**EDITORIAL**

# Exploring the practices of "data-driven innovation" in the European public sector

Danny Lämmerhirt[1] (iD), Marina Micheli[2] (iD) and Sven Schade[2] (iD)

[1]Waag Futurelab, Amsterdam, The Netherlands
[2]Joint Research Centre (JRC), European Commission, Ispra, Italy
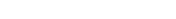**Corresponding author:** Danny Lämmerhirt; Email: danny.laemmerhirt@gmail.com

## Abstract

The European public sector has for a long time tried to change its activities and its relation to the public through the production and provision of data and data-based technologies. Recent debates raised attention to data uses, through which societal value may be realized. However, often absent from these discussions is a conceptual and methodological debate on how to grasp and study such uses. This collection proposes a turn toward *data practices*—intended here as the analysis of data uses and policies, as they are articulated, understood, or turned into situated activities by different actors in specific contexts, involving organizational rules, socioeconomic factors, discourses, and artifacts. Through a mix of conceptual and methodological studies, the contributions explore how data-driven innovation within public institutions is understood, imagined, planned for, conducted, or assessed. The situations examined in this special issue show, for instance, that data initiatives carried out by different actors lack institutional rules to align data use to the actual needs of citizens; that data scientists are important moral actors whose ethical reasoning should be fostered; and that the materiality of data practices, such as databases, enables and constrains opportunities for public engagement. Collectively, the contributions offer new insights into what constitutes "data-driven innovation practices," how different practices are assembled, and what their different political, moral, economic, and organizational implications are. The contributions focus on three particular topics of concern: the making of ethical and normative values in practice; organizational collaborations with and around data; and methodological innovations of studying data practices.

## Policy Significance Statement

The *Exploring practices of "data-driven innovation" in the European public sector* collection includes articles that examine different practical dimensions of data-driven innovation projects. The collection helps to understand what types of innovation practices exist in Europe's public sector, what distinguishes these practices, how these different practices can be studied, and what their political, moral, economic, and organizational implications are. The collection raises questions about what it means for data-driven innovation practices to succeed or fail, according to whom. It also proposes perspectives for policymakers on how to study what could be required to support data innovation practices adequately, including through symbolic investments (e.g., in ethics and norms) and material investments (e.g., in infrastructure).

## 1. Introduction

European institutions and public sector entities across Europe have for a long time tried to change its activities and its relation to the public through the production and provision of data and data-based technologies. Dating back at least to the 1990s (Gray, 2014), many European institutions and organizations have focused on data provision, sharing, and use for various purposes, including the European Commission, governments of European member states, as well as urban regions, companies, policy networks, and civil society. For instance, the European Commission has developed various policies to improve the provision of public sector information (Blakemore and Craglia, 2006), establish sectoral data infrastructures (e.g., Schade et al., 2020), and balance data protection with data reuse (Borgesius et al., 2015). Often, regulatory frameworks and innovation initiatives aim at creating different kinds of value, including economic, democratic, environmental, cultural, and social ones, by assisting policy and decision-making to address pressing societal issues. However, examples of the practical realization of these data policies, and their effects, are still rarely studied or shared (Galasso et al., 2022).

Benchmarks that support public policy in assessing open data initiatives suggest that data use is often neglected in assessments of open data portals and other public technology policies and strategies (Zuiderwijk et al., 2021). To address this gap, public policy initiatives and open data measurement projects such as the European Open Data Maturity Report have begun exploring the realization of "value" from using open datasets (European Commission, 2022). However, we argue that the term "data use" remains conceptually unspecified by such measurement efforts and can mean various noncomparable phenomena, from brief vignettes and self-reported descriptions of use purposes to quantitative studies or interview-based reconstructions of experiences and work processes. Although the growing interest in data use is promising, it may also be problematic if it is not accompanied by more conceptual and methodological reflections on what constitutes data use. As Ruijer et al. argue, studies on open data uses have tended to consider general user requirements, such as completeness, timeliness, and quality of data, while leaving aside the roles and relations between citizens and governments, and how the context of data use, such as social forces and structures may influence data use (Ruijer et al., 2020; Ruijer and Meijer, 2020).

