning contractors. By adopting Crawford's (2021) expanded definition, we give ourselves a greater opportunity to understand the factors at play in the development, deployment, and questioning or contestation of AI. We are also aware that we are, ourselves, part of the AI-cology and thus also change with emerging understanding and insight.

Surveillance AI-cologies might reinforce, create, or combat social divisions along the lines of class, race, ethnicity, gender, etc. As such, surveillance AI-cologies might constitute a new form of AI-enabled (in)justice. They might involve, using Stanley Cohen's (1979, 1985) phrases, "blurring the boundaries" (such as in/out, public/private), "net widening," or "thinning the mesh" (increased intensity and detail of

[1] This concerns the energy consumption of AI solutions (see, e.g., OECD 2022) and directing AI more broadly towards the United Nations Sustainable Development Goals (SDGs) agenda. AI can function as a catalyst to enable the successful implementation of the SDGs on several levels, but it can also inhibit positive change or even undermine existing social, economic, or environmental achievements (Vinuesa et al. 2020). For example, a one-sided focus on peace, justice, and strong institutions can have negative effects on other SDGs, as it might push a securitisation agenda, endangering equal opportunities or life on land, among other possible ramifications.

both monitoring and intervention). The addition of AI-based systems and devices to surveillance ecologies raises a number of potential concerns, including changes to the predictability of systems, a need for new methods of oversight (like algorithm/software registers), a re-consideration of the role humans play in surveillance ecologies, new decision-making mechanisms that account for the way values (including biases) can be unknowingly baked into AI-based systems, and consideration of how public engagement happens in the case of complex technology. This poses a particular problem, as public engagement can become more difficult the more complex, opaque, or misunderstood a technology is, leading to even more difficulties in the already neglected area of social stakeholder engagement (Mosco 2019).

Studying a Surveillance AI-cology: Quintuple Helix and ELSA

We use a quintuple helix innovation model as our point of departure (Figure 1), as we believe it reflects the complexity required to engage with surveillance AI-cologies. The triple helix innovation model (Etzkowitz and Leydesdorff 2000) emphasised the role of universities and governments, alongside industry, in knowledge production and innovation processes. Subsequently, the quadruple helix model (Carayannis and Campbell 2009) claimed that, in advanced knowledge-based societies, the inclusion of civil society is necessary for innovation power and economic considerations, on one hand, and democratic legitimisation and an ecosystem of trust on the other. To incorporate more-than-human concerns, a fifth helix is added (Carayannis, Barth, and Campbell 2012), encouraging inter-species thinking, transdisciplinary knowledge production, and multi-species justice.

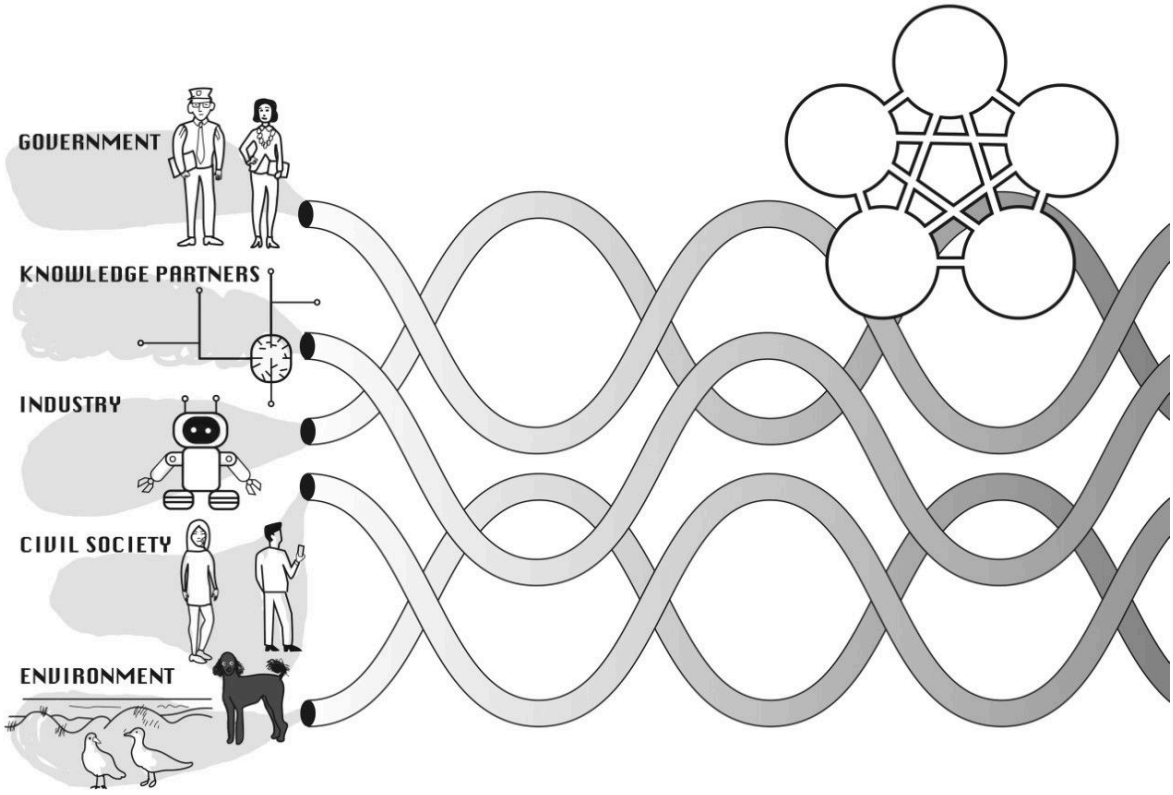

***Figure 1**: Quintuple Helix Model (illustration by Robert van Raffe, based on Carayannis, Barth, and Campbell 2012)*

The study of surveillance AI-cologies provides an opportunity to explore how the (active) involvement of quintuple helix stakeholders plays out and how it allows for the consideration of social practices and diverse values. The framework of "value" needs to encompass types of value that are sensitive, sustainable, and earnestly interested in foregrounding the needs of those who are not directly involved in the development of systems but are constituted as users (coons 2022). Computational systems are not simply about functionality but contain embedded values (Nissenbaum 2001). As such, it is necessary for those who develop technologies to consider the position of specific values in the systems they are designing, and how those values might impact the individuals who come into contact (directly and indirectly) with such systems.

