



**Walking as Method:  
Infrastructural Inversion in  
Datafied Cities**

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**Privacy Studies Journal**  
ISSN: 2794-3941

Vol. 5 (2026)

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**Abstract**

*This article investigates whether citizen perspectives can improve how risks are assessed in datified cities, and how a workshop methodology can support such participation. Starting from the rights to privacy and data protection embodied in the GDPR, and other fundamental rights, such as the freedom of assembly and freedom of speech, we examine risks to those rights to ensure that data processing is necessary, proportionate, and accountable. Fundamental rights are very valuable, yet in practice, they often remain theoretical without impacting how people actually experience data infrastructures in their daily environments. Recognizing data as infrastructure, the paper explores how contemporary cities rely on systems that collect, circulate, and operationalize data, shaping everyday life often in opaque ways. Drawing on Susan Leigh Star's concept of infrastructural inversion, we argue that these infrastructures encode particular priorities, exclusions, and power relations that are rarely surfaced through conventional assessment tools. Our study employs workshops—guided walks during which participants encounter data-collecting technologies in situ. Acting both as a research tool and as a form of infrastructural inversion, workshops make hidden systems visible and open to discussion. Insights from thirteen workshops in Brussels, Ghent, and Leuven reveal concerns about transparency, proportionality, exclusion, and mistrust—issues that standard DPIAs rarely capture. The findings demonstrate that workshops can help ground risk assessment in the lived realities of urban data governance.*

**Keywords**

*Data infrastructure – infrastructural inversion – GDPR*

## Introduction

The ‘smart city’ has become a prominent vision embraced by urban authorities worldwide. It represents an overlap of physical and digital realms, where information and communication technologies (ICT) are leveraged for data collection and processing. Smart city initiatives promise enhanced quality of life through optimized urban governance, sustainable development, and innovative solutions to societal challenges. However, the implementation of these data-driven systems also raises pressing concerns about surveillance, privacy, and citizen autonomy.<sup>1</sup> Despite increasing discourse on the power dynamics and risks embedded in smart city ecosystems, there is a notable gap in understanding the lived experiences and perceptions of urban dwellers.<sup>2</sup> Traditional assessments for smart city technologies often seem to prioritize technical evaluations over human-centred insights. This approach risks overlooking critical dimensions of urban life, such as the emotional, behavioural, or societal impacts of data collection. Citizens, who are directly affected by these technologies, often lack a clear voice in decisions, even though their participation could be essential for identifying the unpredictable consequences of emerging data practices.<sup>3</sup>

This paper addresses this gap by exploring two interrelated questions. First, we ask whether citizen perspectives can contribute to more comprehensive and effective risk assessments. Second, we investigate how a workshop methodology—a hybrid of city walks and workshops—can operationalize these insights. By combining embodied experience with participatory dialogue, the method fosters a deeper engagement with not only the technical but also the socio-political and ethical implications of smart city infrastructures.<sup>4</sup> In doing so, we conceptualize data as infrastructure: invisible, relational, and politically consequential.

Working with data from 13 workshops in three Belgian cities, and analysing findings through the lens of infrastructural inversion,<sup>5</sup> we propose the workshop as both a participatory tool and a method of critique — one that enables citizens and researchers to “see” and contest the infrastructures that govern the datafied city.

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1 Rob Kitchin, “Urban Data Power: Capitalism, Governance, Ethics, and Justice,” in *Data Power in Action*, 1st edn, ed. Ola Söderström and Ayona Datta, *Urban Data Politics in Times of Crisis* (Bristol University Press, 2024), JSTOR, <https://doi.org/10.2307/jj.9827045.7>; Ryan Burns and Max Andrucki, “Smart Cities: Who Cares?,” *Environment and Planning A: Economy and Space* 53, no. 1 (2020): 12–30, <https://doi.org/10.1177/0308518X20941516>.

2 Emiel A. Rijshouwer et al., “Public Views of the Smart City: Towards the Construction of a Social Problem,” *Big Data & Society* 9, no. 1 (2022): 205395172110721, <https://doi.org/10.1177/20539517211072190>.

3 Jonas Breuer and Jo Pierson, “The Right to the City and Data Protection for Developing Citizen-Centric Digital Cities,” *Information, Communication & Society* 24, no. 6 (2021): 797–812, <https://doi.org/10.1080/01369118X.2021.1909095>; Rijshouwer et al., “Public Views of the Smart City”; Autoriteit Persoonsgegevens, *Smart Cities. Onderzoeksrapport Bescherming van Persoonsgegevens in de Ontwikkeling van Nederlandse Smart Cities* (Autoriteit Persoonsgegevens, 2021), [https://autoriteitpersoonsgegevens.nl/sites/default/files/atoms/files/onderzoeksrapport\\_smart\\_cities\\_def.pdf](https://autoriteitpersoonsgegevens.nl/sites/default/files/atoms/files/onderzoeksrapport_smart_cities_def.pdf).

4 Ine Van Zeeland et al., “Workshops for Citizen Involvement: Walk the Talk with Smart City Citizens,” 2021 IEEE International Smart Cities Conference (ISC2), 7 September 2021, 1–4, <https://doi.org/10.1109/ISC253183.2021.9562922>.

5 Susan Leigh Star, “The Ethnography of Infrastructure,” *American Behavioral Scientist* 43, no. 3 (1999): 377–91, <https://doi.org/10.1177/00027649921955326>.