To contribute to these debates, we propose a turn toward data practices within studies of data and policy. Our proposal aligns with social scientists who have recently proposed a practice-theoretical perspective on data uses that unpacks how data uses unfold through arrangements and relations between human actors, contexts, objects, discourses, and structured actions (Leonelli, 2020; Burckhardt et al., 2021; Fiske et al., 2022). These scholars share the argument that data policies ought to be informed by practices with data, rather than by a priori definitions of data types that inform their production, circulation, and repurposability (e.g., defining data as open data, public sector data, or personal data). Instead, these scholars say that data are shaped by the practices they are part of and that the relationship between data objects, data use purposes, and data practices deserves more scrutiny in public policy. Some of these authors have called for a more granular description of the activities that data enable (e.g., filtering, sorting, making visible, comparing, predicting, see also Christin, 2020). Other scholars have stressed the need for structural or socioeconomic factors influencing data practices, drawing on Bourdieu's practice theory (Dencik, 2019). Burkhardt et al. call for a more open-ended "praxeology of data" (Burckhardt et al., 2021, p. 20) that "approaches data practices as cooperatively performed, articulated and understood through specific and shifting [human and non-human] arrangements" (ibid.). Practice-theoretical scholars consider data practices as the performance and construction of social order through data, which is both a symbolic and material resource. Burkhardt et al. argue that a "praxeology of data" can avoid many abstracting tendencies around datafication and empirically specify, with sound social research, how data are imagined, created, and worked with in practice, and the discourse around those same data practices. An example for this would be how particular representations of digital data—such as classifications in a dashboard—are used in everyday situations to judge a citizen's eligibility for welfare payments. Since these conceptually promising approaches have rarely been applied to the study of data policies and their translation into data innovation initiatives in the European public sector, we hope that this collection may

facilitate the dialogue between studies of practices in social science and studies of data (public) policy (Magaudda and Mora, 2019).

What does a practice-theoretical approach to data innovations entail? In the past decades, several practice theories were developed that sometimes have different conceptual assumptions and objects of study (for an overview of practice theories and their origins, see Magaudda and Mora, 2019). As sociologist Theodore Schatzki reminds us, practice approaches contrast with theories that develop institutional or structural explanations for human behavior. Such an approach sidesteps abstracted mental processes that inform an individual's behavior, as well as rules that structure actions, and instead considers how concrete symbolic and material aspects result in structured actions (Knorr-Cetina, Schatzki, Von Savigny, 2001). From a practice-theoretical point of view, agency is distributed across human and nonhuman actors, including material infrastructure and norms, that result in an orderly action. Informed by practice theory, data practice means studying routine practices around data that generate meaning through action. Following practice theory means to unpack the ingredients of practices, including individuals, contexts, artifacts, discourses, routine activities, and their embeddedness in wider contexts. Accordingly, *data practices* are the analysis of data uses and policies, as they are articulated, understood, or turned into situated activities by different actors in specific contexts, involving rules, socioeconomic factors, discourses, artifacts, and other elements.

Some social scientists have explored data practices in the public sector, exploring questions related to labor, the effects of data-intense technologies on decision-making, or how the imaginations of designs for data-intense technologies are implemented. For instance, open data standards not only become a resource to be tapped but also have consequences for knowledge workers within government agencies (Denis and Goëta, 2017). Other scholars examined how specific social groups understand "data innovation," such as by looking at how "ideals" of smart cities are brought into "practice" by local administration employees (Madsen, 2018) or emphasizing the "complex set of interactions" underpinning innovative forms of data sharing at the local level based (Ruijer and Meijer, 2020). A practice-theoretical approach to researching data and policy invites reflection about the effects of data innovation programs. It also allows us to ask what *kinds of practices* public institutions could experiment with and how this changes the relations between the public sector and various publics. To give one example, we may think of participatory design practices that actively create controversies around smart cities as a way of making space for public engagement (Baibarac-Duignan and de Lange, 2021).

The articles in this collection provide analytical studies on the actual practices of data-driven innovation in the public sector. Through a mix of conceptual and empirical studies, the contributions explore how data-driven innovation within public institutions is understood, imagined, planned for, conducted, or assessed by the actors involved in these innovation programs. Collectively, it is our hope that they broaden our understanding of what a "data-driven innovation practice" might include, how different practices are assembled, and what their different political, moral, economic, and organizational implications are.

## 2. Overview of papers

For this collection, we accepted contributions informed by a practice-based understanding of data policies that were open to different conceptual and methodological approaches of what constitutes a practice and how to study it conceptually and methodologically. Thereby, we wanted to reflect the varieties of practice-theoretical approaches conducted around the public sector. The scholars represented in this collection belong to disciplines such as information sciences, sociology, media studies, STS, and empirical philosophy.