In order to conceptualise diverse values, we focus on ethical, legal, and social aspects (ELSA), and we see our approach in line with the hands-on, public engagement, and co-production-oriented research practice in the ELSA tradition (Zwart and Nelis 2009). However, ELSA programs have been criticised as being ineffective (having little to no impact on policy making), and they have been critiqued for a pro-technology bias or as handmaidens of technology (i.e., they promote technology and avoid criticism) (Zwart, Landeweerd, and van Rooij 2014). Additionally, the urgent need for democratic control of smart city (surveillance) technology (Mosco 2019) and calls for collective democratic experimentation in responsible research and innovation (Cohen and Gianni 2022) require the explicit incorporation of democratic values and practices.

Taking on board the four elements typical of ELSA approaches (proximity, early anticipation, interactivity, and interdisciplinarity), taking seriously the two critiques (ineffectiveness and pro-technology bias), and incorporating collective democratic experimentation involving a diversity of publics, inspired our research design for the study of surveillance AI-cologies:

> (1) collective *democratic experimentation* means engaging with surveillance AI-cologies as public issues that cannot be reduced to problem solving (solutionism), technocracy, and enterprise (profit maximalisation), but require a process of social inquiry involving diverse stakeholders from the quintuple helix;
>
> (2) *reflexivity* means our proximity as researchers to the object of study implies a continuous reflection upon pro-AI bias (an open stance towards the "zero option" whereby "No AI" is seriously considered as outcome), and a willingness to map and discuss blind spots;
>
> (3) *participatory criticism* means changing habits and finding a balance while accepting frictions among quintuple helix stakeholders, including ourselves.

We aim to understand the complexity of AI-cologies in order to provide a richer vocabulary for understanding the societal impacts of AI in public safety issues. This calls for a research strategy that is characterised by a willingness to reflect continuously in a critical manner on the opportunities and challenges involved in the approach. In the spirit of democratic experimentation, reflexivity, and participatory criticism, we position ourselves as "critical friends" who do "not seek to bring quick agreement but rather to complicate by probing for deeper meaning and evidence and seeking possible alternative explanations" (Coghlan and Brydon Miller 2014). The illustrations we use in this paper are one channel of storytelling and engaging while another is the development of a toolbox of questions for anyone interested in the study of surveillance AI-cologies.

A Field Guide: Getting the Research Process Started

In the following sections, we describe our toolbox of methods that can be used to study a surveillance AI-cology and, in a next step, illustrate our own learnings as an example. These methods are meant as broad guidelines and inspiration, needing modification, adaptation, and careful selection for each specific study object and context. We suggest a multi-source, multi-level approach to grasp the complexity, specificity,

and situatedness of a surveillance AI-cology. In developing our methodological setup, we are inspired by anthropological approaches, aiming at understanding "[h]ow is the world in "it" and how is "it" in the world" (Dumit 2014: 351).

Studying an AI-cology can be overwhelming in all its complexities. Our intention is not to claim that the whole set of questions and perspectives needs to be used but to suggest that, when setting up research on sub-aspects of an AI-cology, reflecting on complexity, specificity, and situatedness allows nuance. We follow Haraway's (2018: 68) empirical approach to focus on specifics in studying complex settings by starting with one "interesting being in technoscience," such as a particular AI-based device, and teasing it "open to show the sticky economic, technical, political, organic, historical,… threads that make up its tissues." Thus, we put an AI-based device at centre stage and aim at unpacking the connections and meanings it embodies and produces with our quintuple helix and ELSA perspectives. It would not be controversial to say that such connections form an ecology, but AI-cologies are a relevant divergence from ecologies because of the specificities of AI-based devices and systems, such as emergence, opacity, or delegation, issues mentioned already and elaborated further in later sections.

In a first step of our process, we suggest exploring the device as "interested visitor," to visit the device in its actual existing environment (Shelton, Zook, and Wiig 2015). In a second step, we recommend a "brain-drop" exercise (Dumit 2014), for which we suggest a visualisation that we call a hub-and-spoke diagram (see Figure 2). We limit our mapping in the hub-and-spoke diagram to the question, "what entities relate to or are related to by the AI-based device?" rather than map the nature of the connections between different entities or objects. This is an attempt to collect as many entities as possible that have a relationship with the AI-based device. These entities can be other objects, groups of people, organisations, animals, natural phenomena, etc. They are not restricted by the level of abstraction they occupy (the sun is as relevant as the manufacturer of a specific camera) and are represented in the map as being equal to one another. It becomes apparent through the act of identifying all of the entities that they do different things or have different things done to them by the central object, and they share different forms and amounts of information and activity with the object. The act of including them in a map allows us to consider what their individual roles may be without taking the additional step of already putting a judgement about the nature of their relationship down on paper. The visual mapping helps to raise questions like "is the class 'visiting humans' sufficient to cover all humans visiting a location or do subcategories based on known policy or enforcement priorities need to be included (e.g., people with extra mobility needs, surfers, or loitering youth)?" Thus, this exercise helps us to capture "how 'it' is in the world" (Dumit 2014).

We support the "brain-drop" with the following guiding questions:

AI

- What does the term "AI" mean in the context of this device or system (e.g., computer vision, machine learning, etc.)? If this is not apparent, how can it be discerned?
- Where is the AI in the system (e.g., in the camera, on a server, etc.)? What (value/functionality) is it adding (to the surveillance experience)?
- How did the AI component come to be what it is (e.g., how was it trained, what data does it rely on, what form of "learning" did it undertake)?
- What are the blind spots? What is opaque about the way the AI operates? Were measures taken to make it transparent and explainable?