## Revealing urban data infrastructures

### *Datafied cities*

Smart city initiatives have emerged as a dominant response to the challenges of urbanization, positioning data, including personal data, as the key to achieving efficient governance, sustainability, and improved quality of life. Security cameras, Bluetooth trackers, public Wi-Fi, ANPR systems, mobile network data, and much more capture and analyse urban space. In this datafied urban landscape, every interaction, from mobility to waste management, generates data and transforms everyday life into a stream of information used for predictive modelling and optimization.<sup>6</sup>

The pervasiveness of data production and processing leads to the notion of the ‘datafied city’, a city shaped through infrastructures that collect, circulate, and operationalize data. Data do not simply document urban life; they actively configure it by embedding assumptions and priorities into everyday routines.<sup>7</sup> As Latour notes, technologies are society made durable: they stabilize social arrangements by embedding power relations, norms, and institutional priorities into material forms.<sup>8</sup> This tends to neutralize this process as neutral optimization, masking how infrastructures enact pre-existing logics of commodification and control. Data infrastructures have power precisely because they withdraw from view; once embedded choices about efficiency, surveillance, and control are naturalized, they become difficult to contest.<sup>9</sup> This infrastructural power is reinforced by hybrid governance models that blur public–private boundaries.<sup>10</sup> Such arrangements fragment accountability and obscure who is responsible for data governance decisions, further entrenching infrastructural opacity. Ensuring democratic oversight would require establishing a form of “cooperative responsibility” that clarifies how different actors share obligations in governing the data infrastructures that organize public space.<sup>11</sup>

Urban data infrastructures also reinforce structural asymmetries. Their technical designs often reflect the priorities of institutions and markets rather than residents, embedding

6 Alison B. Powell, *Undoing Optimization: Civic Action in Smart Cities* (Yale University Press, 2021); UN Habitat, “Transforming Global Urban Data. 2023-2029,” UN Habitat, 2023, <https://unhabitat.org/transforming-global-urban-data-2023-2029>; Kitchin, “Urban Data Power: Capitalism, Governance, Ethics, and Justice.”

7 Davide Beraldo and Stefania Milan, “From Data Politics to the Contentious Politics of Data,” *Big Data & Society* 6, no. 2 (2019): 205395171988596, <https://doi.org/10.1177/2053951719885967>; Ine Van Zeeland and Jonas Breuer, “Cameras Are No ‘Easy Solution’: Practical Privacy Decision-Making in Smart Cities,” *Transforming Government: People, Process and Policy* (2026): 1-17, <https://doi.org/10.1108/TG-11-2025-0366>.

8 Bruno Latour, “Technology Is Society Made Durable,” *The Sociological Review* 38, no. 1\_suppl (1990): 103–31, <https://doi.org/10.1111/j.1467-954x.1990.tb03350.x>.

9 Powell, *Undoing Optimization*; Star, “The Ethnography of Infrastructure.”

10 L. Vandercruysse et al., “Data Protection in Smart Cities,” *European Procurement & Public Private Partnership Law Review* 17 (January 2022): 81–93, <https://doi.org/10.21552/epppl/2022/2/5>.

11 Breuer and Pierson, “The Right to the City,” 797; Natali Helberger et al., “Governing Online Platforms: From Contested to Cooperative Responsibility,” *The Information Society* 34, no. 1 (2018): 1–14, <https://doi.org/10.1080/01972243.2017.1391913>.

dominant interests into the architecture of urban systems.<sup>12</sup> The exchange value of data, its utility to institutions for optimization, profiling, or monetization, frequently outweighs its use value for citizens, such as improved services or enhanced agency. Harvey and Peck & Tickell situate this imbalance within broader capitalist urban logics in which accumulation displaces lived utility, while Mattern shows how data systems similarly privilege administrative and commercial imperatives over everyday civic relevance.<sup>13</sup> This commodification becomes visible when data collected under the banner of safety or efficiency is later repurposed for marketing or city branding, often without meaningful public oversight.

Recognizing data as infrastructure helps clarify its relational, opaque, and power-laden character. It is not simply content flowing through neutral systems, but a force that shapes decision-making, narratives, and social interactions. This perspective grounds the methodological focus of this paper: to make these hidden infrastructures visible and open to critique.

### *Rethinking risk in the datafied city*

Smart city infrastructures challenge conventional approaches to data protection because they redistribute how risk is defined, perceived, and governed. The GDPR's basic tenets (purpose limitation, necessity, proportionality, transparency, and public interest) offer a normative grammar for evaluating data practices.<sup>14</sup> In theory, they require data to be collected for clear aims, in minimal and proportionate ways, with understandable explanations, and only when serving a legitimate task of public value. In practice, these principles encounter the material and organizational realities of the datafied city, where infrastructures operate opaquely, evolve over time, and reflect institutional and commercial priorities more than citizen needs. Budget-driven technology choices, fragmented accountability structures, limited data protection expertise among public servants, and the uneven influence of political and commercial actors all shape how data infrastructures are designed and governed in ways that formal compliance frameworks rarely capture.

This tension is very visible in so-called **Data Protection Impact Assessments (DPIAs)**. DPIAs are designed to translate the GDPR's principles into structured evaluations of potential harm when processing may pose high risks to rights and freedoms.<sup>15</sup> They are meant to ensure that intrusive technologies are justified, that alternatives are consider-

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12 Kitchin, "Urban Data Power: Capitalism, Governance, Ethics, and Justice"; Langdon Winner, "Do Artifacts Have Politics?" *Daedalus* 109, no. 1, (1980): 121–36.

13 David Harvey, "The Right to the City" *New Left Review*, no. 53 (2008): 23–40; Jamie Peck and Adam Tickell, "Neoliberalizing Space," *Antipode* 34, no. 3 (2002): 380–404, <https://doi.org/10.1111/1467-8330.00247>; Shannon Christine Mattern, *Code + Clay... Data + Dirt: Five Thousand Years of Urban Media* (University of Minnesota Press, 2017).

14 EU, "Regulation (EU) 2016/679 of the European Parliament and of the Council on the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data," 2016.