Context

- Where is the device located? How do you perceive the location?
- Do you feel safe? What contributes to your feeling of safety? What not?
- Can you see information about whether AI is used? If yes, where? For what? If not, is there other information about surveillance devices?

- What other (surveillance) technology do you see?

Operation

- Can you see which data are collected?
- Is operation restricted by time, circumstances, or other bounds?
- How does the device or system work?
- What does it do (e.g., counting, recording, listening)?
- Is it fixed or is it mobile?

Materiality

- Can you say something about the infrastructure (what kind of infrastructure, where is it, who maintains it)?
- Who owns what?
- Where is the device?
- What is it made of?
- How is it connected? Where does it get its energy from? How much energy does it need?

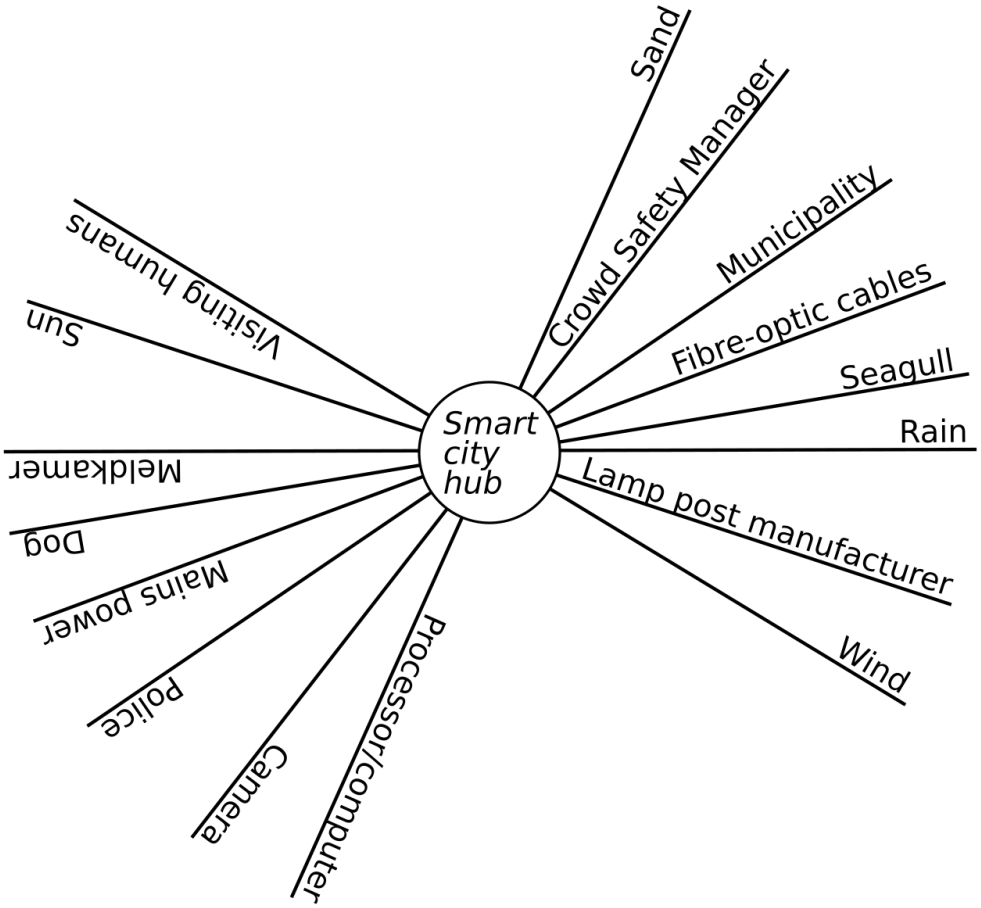

***Figure 2**: Example of an in-progress hub-and-spoke diagram*

Next, we unpack how the world is in "it" (Dumit 2014) and suggest a systematic exploration of the role of the quintuple helix stakeholders and ELSA values. For this, we again use guiding questions and answer them in an iterative process of observation at the location itself, supported by the analysis of public sources, additional empirical research, and academic resources.

The guiding questions are as follows:

Quintuple Helix

- Who are the public, private, academic, social, and natural entities relating to the AI-based device?
- Which data is collected? By whom? For what?
- How is it analysed?
- How is safety defined? By whom? Who is protected from what?
- Who has a say? Who has what interests? Concerns? Who is not considered? How are publics involved, how is participation performed?
- Which structural biases may be built into the system?
- Which configurations in the quintuple helix are more powerful than others (e.g., how are surveillance AI-cologies conditioned and affected by privately owned infrastructures and flows of capital?)
- What justifications or constructions are used for the deployment of AI?

ELSA

- Ethical
  - How exactly is ethics being done (reflections, procedures, which values are taken into account and how)?
  - How is the AI-based device preserving dignity and solidarity and promoting prosperity (and for whom)?
  - How are privacy issues dealt with?
  - How secure is the device and how is security organised in the AI-cology?
  - How are overuse and misuse being prevented?
- Legal
  - What kinds of legislation (e.g., criminal, administrative, police, etc.; or in terms of scale: municipal, national, European, etc.) affect the device and AI-cology?
  - How is legislation affected by it?
  - What accountability mechanisms exist?
  - How are legal responsibilities divided and at which phase (development, implementation, consequences)?
- Social
  - How is the device part of an assemblage of power and how is this related to knowledge?
  - How are different public safety ideologies embodied in the device?
  - What types of subjects are produced?
  - How does income, employment, housing, or education affect the construction of safety and impacts of the device? What about religious beliefs, language, business practices, social organisation, and customer preferences?

The "Living Lab Scheveningen"

We now describe a pilot study we conducted starting from the position of "critical friend." This implied active engagement in the quintuple helix, thus to "be in the world" (Dumit 2014) by becoming members of the public or a colleague talking to other security experts from different sectors. We engaged in conversations with security experts and individuals in the field to identify an appropriate AI-based device in public safety. Jointly with practitioners from the private and public sectors we identified the "Living Lab Scheveningen" as a site where we could explore the use of a collection of AI-assisted tools developed for safety management.

The Living Lab Scheveningen (LLS) is, geographically, a stretch of seaside just over three kilometres long, hugging the coast of the North Sea in Scheveningen, a neighbourhood on the western side of The Hague. While The Hague is perhaps most known outside of the Netherlands as the home of a number of international organisations, including the International Court of Justice, Scheveningen is known for its beach, which is attractive to surfers, swimmers, dog walkers, families, teens, and myriad other parties. The beach at Scheveningen stretches from a commercial port, through the built up "boulevard" area, to the dunes, part of a protected nature area.[2]

While the LLS project originated in 2017, the first installations of smart city technology through the project took place in 2020. At the time of writing, LLS encompasses municipally owned electricity and fibre optic infrastructure, a variety of sensors in public locations, several implementations of software (provided by private sector partners and contractors), and digital displays or dashboards for the use of, variously, visitors and municipal employees. An important component is the Crowd Safety Manager (CSM) collaboration. Here, the municipality of The Hague and the police cooperate with various private partners: a foundation linking municipalities and private companies, a technical university, and a technological research institute. Surrounding these tools are public involvement and awareness activities, as well as a complex web of relations between different governmental parties, NGOs, the private sector, and civil society parties. LLS illustrates the proactive involvement of quintuple helix stakeholders in the design and operation of AI-based surveillance. Already in the planning phase of the LLS, the municipality of The Hague developed use cases together with members from civil society and businesses of various sizes, and invited art school students to create locally implemented projects.

Data Collection

We first approached the site as individuals in a public space, carrying out activities that are typically carried out in such locales. In addition to this self-framing as members of a public, and during a second visit as security experts (this time accompanied by a dog as research partner to represent the stakeholder of "nature" and experience Scheveningen as it is experienced by visitors), we deployed the more standard qualitative social science methods of semi-structured interviewing and site visits with key stakeholders from organisations directly or indirectly involved in the development of LLS. A third visit was carried out by one of the researchers during the summer to experience the site when busy and to spend time observing the way certain smart city devices function in LLS.

We prepared for our first visit to the beach in Scheveningen with some light online reading on the setup of the LLS, took photos on the spot, and noted our questions and observations in a field log. Based on these observations we did a deep dive into available public resources on the LLS and carried out conversations with nine security experts from the private and public sectors to test our observations and questions. Three of these experts were directly involved in the LLS (one via an associated platform), two had related expertise as international security consultants in the field of inclusive AI, one was an expert in AI-based technologies, and two belonged to another Dutch Living Lab. Finally, with two experts directly involved in the LLS, we

[2] The Living Lab encompasses all of these areas and is strategically linked to another initiative known as "Kust Gezond" (Healthy Coast), which emphasises the sustainability of the coast in, among others, environmental, social, and economic senses.

had our second visit to the beach. We talked to the LLS-linked experts again after nine months to follow up on the developments and discuss an earlier draft of this manuscript with them. Next to this, we participated during these nine months at a public engagement event, closely followed media reporting about the site, attended a demonstration of one of the AI-aided tools developed at LLS, this time used in another context, and had a conversation with the expert in charge of that tool.

Impressions

The overall impression we got from our visits, conversations, and online research was that LLS does not have a panoptic surveillance vision (Kitchin 2014) but rather is an assemblage of co-existing players and initiatives (Murakami Wood and Steeves 2021). These different players might have conflicting interests in terms of selling specific products (consultancy, software, hardware) or diverse political or value driven objectives. Even though the municipality takes a coordinating role, this role leaves significant leeway for individual partners. We find on websites of different partners slightly differing presentations of LLS in terms of goals, activities, and additional involved partners. On the boulevard, we notice different types of street lights with varying devices—predominantly cameras—attached to them. The cameras are connected with hanging cables and added fixing systems, and they are owned by varied stakeholders, including the municipality and the police. The boulevard is populated by many shops. In one part they seem to target tourists and younger customers who might desire slot machines, fast food, and bungee jumping opportunities. A second part of the boulevard has a different look and feel with more up-market cafes and light poles that have integrated sensors and other devices, such as cameras, microphones, networking devices, and the capacity to add other modules, such as particulate sensors. The uses envisioned for these various devices include identifying different light situations that might impact animals or plants, detecting fights or breaking glass, or highlighting other potential safety issues such as fire. We do not see information boards publicising the surveillance technology except for one sign attached to a pole, indicating that "biking is surveilled by the police and municipality for your own safety."

Experimentation in the Living Lab

The living lab is closely connected to what Halpern et al. (2013) have called "test-bed urbanism." Although the laboratory discourse and laboratory infrastructure are part of this more general new and experimental technosocial way of governing problems and populations in time and space (cf. Lyon 2001: 23), the Netherlands seems to be a frontrunner in this regard, as many Dutch cities are now hosting these kinds of "urban labs." This is not only related to the domain of public safety but also to the fields of housing, healthcare, liveability, and mobility (van Houdt and Schinkel 2019).

One important implication of this laboratory logic is the emphasis on innovation. As one conversation partner remarks, sometimes technical feasibility is more dominant than other considerations. Two conversation partners explain that framing a problem as "public safety" can be used to justify experimentation, while a more technical problem analysis ("lack of parking places") or a more idealistic vision ("the liveable smart city") would not have generated enough political support for a broader setup of AI-based tools. This observation is also supported by the public assessment report (Smart City Den Haag 2018) that was developed by the Municipality of The Hague in the preparation of LLS. Most use cases created with residents and local entrepreneurs seem to hint at liveability issues such as traffic jams, illegal parking of beach tourists, rubbish overload, or loud parties of young beach visitors, and they were subsequently labelled as "public safety problems." One conversation partner explains to us that safety is a "stronger argument," as when there are safety problems at hand, it seems easier to find within the municipality or police people or units who "own" the problem and are willing to support a living lab and experimentation with new technology, such as AI.