15 Niels van Dijk et al., "A Risk to a Right? Beyond Data Protection Risk Assessments," *Computer Law & Security Review* 32, no. 2 (2016): 286–306, <https://doi.org/10.1016/j.clsr.2015.12.017>.

red, and that data is not collected or repurposed without necessity or proportionality. Crucially, **Article 35(9)** of the GDPR calls for the inclusion of data subjects' views, an explicit recognition that public value and perceived risk cannot be meaningfully assessed without those affected. While the intention behind this provision is applaudable, the use of DPIAs in reality narrows risk to organizational concerns such as security, liability, and technical robustness. Complex social, political, and emotional dimensions of risk (e.g. confusion, exclusion, perceptions of surveillance, and erosion of trust) are difficult to quantify and easily excluded. Citizens navigate data infrastructures through anticipatory reasoning—imagining potential harms and developing situated judgements about proportionality and legitimacy even in the absence of concrete harm.<sup>16</sup> Such responses reflect lived vulnerabilities that formal assessments cannot capture: unease at being monitored without understanding why, resignation from repeated encounters with opaque systems, or distrust generated by infrastructures that claim transparency but remain practically illegible.<sup>17</sup>

As a result, infrastructures that shape everyday life are assessed through metrics that leave little room for contextual or experiential forms and perceptions of harm. The principle of **public interest** then becomes especially fragile: invoked as a justification for data collection, yet rarely grounded in citizens' understandings of what constitutes meaningful public value. This disconnect underscores a broader limitation of the GDPR's risk-based approach. When risk is operationalized primarily by the institutions deploying the technology, assessments reflect the vantage point of those already empowered to shape the infrastructure. Citizen perspectives—contextual, affective, and situated - remain peripheral, even though they reveal forms of vulnerability and dependency that traditional DPIAs cannot capture.

There is a need for methods capable of bridging the gap between compliance-oriented assessments and citizens' lived realities in datafied cities. Incorporating citizen experience is not merely a procedural enhancement; it should be an epistemic necessity for assessing public value, proportionality, and legitimacy.<sup>18</sup> This underlines our study's first research question, whether citizen perspectives can contribute to more comprehensive and effective risk assessments. It prepares the ground for examining how **walkshops** can operationalize these insights by making data infrastructures visible, discussable, and contestable in situ.

16 Becky Kazansky, "It Depends on Your Threat Model": The Anticipatory Dimensions of Resistance to Data-Driven Surveillance," *Big Data & Society* 8, no. 1 (2021), <https://doi.org/10.1177/2053951720985557>.

17 Shazade Jameson et al., "People's Strategies for Perceived Surveillance in Amsterdam Smart City," *Urban Geography* 40, no. 10 (2019): 1467–84, <https://doi.org/10.1080/02723638.2019.1614369>.

18 Kazansky, "It Depends on Your Threat Model": The Anticipatory Dimensions of Resistance to Data-Driven Surveillance"; Claudia Quelle, "Enhancing Compliance under the General Data Protection Regulation: The Risky Upshot of the Accountability- and Risk-Based Approach," *European Journal of Risk Regulation* 9, no. 3 (2018): 502–26, <https://doi.org/10.1017/err.2018.47>; Ine Van Zeeland et al., "Walkshops for Citizen Involvement: Walk the Talk with Smart City Citizens," 2021 IEEE International Smart Cities Conference (ISC2), 7 September 2021, 1–4, <https://doi.org/10.1109/ISC253183.2021.9562922>.

*Data as infrastructure*

In media and communication studies, scholars have highlighted how data functions not merely as a by-product of digital systems but as an infrastructure in its own right, one that organizes cultural, political, and urban life.<sup>19</sup> This perspective emphasizes how infrastructures extend beyond physical “pipes” to include platforms, standards, temporalities of storage and flow, and the systems that condition how interaction, movement, and governance unfold in the city. These analyses foreground the shift from content-centred to systems-centred critique, revealing how data infrastructures embed political and economic arrangements that shape what becomes visible, actionable, and contestable in urban environments.<sup>20</sup>

This builds on Susan Leigh Star’s foundational concept of infrastructure as a relational, ecological, and often invisible assemblage. Infrastructures become visible when they break down, are accessed from the margins, or deliberately made objects of scrutiny, moments when, as Latour notes, black-boxed artefacts reveal the inscriptions and relations that ordinarily remain hidden. Data infrastructures such as sensor networks, meta-data exchanges, or algorithmic routines are embedded, standardized, and “sunk” into everyday life. Their apparent neutrality is based on this invisibility. Understanding them, Star argues, requires methods that can “invert” this invisibility and foreground their social, technical, and ethical entanglements.<sup>21</sup> The notion of *infrastructural inversion* thus becomes a crucial methodological stance, as it entails a deliberate analytic move to foreground what is normally backgrounded: the norms, exclusions, materialities, and power relations that data infrastructures carry with them.<sup>22</sup> In smart city settings, this means examining the presence of cameras or trackers and assumptions, purposes, and values encoded in their deployment. Who can opt out, who benefits, and who is disadvantaged. These systems are never neutral technical solutions; they embody political and ethical commitments.

Walkshops—a neologism combining ‘walk’ with ‘workshop’—are a form of ethnographic fieldwork in which the urban environment provides probes that prompt discussion of the socio-political dimensions of technological infrastructure. As facilitated walks through datafied urban space, they combine embodied encounter with participatory discussion, creating situated occasions for participants to question neutrality claims, interrogate proportionality and public value, and reflect on their own position within opaque data systems. Building on prior work with data walks and Systems/Layers walkshops, the approach reorients these walking-based methods toward a more systematic and reflexive

19 Andreas Hepp et al., “New Perspectives in Critical Data Studies: The Ambivalences of Data Power—An Introduction,” in *New Perspectives in Critical Data Studies*, ed. Andreas Hepp et al., *Transforming Communications – Studies in Cross-Media Research* (Springer International Publishing, 2022), [https://doi.org/10.1007/978-3-030-96180-0\\_1](https://doi.org/10.1007/978-3-030-96180-0_1).

20 Jean-Christophe Plantin et al., “Infrastructure Studies Meet Platform Studies in the Age of Google and Facebook,” *New Media & Society* 20, no. 1 (2018): 293–310, <https://doi.org/10.1177/1461444816661553>.

21 Star, “The Ethnography of Infrastructure”; Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Harvard University Press, 1987).

22 Jo Pierson, “Digital Platforms as Entangled Infrastructures: Addressing Public Values and Trust in Messaging Apps,” *European Journal of Communication* 36, no. 4 (2021): 349–61, <https://doi.org/10.1177/02673231211028374>.

tool for smart city and data protection research.<sup>23</sup> This connects to data protection as an operationalization of privacy in datafied environments, and to the GDPR's risk-based approach in particular. DPIAs are designed to anticipate and mitigate risks of personal data processing, yet participatory elements are often limited in practice. Walkshops are designed to complement these procedural assessments by eliciting forms of situated knowledge that technical and compliance-oriented framings can miss—not only questions of transparency, proportionality, necessity, exclusion, purpose, and public value, but also the subjective and perceptual dimensions of risk: how infrastructures are experienced, interpreted, and felt by those who live among them. The next section details how we designed and conducted the walkshops as a situated method of infrastructural inversion.