In line with a public safety agenda, one experiment within the LLS focused on detecting potential violence. The tested scenario was a computer vision system running at the edge of a closed fibre optic network using real-time footage from cameras mounted on municipally owned lampposts to determine whether altercations required the attention of the police. The incident would be flagged, alerting a municipal employee through

a digital dashboard. The end result, through the agency of the employee, would be a police call-out to the site of the fight. We illustrate this lab-vision in Figure 3.

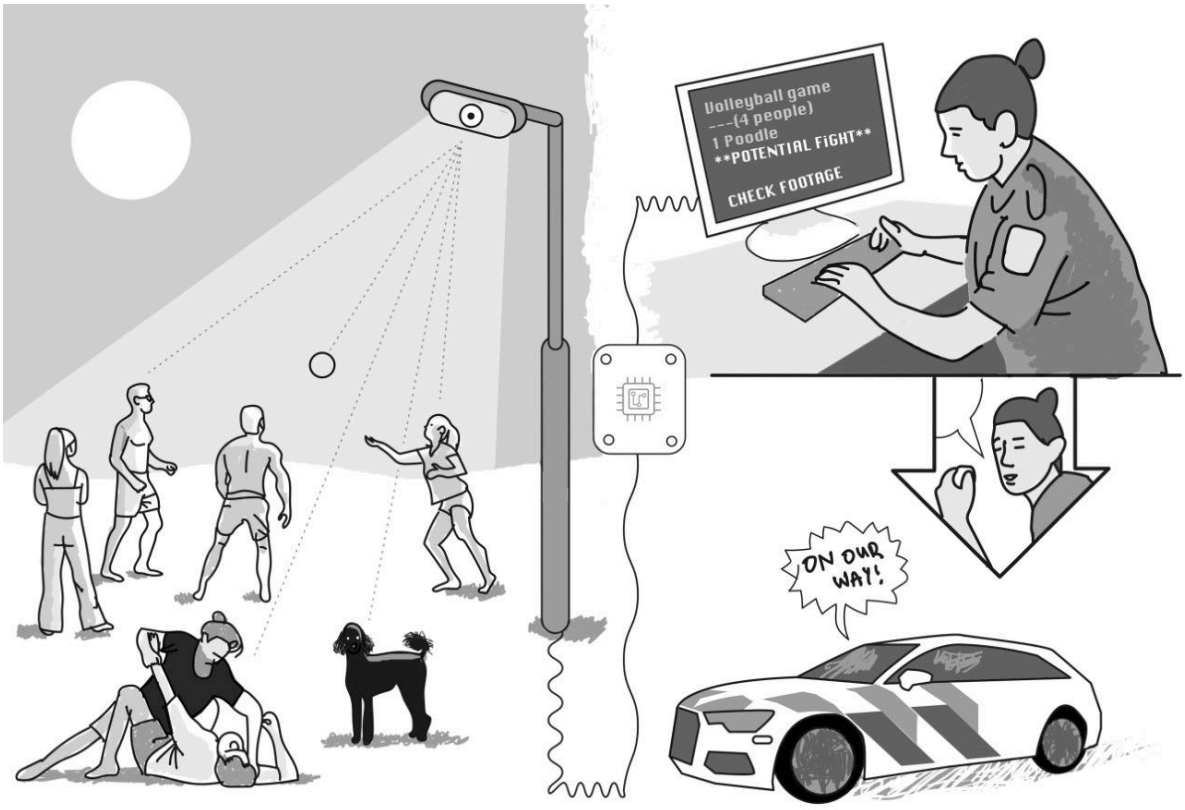

***Figure 3**: AI-supported fight detection (illustration by Robert van Raffe)*

Decisionmakers from LLS concluded that the AI-based device was not well-suited to identifying fights, and the pilot was therefore terminated after the experimentation period. With our illustration we aim to capture the fuzziness of altercations. Is it rough-play? Is it a fight? Why don't the ballplayers pick it up? The dog seems interested, but not fearful; wouldn't he react differently when observing real violence? Or is the dog looking through the third wall to us, as viewers of the whole picture, asking for advice on how to interpret the situation? [3]

Other aspects of this experimentation phase encompassed the AI-supported counting of people and detection of groups. Security authorities concluded based on the experiment that information on the number of people at the beach and on the presence of groups does not help to identify security risks. Although the collaboration has ended, both parties say they have benefitted from the collaboration. The start-up has been allowed to experiment, use, and train its hardware and software in a real-life situation. It helped to clarify the information needs of security agencies, helping them understand the complexities of legal requirements, and

[3] One of our anonymous reviewers referred to the example of the 1560 renaissance painting by Pieter Bruegel, "The Fall of Icarus." It is said to depict the indifference of humans and animals to the suffering of others. The reviewer poses the interesting question of whether the human hope is that AI might function as a safety net overcoming the lack of human solidarity.

generated knowledge on the environmental conditions under which such surveillance systems are implemented. This refers not only to the needs in energy supply but also to the impact of blurred camera vision due to sand and salty air.

From a technical perspective, nature is often framed as a challenge: the impact of salt spray on camera lenses and on metal is raised as an issue (of resistance) that needs to be addressed or accommodated (cf. Pickering 2010). Even though it is planned that some of the poles will measure light for a sustainability project and LLS has won an international smart cities award for sustainability, "nature" is frequently addressed from an operational perspective. The natural world is an implicit stakeholder in energy grid constructions, which are designed to save energy or introduce the use of more sustainable energy sources. Nature is not only the main asset of the location but also a safety risk in that the sea is frequently positioned as something visitors need to be careful of or knowledgeable about. We are informed that even though the beach has witnessed several tragic surfing accidents, the surveillance of surfers would not be covered by legal regulations. We also wonder if there are projects looking at animals, but it seems that more-than-human visitors or inhabitants of the beach space are not yet part of the discussion, though there is an intention for that to change in future.

Ethical, Legal, and Social Aspects

In the following section, we start with the ethical aspects, but we are aware that ELS aspects are difficult to disentangle, as they are interconnected in their meaning and consequences.

Although the field of ethical AI may see a limited emerging consensus (Morley et al. 2019), the transfer of the "what" of this consensus from academia to practice has not yet occurred, is "delayed," or is relatively weak. For example, as an interview partner explains, the inclusion of ethical considerations on the operational level boils down to discussions with and a check by a privacy officer who is employed by the municipality and performs a data privacy impact assessment of the experiments. Thus, ethical intuitions and deliberation are incorporated into the design of the experiments by the operators themselves, even though they express that this approach does not live up to their own expectations of ethics.

Our conversation partners, experts who are knowledgeable and ethically engaged practitioners working at the intersection of technology and policy, take positions that weigh the benefit to individuals and society against their perception of the ethics of individual instances of surveillance. For example, one application for detecting and managing crowds uses data provided by a private company rather than data collected in-situ by the municipality's own technical infrastructure (i.e., cameras and other sensors). Our conversation partner has ethical concerns in this regard. This company owns and sells data from a portfolio of applications installed on mobile phones. People consent to data being collected and shared with other companies and authorities after installation of the app on their phones. This case was also discussed and problematised in the Dutch network of field labs. LLS, however, is still using what they consider to be a (legally sound but ethically problematic) "backdoor to consent," and this illustrates the risk of the privatisation of public surveillance outside traditional protective safeguards (Crawford 2021: 200). The goal of finding a more ethical solution is one of the reasons the lab continues to pursue a source of crowd information that is produced by the municipality's own infrastructure and is under their control.

To illustrate intertwined ethical and legal aspects (Philipsen, Stamhuis, and de Jong 2021) we zoom in on ownership, training datasets, fibre, and the relationship between public and private stakeholders in the LLS. It seems that the legal situation is not fully clear in the case of the use of public, municipally owned data for the training of privately owned crowd control systems. Here, the technical (innovation discourse) is foregrounded. It also points, in the eyes of our conversation partners, to the need for change in the legal infrastructure, as the current legal framework seems to allow excess leeway.

The complex configuration of infrastructures, including (development and maintenance of) hardware and software, relationships, values, and decisions in surveillance AI-cologies is demonstrated by the issue of ownership of fibre optic cables, cameras, software, and data (including processing and results) in the context of public-private collaboration. The municipality is engaging with the private sector (particularly start-ups)

for some purposes (e.g., development of algorithms for analysing data streams), while ensuring public ownership and maintenance of other aspects of the living lab (particularly ownership of the fibre optic cables running under the boulevard).

Our conversation partners stress the importance of the municipal ownership of the infrastructure: owning the fibre allows the network to be completely managed by municipal stakeholders, who are its primary users. It is perceived as safer for the municipality to control the infrastructure in terms of issues like legal compliance, but it is also more useful to the municipal stakeholders in the sense that it becomes possible for the municipality to control when hardware is upgraded or when network downtime takes place. At the same time, while both political and instrumental justifications were used to experiment with publicly owned fibre infrastructure, our conversation partners question whether this would be possible outside the relatively closed LLS environment thanks to the enormous financial and political commitment it would require.

We see the development of training data for computer vision systems piloted on the boulevard as an appropriation by the private sector of publicly produced data, while our conversation partners view it as a collaboration: they get a system tailored to their needs and profit from the innovation potential of the private sector while helping their supplier improve its product. This has been the case in multiple pilots, both those that were not subsequently continued and those that were considered successful.

When it comes to the social aspects, our conversation partners stress the complex inclusivity challenge around AI and public discussion events that they refer to as "ethical tables." They indicate that individuals who are suffering stigmatisation or racism might not easily indicate this at such round tables or not come in the first place. Conversation partners stress that they perceive the involvement of the public as demanding. There have been several formats tested alongside round tables, such as festivals focussing on young people or families. Yet, it seems that such involvement of the public stays shallow and true conversations with diverse groups do not really happen. One reflection on this by our conversation partners is that it should be the responsibility of those developing and implementing AI surveillance to make the AI bias-free and not the responsibility of residents and other members of the public to point out the ethical failings of AI. An argument raised in this context is that the known weaknesses of AI systems need to be solved by developers and implementors: governmental and private AI developers should not claim that they are building systems for safety for all when it is known that AI systems still display racial and/or gender biases (Schelenz 2022). Another conversation partner describes to us how the voice of residents complaining about noise on the boulevard or subjective feelings of lack of safety get prime attention via their access to decisionmakers or presence at community events. Questions of direct and open lines of communication and how to balance different stakeholders arise. This points to the issue of how social inclusivity can be fully realised, and the problem of mechanisms of (differential) valuation.