### **Methodology: Infrastructural inversion as situated method**

We use walkshops—facilitated group walks through datafied urban space—as a participatory and reflexive method to surface how urban data infrastructures are encountered, interpreted, and contested in situ. The approach operationalizes infrastructural inversion by making otherwise backgrounded sensing and data-processing arrangements observable and discussable in the places where they operate. We conducted 13 walkshops across the Belgian cities Ghent, Leuven, and Brussels, involving 95 participants in total (Table 1).

Citizen participants were recruited through online sign-ups facilitated by partner organizations: the Brussels Regional Informatics Centre (BRIC) and Muntpunt library in Brussels; civil society organization Avansa in Ghent; and the City of Leuven's communication channels (city magazine LVN, social media) in Leuven. Decision-maker walks involved smart city managers and municipal officials invited directly by the research team. We deliberately did not collect full demographic profiles; participant characteristics reported here draw on facilitator and note-taker observations recorded in fieldnotes. Across walks, participants were largely adults with relatively high digital confidence; this reflects the recruitment channels and is treated as a limitation in the analysis.

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23 Alison B. Powell, "The Data Walkshop and Radical Bottom-up Data Knowledge," in *Ethnography for a Data-Saturated World*, ed. Hannah Knox and Dawn Nafus (Manchester University Press, 2018), <https://doi.org/10.7765/9781526127600.00018>; Karin Van Es and Michiel De Lange, "Data with Its Boots on the Ground: Datawalking as Research Method," *European Journal of Communication* 35, no. 3 (2020): 278–89, <https://doi.org/10.1177/0267323120922087>; Adam Greenfield, "How to Bring a Systems/Layers Walkshop to Your Town," Adam Greenfield's Speedbird, 10 May 2010, <https://speedbird.wordpress.com/2010/05/10/how-to-bring-a-systemslayers-walkshop-to-your-town/>; Phil Jones et al., "Exploring Space and Place With Walking Interviews," *Journal of Research Practice* 4 (2008); Brit Ross Winthereik, James Maguire, and Laura Watts, "The Energy Walk: Infrastructuring the Imagination," in *digitalSTS: A Field Guide for Science & Technology Studies*, ed. Janet Vertesi et al. (Princeton University Press, 2019), 221–39; Van Zeeland, "Walkshops for Citizen Involvement."

Table 1. Walkshop distribution and participant numbers

City	Dates	Participants	Partner Organization	Language
Brussels test	14.07.2021	3	BRIC	English
Brussels	14.09.2021	10	OpenLab Summerschool <sup>24</sup>	English
Brussels	24.01.2022	6	BRIC	Dutch
Brussels	01.02.2022	11	BRIC	Dutch
Brussels	06.02.2022	4	BRIC	French
Brussels Decision Maker	09.02.2022	6	BRIC/ SC dept. Brussels	English
Ghent	11.09.2021	10	AVANSA Gent	Dutch
Ghent	12.09.2021	8	AVANSA Gent	Dutch
Ghent	13.09.2021	5	AVANSA Gent	Dutch
Leuven	17.10.2021	3	SC dept. city of Leuven	Dutch
Leuven	19.10.2021	11	SC dept. city of Leuven	Dutch
Leuven	24.10.2021	10	SC dept. city of Leuven	Dutch
Leuven Decision Makers	01.12. 2021	8	SC dept. city of Leuven	Dutch

Route design and encountered infrastructures: Routes were designed in collaboration with local partners to create meaningful encounters with smart city technologies operating in everyday urban spaces. Across sites, walkshops focused on infrastructures that combine visible urban devices with less visible data-processing arrangements (e.g., connectivity and back-end data flows). Sensor stops were chosen to capture a varied set of public-space data practices (surveillance, mobility, connectivity, and urban services) and were chosen based on their capacity to prompt meaningful and multi-layered discussion about data collection. **Brussels** (Rogier–Muntpunt area): a dense transport and commercial district (including a metro station and shopping areas). Infrastructures encountered included CCTV in multiple institutional constellations, access and ticketing systems, public Wi-Fi hotspots, cellular connectivity, pedestrian counting sensors (e.g., Wi-Fi/Bluetooth), smart waste bins, e-scooters, smart street lighting, and a municipal reporting app (e.g., “Fix My Street”). **Ghent** (Zuid / De Krook): a central cultural and commercial route. Infrastructures encountered included CCTV, public Wi-Fi hotspots, cellular connectivity, pedestrian counting sensors, and municipal apps. **Leuven** (city centre/De Bruul Parc): a route including locations where mobility and policing infrastructures are prominent. Infrastructures encountered included CCTV (multiple types), ANPR cameras, public Wi-Fi hotspots, cellular connectivity, parking sensors, information boards, and other sensors.

Walkshop procedure: At the start of each walk, facilitators introduced the smart city context and key GDPR principles relevant to public-space data processing (e.g., legal bases, transparency and information requirements). Participants received a flyer containing a route overview and concise descriptions of selected infrastructures, alongside basic legal/technical pointers and contact details of facilitators. At each “sensor stop,” facilitators provided brief context about the infrastructure and its stated purpose, then invited open-ended discussion about participants’ information needs, concerns, and interpretations.

<sup>24</sup> The summerschool workshop helped us to test a free-floating format for the walks. It worked but mainly with participants who already recognized sensing infrastructures and could discuss their purposes and affordances; we therefore used a facilitator-led format for the remaining walkshops.

Facilitation aimed to elicit both perceived benefits and harms, and to prompt reflection on differential impacts across urban populations. Walks balanced structured prompts with conversational flow to allow participants to connect infrastructures to situated experiences. After approximately one hour of walking, groups gathered for 30–45 minutes of broader discussion and evaluation. Participants completed a brief, anonymous post-walkshop evaluation form consisting of seven Likert-type items (five-point response scale).<sup>25</sup>

**Data collection and analysis:** Two researchers took detailed, real-time fieldnotes during each walk rather than audio recordings. Since walks took place in public urban space, ambient noise (traffic, passers-by, construction) risked producing recordings of insufficient quality for later analysis. Numbered stickers on participants' chests supported attribution in notes while maintaining anonymity. Documentation included fieldnotes, facilitator memos, and completed evaluation forms. Analysis proceeded iteratively: materials were reviewed across sites and coded thematically. We combined sensitizing concepts from the theoretical framework (e.g., infrastructural inversion, proportionality, necessity, public value, opacity, trust, exclusion) with inductive coding of recurring moments of confusion, contestation, and shifting awareness. We then compared how themes surfaced across cities and participant groups and selected illustrative excerpts for presentation in the findings.

**Reflexive limitations:** The workshops' composition reflects both recruitment constraints and broader patterns of infrastructural exclusion. Participants were predominantly middle-aged, white, well-educated, and digitally literate, underrepresenting populations most affected by surveillance and algorithmic systems. Walks were conducted primarily in Dutch, with three walks in English and one walk in French (Brussels), where informal English translation was provided when needed, thereby excluding non-speakers of these languages and potentially affecting participation depth for non-native speakers. Recruitment relied on institutional partners and online sign-ups, favouring those already engaged with civic institutions and digitally connected. No-show rates varied unpredictably (one walk saw only 4 of 20 registrants attend due to weather), affecting sample sizes. Gender balance varied across walks, with most having balanced or female-majority participation, though one walk was male-majority, limiting insight into gendered experiences of urban surveillance. Finally, the study's geographic focus on three mid-sized Belgian cities means findings may not transfer to larger metropolises, rural areas, or different national and regulatory contexts.

These limitations are acknowledged as inherent to the study's primary aim. While the workshops generated empirical insights into citizen and decision-maker perspectives, the core objective was methodological: to develop, test, and refine infrastructural inversion as a situated practice for making urban data systems observable and contestable. As a method-building study, the aim was not representativeness but to demonstrate what becomes observable when infrastructures are made discussable in situ.

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25 Questions assessed perceived usefulness, learning, clarity and sufficiency of the information provided, willingness to recommend the workshop, and self-reported changes in concern about urban data collection and in perceived benefits of the (datafied) city compared to before the workshop.

## Results

Across the walks, participants repeatedly demonstrated how the act of walking while being prompted to observe, question, and reflect enabled a shift in perception. Sensors that had long blended into the background became visible; familiar spaces were reinterpreted; and infrastructures that had previously gone unnoticed or unexamined became objects of reflection, surprise, or discomfort. The following sections trace how these encounters unfolded: as moments of recognition and confusion that made infrastructures visible; as critical evaluations of their necessity, purpose, and trustworthiness; and as reflections on the structural inequalities these systems reproduce.

### *Making infrastructures visible*

This process of recognition unfolded on different levels. Participants noticed sensors and systems they had previously overlooked, encountered confusion about their function and legal status, and began to question their necessity and purpose. The process involved shifting awareness and affective responses: surprise, discomfort, and a heightened awareness of being observed.

**Noticing what was always there** emerged as one of the clearest patterns across cities. Participants' were often surprised at discovering the extent of sensor-based surveillance in their everyday environments. This was true for trackers, smart bins, the presence of high-mounted cameras, or the data-based business models of e-scooter providers. Participants, for instance, had not noticed Bluetooth and Wi-Fi tracking signs at busy shopping malls in Ghent and Brussels despite walking past them regularly. Also several smart city administrators participating in a walk admitted they had not previously registered the presence of some signs and sensors. This type of revelation emerged through the embodied and social nature of the method: the stop-and-look dynamic interrupted routine perception and encouraged focused noticing.

This noticing was often accompanied by **confusion and misinterpretation**, not only about the function of individual technologies, but also about their legal basis, informational signage, and the rights citizens have in relation to them. Participants repeatedly pointed to the difficulty of interpreting signage in public space.<sup>26</sup> Signs may not be visible, or so overloaded and legalistic that they were unreadable for passersby: "The more concretely nuanced the rules are - when you list dozens of exceptions on the sign - it actually backfires, because no passerby can read all that at a glance. It needs to be simple and follow patterns people already know." (Leuven, 19.10.2021)<sup>27</sup> The walkshops surfaced multiple examples of gaps in public understanding of rights and responsibilities. What

26 In Leuven, also the absence of information signs in the city center was topic of discussion. This absence is due to the city's policy, following requirements in the national camera law, to inform visitors when entering the city from the periphery with big signs, but not at each camera.

27 All quotes are attributed generically to preserve anonymity, with city and date indicated as [City, Day, Month, Year]. Where relevant, quotes are identified as coming from a decision-maker walkshop. Most walkshops were conducted in Dutch, some in French or English; all quotes have been translated into English by the authors.

the data protection authority actually does, or whether surveillance cameras require signage at all, one comment captured the tone: “I’ve heard of the privacy commission, but I have no idea what they do.” (Ghent, 12.09.2021) These moments did not stem from indifference. Participants were engaged, but their knowledge was partial, fragmentary, or based on assumptions. An illustrative moment occurred when a participant in Ghent misunderstood the function of a sensor entirely: “I didn’t perceive those devices as cameras - I thought it was an alarm.” (Ghent, 12.09.2021)

Through noticing, **observation and questioning**, the groups moved beyond surprise or confusion and into more critical reflection. The presence of infrastructure sparked a series of questions about necessity, purpose, and proportionality. Rather than accepting these technologies as neutral or inevitable, participants began to interrogate their design, justification, and alignment with public values. For example, participants repeatedly questioned the purpose of camera installations. One asked whether increased surveillance in certain streets was justified: “Is it proven that there’s more crime on this street?” (Ghent, 11.09.2021) Another reflected on the role of political decision-making, observing that: “Liberal mayors [participant referring to the cities of Kortrijk and Mechelen] have invested in more cameras than Ghent [referring to the socialist government in this city] - far fewer here.” (Ghent, 11.09.2021) These comments shifted the discussion from technology as object to technology as policy, raising the issue of who decides where and why surveillance is implemented. Participants in Leuven and Brussels also questioned the ownership and accountability of certain infrastructures. In one case, a participant pointed out a private telecom company’s camera and asked what happened to the footage. Others wondered whether private actors are held to the same standards as public authorities, and how citizens could find out who was responsible. Participants did not just want to know what technologies were present, but why they were chosen, who benefits from them, and whether alternatives had been considered. Some pointed to less invasive solutions—such as increased public presence or better lighting—as preferable to pervasive surveillance. Participants assessed not only what was seen, but also what was absent, unspoken, or assumed.