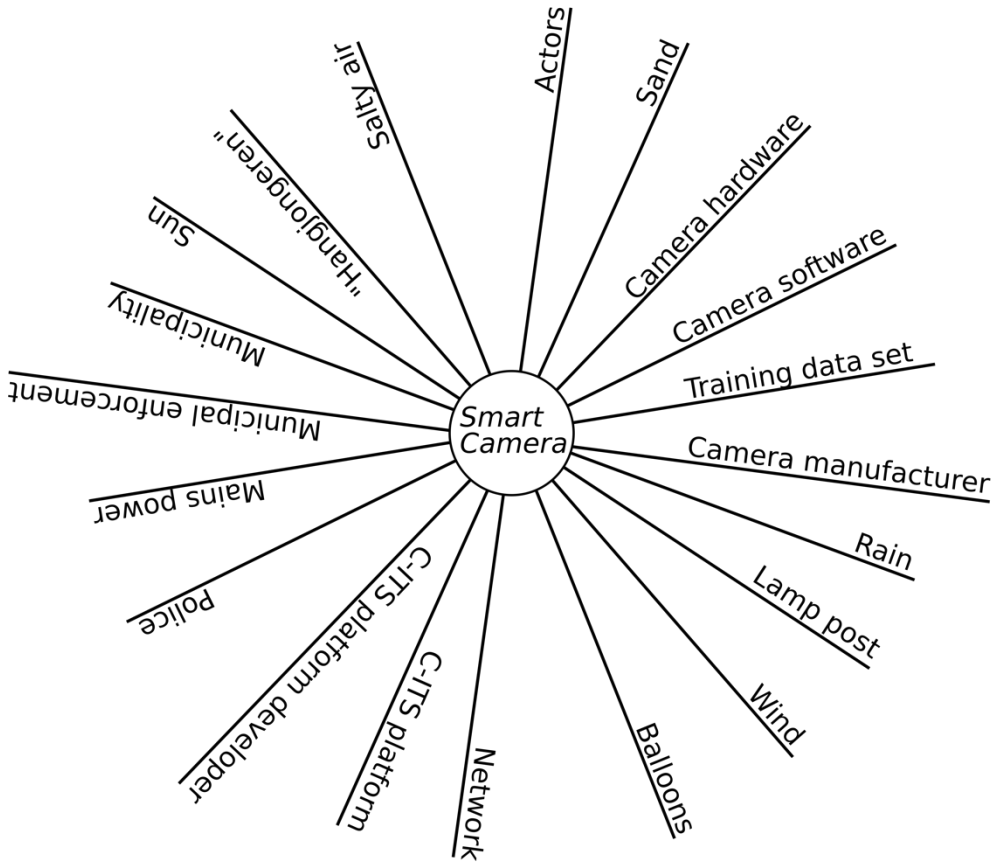

***Figure 4**: A hub-and-spoke diagram representing an AI-enabled smart camera*

Another pilot, focusing on nitrous oxide detection, illustrates how ELSA and quintuple helix aspects are intertwined (see Figure 4 for an example of our method of investigation). This pilot shows how selective problematisation by a group of residents, a relevant legal framework, combined with the availability of technological infrastructure and expertise, configures a surveillance AI-cology. Local residents had concerns about the public nuisance represented by groups of loitering young people ("hangjongeren") using nitrous oxide on the Scheveningen boulevard. Since the beginning of 2023, the use of nitrous oxide as a recreational drug has been illegal in the Netherlands, and the enforcement of this law is picking up speed. The pilot, in collaboration with two startups, was conducted on the boulevard to see if it is possible to detect nitrous oxide use via cameras in a privacy-sensitive way. Our conversation partners explain to us that this is an experiment that some consider as "disproportionate" and "biased" towards certain groups of visitors (though the position of our conversation partners is that it is about nuisance, not exclusion). Furthermore, they argue that simply having the infrastructure and experience to work on AI solutions for public safety issues creates the risk of a tendency to frame and tackle social issues quickly with cameras and AI (in this case, computer vision) while forgetting about other (social) possibilities. The pilot was seen as successful in that it achieved the technical goals set out for it, and it did so while respecting values such as doing all data processing at the "edge" of a network rather than with centralised data processing. The camera has been removed, while a discussion is ongoing about the further implementation of the tested technology. This pilot shares many similarities with previous public-private collaborations, also indicating that innovation activities are informed by perceptions of success or impact on the part of the stakeholders responsible for facilitating collaborations.

The Study of Surveillance AI-cologies as on Ongoing Multi-stakeholder Conversation

In line with our starting point that the study of AI should be not only about its technical aspects but also about social practices like training, the construction of values, and daily life, we advocate for the idea of embracing the complexity, specificity, and situatedness of the social reality of public safety and the implications for AI surveillance. We use the metaphor of an "AI-cology" to map all three dimensions: the complexity of the problem balanced with its specificity and situatedness. These three aspects help take into account the interconnectedness of all parties in the field of public safety. Stakeholders are positioned within an ecosystem and the actions of any one player impact the actions of others, meaning that sustainable development of technical solutions to public safety challenges is only possible through co-creation within the quintuple helix alongside ELS principles.

The joint configuration of ELSA and the quintuple helix to study surveillance AI-cologies transcends disciplinary boundaries and is full of pitfalls (e.g., power struggles or value conflicts) that, however, are part of the co-productive methodological setup, as conflict should in this context be understood as productive. The study of surveillance AI-cologies needs contextualisation, as we have seen through the example of LLS. The analysis of a complex question such as how to improve city life and public safety requires situated analysis. Many issues can be folded into the problem at hand (public safety is often connected to liveability), and careful analysis is needed to disentangle how the problem is constructed by many interested parties often in different and sometimes conflicting ways. Therefore, crucial for the study of surveillance AI-cologies is the study of the object of problematisation with the objective of re-problematisation (cf. Lemke 2011; Koopman 2013; Van Houdt 2014), namely to study how, when, where, why, and by whom a specific surveillance AI-cology is introduced and with what consequences and where there are openings and necessities for reconfiguration. Thus, when analysing AI-cologies, it is essential to identify the stakeholder group (safety for whom?) and to identify the choices made (who or what is included or excluded and why?).

Within our study of the LLS, we have followed some threads, left some untouched, and scrutinised others more closely. We feel that this is how a study of AI-cology should look. Being "in the world" and "understanding the world in it" also implies that perspectives and aspects can be dropped or added (Dumit 2014: 12). Creating hub-and-spoke diagrams, in conjunction with asking questions suggested by a quintuple helix and ELSA perspective, invites a nuanced understanding of the surveillance AI-cology. Drawing our hub-and-spoke diagrams and challenging ourselves to "brain-dumps" with the help of our questions allowed us to develop curiosity, to move beyond our own disciplinarily blinded views and to identify our "gap and ignorance map" (Dumit 2014: 12).