These encounters produced a **shifting awareness** that extended beyond individual moments of noticing or questioning. Participants began reflecting on how the walkshop itself altered their perception, not only of specific technologies, but of the city around them. One participant commented that although they had passed a certain place before: “I’d never noticed those Wi-Fi and Bluetooth-tracking signs before. I normally don’t pay attention to that stuff - you couldn’t live if you did. It makes you paranoid.” (Brussels, 24.01.2022) Some spoke of feeling watched without knowing or not having consented, also in the absence of overt harm. Several indicated that they would speak to others about what they had learned or would be more attentive to urban infrastructures in the future. Post-walkshop evaluations (n=62) confirmed this shift: while responses were mixed, more participants reported increased concern about urban data collection than decreased concern, suggesting that the walkshop meaningfully altered perceptions without producing uniform alarm.

### *Evaluating infrastructure*

As participants became more aware of data collection in their cities, many began to critically evaluate the presence and design of smart city infrastructures. These reflections involved questions of necessity, proportionality, purpose, and trust, challenging the framing of such technologies as neutral, inevitable, or inherently beneficial.

**Contesting proportionality and necessity** became a central theme. The workshops enabled not only questions of what or who, but also why: Why here, why this tool, and at what cost? These moments of scrutiny also marked shifts to normative debate. Not only the participant in Ghent, who wondered if there was actually more crime in a certain place to justify permanent cameras. Or another stating that: “Crime isn’t prevented by cameras - the real question is whether crime actually goes down when cameras are present.” (Leuven, 24.10.2021) Participants also challenged the necessity of specific technologies: “What use is it to count incoming cars...?” (Brussels, 01.02.2022) or more broadly “Why do they need so much information” (Ghent, 12.09.2021). These reflections challenged the dominant framing of such technologies as inherently necessary or effective, questioning their real-world utility as tools for prevention. These questions are about proportionality. In Leuven, participants proposed alternatives that felt more humane and responsive, like city officials or students that could do a study for the city administration. Another said, “A camera is a power tool. I can’t pose questions to it. But I can talk to a student or city worker.” (Leuven, 24.10.2021) These suggestions reframed the debate from one of efficiency to one of relationality and trust, pushing for interventions that could achieve similar objectives without the alienating effects of surveillance. Others contested the implied cost-benefit logic. A participant noted: “Cameras cost less than hiring someone, but a neighbourhood officer meets less resistance than a camera.” (Ghent, 13.09.2021) Here, financial pragmatism was weighed against social cohesion, exposing how fiscal calculations often dominate public interest discussions, sidelining citizens’ lived experience and emotional responses.

These citizen concerns were mirrored, though perhaps in different terms, by decision makers themselves. In the Leuven walkshop, one city official stressed that alternatives such as student observers had been considered but rejected as “not objective” and too costly, concluding that “we wanted objective information” and therefore cameras were the only viable solution (Leuven, 01.12.2021). Similarly, managers explained that proportionality was primarily framed through cost-effectiveness and reliability of data, rather than the intrusiveness of the technology (Leuven, 01.12.2021).

Participants also debated the deterrent function of surveillance. In Leuven, someone remarked: “They probably see that people do less sport here due to these cameras, because they do not give a feeling of safety I think,” (Leuven, 24.10.2021)<sup>28</sup> while another

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28 The Leuven workshops began in a park where the “Smart Sporting Cities” pilot was ongoing. The project used cameras to monitor sporting behaviour (football, basketball, outdoor fitness), processing data directly on the device and sending only aggregated statistics to a central server. Amid critical media scrutiny and incomplete public communication, the resulting controversy actually heightened interest in participating in the workshops.

participant of that workshop insisted that better lighting could sometimes be as effective as cameras. This opened up conversations about what kinds of risks smart technologies are meant to mitigate (and for whom) drawing attention to how safety is imagined and operationalized in urban planning. Finally, participants raised concerns about democratic legitimacy. “People are not informed or asked whether they want this,” one said (Leuven, 24.10.2021). While this echoed broader discussions about transparency, participants also sharpened the critique: even if the presence of cameras is legally sanctioned, their deployment without meaningful consultation renders them socially illegitimate in the eyes of some.

These reflections on necessity extended into broader **challenges to public value and purpose** of smart city infrastructures. Questions of benefit and legitimacy emerged repeatedly, not in abstract terms, but grounded in the everyday realities of living with data-driven systems. Participants questioned whether infrastructures genuinely serve collective needs or primarily benefit private actors operating through public contracts or opaque governance models. These reflections revealed discomfort with the uneven distribution of risks and rewards. Technologies framed as improving public services or safety were interpreted as reinforcing commercial agendas or control. Infrastructures were seen as serving multiple masters: formal purposes presented to citizens, and secondary uses—often economic—that remained invisible. These moments made visible what Star conceptualizes as “inscribed values”: social and political choices embedded deep within built systems that shape, constrain, and legitimize certain forms of action while excluding others.

The question of public value was also approached very differently during the walks with smart city managers. Public value was less framed in terms of inclusivity or collective rights than the “accountable spending of tax money” and ensuring efficiency in urban governance. By contrast, citizens repeatedly raised questions of fairness, representation, and the everyday relevance of these systems. This underscores how managerial framings of “value” can conflict with more plural and contested understandings of public interest.