When diving into the concrete example of the Living Lab Scheveningen and teasing some of its threads open (Haraway 2018), we became aware of how the availability and promise of surveillance AI impacts thinking about policing operations and public safety. It also points both at the dominant economic logic of scarcity and efficiency (of finances, resources and time—or instrumentality) and the cultural logic of controllability (Rosa 2020). Economic and cultural arguments and considerations are always important for the actual configuration and working of an ecology, but whether the use of surveillance AI in public safety and policing should be configured this way and whether it actually delivers these results is questionable, to say the least, and should be studied and problematised. It is crucial to problematise the technological impetus not only to avoid unnecessary investments in the rush to implement AI but also to avoid other (unintended) societal effects. Furthermore, the observation also points to something else: a fundamental transformation of the police and law enforcement. The introduction of surveillance AI effectuates "a shift from law enforcement to intelligence activities" (Crawford 2021: 197), and the repercussions of this should be part of active reflection among diverse stakeholders.

Surveillance AI-cologies tap into different affects or imaginaries such as fear ("surveillance AI-cologies of fear," to adapt Davis 1999), danger, punitivity, pleasure, joy, and purity—or combine different visions at once. This brings the need to be explicit about the intentions of the surveillance, the safety problem that

should be solved, and the stakeholders that are (not) considered. The general intention to turn the boulevard into a venue that is more attractive to "upscale tourism" might influence the definition of suspicious patterns and pre-emptive intervention. The wish to create safe and attractive places for "tourists" implies a decision to welcome a specific group, namely those whose profile indicates spending power and positively connects to the imaginary of consumption. It also seems to imply the exclusion of "vagabonds," namely unwelcoming those individuals whose profile (e.g., coming from a particular neighbourhood) indicates a lack of spending power (cf. Bauman 1997). Certain AI-based devices, such as those identifying group size, can show bias on axes of culture, class, or age, and the focus on specific safety problems may be influenced by a choice to divert resources into the enforcement of laws that, whether intentionally or not, have the effect of keeping specific groups out of the boulevard. We see this in the laughing gas detection case, in which an activity practiced predominantly by youth is legally stigmatised, with technological enforcement using AI.

Learning from failures in surveillance AI-cologies through in-depth studies, understanding the impact on civil society, and determining how these failures could have been prevented is an important field of study. This also follows the call of civil society organisations like Amnesty International (2020) to do everything possible to prevent abuses of AI-based tools. An ELSA and quintuple helix approach encourages the participation of civil society organisations in the development of surveillance AI-cologies. Further research on public-private-partnership dynamics behind innovation processes is also crucial (Philipsen, Stamhuis, and de Jong 2021). Possible avenues include studying how surveillance AI-cologies are configured by big tech companies and the tracing of controversies and legal pushbacks such as the German court ruling that the police use of automated and AI-based analysis of surveillance data for prevention purposes is unconstitutional (More 2023). The plaintiffs had argued that the technology developed by a US-based data analytics firm "could be used for predictive policing, raising the risk of mistakes and discrimination by law enforcement" (Kileen 2023) Another example could be the tracing of proposal and funding processes and analysing the (lack of) input from the different stakeholders. In the context of the LLS, municipalities and startups from some of the pilots met at hackathons organised around specific challenges. We also observed that prototypes developed within the LLS were further adapted for other municipalities, which is a feature of the AI-cology that can be closely followed, for example, using the observational tools of anthropology or the methods of mapping and tracing devised within science and technology studies.

One of the main difficulties we encountered in our surveillance AI-cology is the involvement of stakeholders from civil society. We also understood from our conversations that engagement with the public is a notoriously difficult problem. This is reflected in the academic literature exploring new forms of true social inclusivity (Harrison et al. 2021). Interesting avenues include the question of what groups should be involved in what topic and at what moment in the AI development cycle. Another important aspect is the weighing of voices and being more innovative in the means of "hearing" such voices (e.g., involving art; Butot et al. 2023) or being more flexible in gathering data through field research and thus literally being "in the world." It could also be argued that as a requirement for every investment in technological infrastructure to make AI surveillance possible, the same investment must be made in democratic infrastructure.

Another blind spot was the overlooked role of nature—something that extended to our own work. In our hub-and-spoke diagrams, nature was present, as when being at the beach we became very much aware of animals, sand, water, wind, and rain. In our online research on the LLS, we found several reports on seagulls chasing tourists for food (NH Nieuws 2018), which triggered counteractions by food shop owners. We came across interesting academic work on the interaction of seagulls and humans at the beach (Goumas, Boogert, and Kelley 2020). The relevance of the consideration of animal co-visitors or residents also became more vivid to us through the intense beach joy the dog of one of our co-authors expressed during a site visit. Work on responsible research innovation for and with nature can inform the development of a meaningful inclusion of the voice and knowledge of nature (Gremmen, Blok, and Bovenkerk 2019). Recent calls for "Just Sustainability Design" wishing to overcome the fragmentation of perspectives and agencies of human and more-than-human life are encouraging developments to engage in more "critical friendships" in the development of AI (Becker 2023). AI has fascinating potential in this regard as was shown in the cases of remote-sensoring in rangeland management and seagrass monitoring (Yang et al. 2022). Balancing the

needs of diverse stakeholder groups in such forms of nature monitoring is certainly one relevant research avenue for the future (Devitt, Baxter, and Hamilton 2019; Eastwood et al. 2019).

We see the study of surveillance AI-cologies as an ongoing conversation as the AI-cology constantly changes, which impacts the actors in it, including us as researchers. One of the most important learnings for us was that the position of the "critical friend" sometimes also means a long-term engagement. We realised how the conversations we had with partners in the field were continued, nuanced, revised, and followed-up on over time. The conversations not only impacted us and our perspective on the use of AI but our questions and reflections also impacted our conversation partners, and we realised that conversations and reflections were continued without us. We see our approach as an invitation to not only surveillance scholars but also security experts and members of local communities confronted with surveillance AI to be part of the conversation, to actively engage, and to (re)design the surveillance AI-cology. We hope we have provided some tools (research questions, values, etc.) to do this, and we wish to be part of a continuing conversation about smart and innovative surveillance technologies, including their critique. We will continue working, studying, and (re)designing surveillance AI-cologies, and invite others to compose with us, to add or delete tools, and to (help) take democratic control whereby "No Surveillance AI-cologies" can always be an answer or a call for mobilisation.

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