Participants expressed scepticism about whether smart city priorities of innovation and efficiency align with their lived experiences. Some challenged why these systems need to be “smart” at all, suggesting that relational, slower, or more human alternatives might provide more meaningful public value. Several participants noted how stated purposes of technologies often diverge from observed realities. Systems justified on the grounds of safety or efficiency may change over time, repurposed without public oversight. This sense of „function creep“ contributed to growing mistrust and reinforced doubts about who gets to define the success or failure of smart infrastructures.

Questions of value were further complicated by **opacity, mistrust, and the limits of transparency**. Participants frequently expressed confusion or frustration regarding the clarity and transparency of smart city infrastructures. Even infrastructures considered transparent by formal standards (clearly signposted or legally compliant) often failed to be transparent in practice. Participants encountered signs too small or hidden to notice or so loaded with jargon and technical language that they provide little real understanding.

These experiences underscore the subjective dimensions of transparency: what might seem clear to a technical expert can remain opaque to everyday users. Several participants voiced feelings of resignation when faced with inaccessible or unclear information: “You can’t pay attention to all of that either — you couldn’t live like that” (Brussels, 24.01.2022). They noted that the burden of understanding and navigating these systems often falls on citizens, despite inadequate communication by authorities or companies. As one participant touched upon, there is a pervasive sense that understanding smart city technologies required specialized knowledge or skills, creating a division between those who could navigate urban data systems and those who could not. This might also further exacerbate the digital divide among citizens in a city.

Interestingly, also the decision makers participating in the walks recognized these problems. In Leuven, participants in the dedicated decision-maker workshop brainstormed that different types of cameras could be colour-coded—“blue for sport cameras, green or yellow for others”—in order to make their purpose more transparent (Leuven, 01.12.2021). Others echoed this frustration, acknowledging that existing signage was largely unintelligible to lay publics. Furthermore, some pondered on the idea of relying on signage alone, even if cameras were absent, in order to exploit the deterrent effect of surveillance. Such remarks, albeit not fully serious, expose an interesting tension between transparency as a genuine democratic safeguard and transparency as symbolic reassurance. This could fuel rather than alleviate mistrust.

Even when technologies were explained clearly by the facilitators, many participants remained uncomfortable or sceptical. Emotional reactions ranged from unease and irritation to reassurance through the presence of data processing technologies. The emotional and ethical dimensions of transparency often remained unresolved, despite increased understanding. During the Leuven decision-maker workshop, in which facilitators shared key findings from the citizen walks, one official said they had not expected citizens to offer such nuanced critiques of city marketing and profiling: “Wow, did our citizens really say that? I am proud of our citizens” (Leuven, 01.12.2021). Another worried that people are becoming resigned to surveillance as the new normal.

### *Structural implications*

The workshops also surfaced critical dimensions of **inequality and exclusion** embedded in urban data systems. Participants highlighted significant differences in how easily various groups could engage with or benefit from smart city technologies, how infrastructures assume universal access, linguistic competence, and digital literacy, automatically excluding or disadvantaging substantial segments of the urban population.

One recurring theme was the assumption of universal smartphone access. It was pointed out that smartphone dependency can automatically exclude or disadvantage older residents, economically marginalized individuals, or those uncomfortable with digital technology. The use of apps or mobile-based services, while convenient for many, implicitly set barriers that limited participation and engagement for substantial segments of the

population. The decision-makers were not blind to these dynamics. During their walkshop in Leuven, they explicitly recognized that certain groups (notably young people) were disproportionately subject to surveillance and sometimes treated primarily as potential sources of nuisance (Leuven, 01.12.2021). Structural inequality, one might think, is not merely a by-product of data infrastructures but rationalized within official decision-making itself.

Language was another important factor for exclusion. Participants frequently noted how information is often available only in dominant languages, restricting accessibility for multilingual or non-native-speaking residents. Participants remarked that even in officially bilingual cities like Brussels, crucial information seems to appear more in the dominant language, further entrenching existing social divides. These observations prompted critical reflection on the walkshop method itself. Participants and researchers acknowledged that recruitment tended to attract digitally literate, middle-class, and linguistically comfortable citizens, potentially reproducing the same exclusions the walkshops aimed to expose.

### **Discussion: Walkshops as infrastructural inversion**

The walkshops operationalized infrastructural inversion as a situated practice. By walking, pausing, and discussing on location, participants moved from being passive subjects of data collection to being active interpreters of their environments. The stop-and-look dynamic enacted the ethnographic engagement with infrastructure conceptualized by Star: making space for misreadings and confusion to surface, enabling real-time clarification, and turning infrastructural ambiguity into an object of collective sense-making. What participants' observations reveal is a transition from infrastructure as physical artefact to infrastructure as normative and political issue—reframing urban data systems as matters of public debate and prompting questions about what kinds of futures are being built, for whom, and according to whose values.

These transformations underscore the walkshop's dual role as both investigative tool and participatory intervention. It not only surfaces hidden systems but also reconfigures how people relate to them. In Star's terms, it enables infrastructural literacy through experience, turning the taken-for-granted into something that can be seen, felt, and acted upon. The methodology managed to create 'friction' and make technologies 'seamful', revealing the elements, workings, and outputs of data systems.<sup>29</sup> Couldry and Mejias frame seamfulness as a tool for resisting less accountable and more unequal social worlds.<sup>30</sup>

The method's strengths lay in its embodied nature, which fostered a unique kind of engagement blending sensory input, conversation, and reflection into a coherent experience.

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29 Sylvie Delacroix and Michael Veale, "Smart Technologies and Our Sense of Self: Going beyond Epistemic Counter-Profiling," in *Life and the Law in the Era of Data-Driven Agency*, ed. Mireille Hildebrandt and Kieron O'Hara (Edward Elgar Publishing, 2020), <https://doi.org/10.4337/9781788972000.00011>.

30 Nick Couldry and Ulises Ali Mejias, *The Costs of Connection: How Data Is Colonizing Human Life and Appropriating It for Capitalism* (Stanford University Press, 2019).

Its flexibility allowed adaptation to different urban environments, while its simplicity enabled meaningful participation without requiring technical expertise. The balance between structure and spontaneity proved crucial: spontaneous moments—unexpected observations, candid comments—proved most revealing, yet required sensitivity and careful note-taking to capture without disrupting conversational flow.

#### *Citizen perspectives and risk assessment*

Citizen perspectives revealed dimensions of risk that conventional data protection impact assessments rarely capture. Participants articulated risks in contextual, experiential, and affective terms, raising concerns about transparency, proportionality, exclusion, and the normalization of surveillance. These moments of interpretive uncertainty reveal how infrastructure in smart cities is not just materially opaque, but cognitively and normatively opaque as well. Formal transparency efforts—signage, legal compliance—may satisfy regulatory obligations yet still fail in practice: understanding the workings of a technology does not equate to acceptance or trust. Confusion, mistrust, and resignation were symptoms not merely of poor communication but of deeper imbalances in power, knowledge, and agency that compliance-oriented checklists cannot capture.

Incorporating citizen voices expands the scope of risk assessment from technical evaluation to situated, lived realities. The method functioned as a literacy intervention, providing clarifications and creating space to openly discuss confusion, while simultaneously surfacing risks that formal assessments overlook.

#### *Implications for participatory data protection*

The GDPR's Article 35(9) explicitly calls for the inclusion of data subjects' views in Data Protection Impact Assessments, recognizing that public value and perceived risk cannot be meaningfully assessed without those affected. Yet in practice, participatory elements remain limited. DPIAs tend to operationalize risk through organizational concerns—security, liability, technical robustness—leaving little room for the complex social, political, and emotional dimensions that the workshops surfaced.

Decision-makers who participated in the workshops acknowledged this tension. While they frequently emphasized the importance of transparency, they also described citizen participation and co-creation as "too complicated" and administratively burdensome. One official remarked on the danger of resignation to cameras becoming normalized but simultaneously questioned whether citizens should be engaged at all in co-design processes. This ambivalence reflects a broader challenge: how can citizen input be meaningfully incorporated into large-scale infrastructure projects without these becoming tokenistic or logistically unmanageable?

The critique of DPIAs for not functioning as participatory governance mechanisms is fair precisely because participation was designed into the regulation but fails in imple-

mentation. Walkshops address this gap by staging situated encounters that made infrastructures tangible, creating the very conditions for deliberation that formal processes rarely achieve. They demonstrated that low-threshold, experiential methods can elicit nuanced citizen perspectives without requiring extensive technical expertise or imposing unsustainable administrative burdens.

By bridging the gap between managerial pragmatism and the GDPR's empowering intent, walkshops offer a viable approach to participatory data protection. They translate abstract regulatory requirements into tangible experiences and allow participants to interrogate the values inscribed in urban data infrastructures. For policymakers and practitioners, this underscores the need to move beyond formal compliance toward participatory, situated approaches that recognize citizens as active interlocutors in the governance of smart cities.

### *Limitations and future directions*

The walkshop methodology revealed limitations alongside its strengths. Recruitment proved challenging in reaching more diverse or marginalized populations. Although sessions were public and co-organized with local partners, most participants were relatively digitally literate and middle-class. The walkshops were held only in English, Dutch, or French, creating additional layers of exclusion and reinforcing inequalities along linguistic and cultural lines.

This insight turned attention inward: methodological choices around recruitment, facilitation, and language can inadvertently mirror the systemic biases the walkshops aimed to expose. The walkshop thus became a reflexive tool, surfacing not only external infrastructural inequalities but also the limitations inherent in participatory methods themselves. These gaps are analytically significant, mirroring the exclusions that smart city systems reproduce. Future iterations should therefore prioritize inclusivity through multilingual facilitation, diverse recruitment strategies, and explicit attention to digital divides.

Despite these limitations, the walkshop holds promise as both an empirical and critical practice. It generates qualitative insights grounded in lived experience while acting as a platform for participatory critique. It invites not only observation but evaluation, not only reflection but response. In doing so, it aligns with Star's call for ethnographies of infrastructure that surface the values inscribed in technological systems and foreground the politics of visibility, access, and accountability. By transforming the city into a site of inquiry, the walkshop reclaims urban space as a terrain for democratic knowledge production.

## Conclusion

This paper set out to examine whether citizen perspectives can meaningfully contribute to more comprehensive and effective risk assessments in the smart city, and to assess how a walkshop methodology can operationalize such engagement. Our findings show that citizen perspectives do not merely supplement technical assessments, but fundamentally reorient them. Participants articulated risks in contextual, experiential, and affective terms, raising concerns about transparency, proportionality, opacity, mistrust, structural exclusion, and the normalization of surveillance. These dimensions are rarely captured by conventional (data protection) impact assessments, yet they speak directly to the democratic and ethical stakes of datafied urban governance. Incorporating these voices expands the scope of risk assessment from compliance-oriented checklists to situated, lived realities.

The walkshop methodology proved a powerful means to elicit and make sense of such perspectives. By situating participants in the physical sites of data collection, walkshops enacted a form of infrastructural inversion: rendering visible what is usually backgrounded, surfacing confusions and contestations, and creating space for critical reflection. They functioned not only as research instruments, but also as participatory interventions that foregrounded alternative imaginaries of urban governance. Importantly, walkshops can enable dialogue not only among citizens but also between citizens and decision-makers, revealing shared uncertainties and divergent priorities. Decision-makers expressed surprise at the nuance of citizen critiques and concern about the normalization of surveillance, demonstrating that infrastructural inversion is needed also for those governing smart city projects.

Together, these insights suggest that walkshops can enhance risk assessment practices by embedding them in democratic, context-sensitive processes. They translate abstract regulatory requirements into tangible experiences and allow participants to interrogate the values inscribed in urban data infrastructures. For policymakers and practitioners, this underscores the need to move beyond formal compliance and towards participatory, situated approaches that recognize citizens as active interlocutors in the governance of smart cities. In this way, the paper demonstrates that citizen perspectives are indispensable for comprehensive risk assessment, and that walkshops provide a viable, critical method for operationalizing these perspectives. They enable both the identification of risks overlooked by conventional tools and the articulation of alternative visions of the datafied city, visions that challenge resignation and reaffirm democratic agency in an increasingly datafied urban life.

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