Gangneux and Joss explore in their article "Crisis as driver of digital transformation? Scottish local governments' response to COVID-19" how the COVID-19 pandemic has led to an intensification of public sector data use and sharing between Scottish local authorities. Using surveys, focus group discussions, and interviews, the paper discusses how authorities exchanged health-related data and integrated datasets related to public services. The authors suggest that the surveyed local governments

predominantly worked with, and exchanged public sector data, while third-sector data were seen as useful by many respondents but rarely used, thus highlighting a discrepancy between perceived importance and practical use. The article also suggests that Scottish local authorities were quick to adapt their data integration and sharing approaches to deliver information on the COVID-19 pandemic, while also highlighting the need for sustained investments to grow teams and infrastructure.

Liva et al. (2023) ask in their article "City data ecosystems between theory and practice: A qualitative exploratory study in seven European cities" what currently prevents the establishment of data ecosystems, examining the experiences and obstacles to data sharing within seven municipal administrations in Europe. Relying on expert interviews with policy officers, technology specialists, or heads of unit of digital or smart city departments, the study explored the roles and perspectives of actors engaged in a data sharing ecosystem, the incentives to share data, data governance models, and technologies for data sharing. Its findings suggest that across all surveyed cities, private sector organizations play a limited role in data sharing, that technological perspectives of the data ecosystems capture the attention of cities' representatives more than the socio-technological ones, and the predominance of centralized digital infrastructure.

Chignard and Glatron consider, through 10 years of experience in the French city Rennes, how data collaborations are organized at a local scale. Their article "Data collaborations at a local scale: Lessons learnt in Rennes (2010–2021)" elaborates on trustworthy data governance at municipal level, using cases from the culture and energy sectors. They pay particular attention to the relationships between the different actors that are involved in data sharing and use, and underline three main messages. First, they advocate for a holistic approach to data governance, especially at the local level, due to the power dynamics between different sectoral data governance approaches that interact are highly intertwined. Second, Chignard and Glatron call for public authorities to act in their role as infrastructure providers and potential data intermediaries—while at the same time being cautious of potential conflicts of interest, and suggesting the creation of a new non-for-profit data intermediary at the local level. Third, the authors underline the required (long) process of building trust between the many actors that are involved in the data exchange and its valorization. They stress the need for strategic alignments and regulatory frameworks that enable in-depth experimentation and accept failures.

Thuermer et al. (2024) explore how quadruple helix collaborations between SMEs, municipal authorities, and citizens may utilize citizen data toward the benefit of citizens in order to accomplish more just outcomes through data innovation activities. In their article "When data meets citizens: an investigation of citizen engagement in data-driven innovation programmes," the authors develop a comparative case study of two air quality data collaborations in the United Kingdom and Belgium, how these envisioned the role of citizens as active participants and beneficiaries, and how the data were ultimately put to use. The study finds differences in how the collaborations accomplished benefits for citizens, which varied by how project stakeholders envisioned the roles and needs of citizens, how they designed and prioritized actions to accomplish these benefits, and funding priorities shaping engagement with citizens. The concrete realization of citizen engagement led to promissory future value and the improvement of processes within partner organizations, raising questions around the just distribution of such value. As a response, the authors argue for "data justice plans" as a way of informing citizen engagement in the funding and project development processes.

How the material and infrastructural dimensions matter for public data practices demonstrates the contribution by Gray. In his article "What do data portals do? Tracing the politics of online devices for making data public," Gray explores novel digital methods for a study of the materiality and performance of data practices. Building on the notion of digital infrastructures as devices (Ruppert et al., 2013), his piece contributes three methods for empirically studying data portals as technopolitical devices, including interface analysis, software analysis, and metadata analysis. Each method provides an empirical entry point into how data portals become dynamic, heterogeneous, and contested sites of public sector datafication. These methodological approaches to data portals are intended to contribute to critically assessing how participation around public sector datafication is invited and organized with portals, and how participation may be rethought and recomposed.

Van Maanen discusses why a study of practices is always political. In his commentary "Studying open government data: Acknowledging practices and politics," he reviews the recent turn toward practice-oriented studies of open government data initiatives, and explores what an emphasis on their practical and political dimensions might mean. Proposing a praxeographic approach (Mol, 2002) to open government data practices, he argues that any seemingly stable phenomena such as databases should be seen as the *results* or *products*, rather than as starting points, of interactions that include discursive elements, material objectifications, and activities. Van Maanen argues that scholars should attend to how open government data policies present solutions to what kind of problems, and provide detailed empirical analysis of how different actors practically accomplish open data to address particular problems.

Wieringa explores what a praxeographic approach can teach us about how different actors realize algorithmic accountability in practice. In their research article "'Hey SyRI, tell me about algorithmic accountability': Lessons from a landmark case," the authors ask how algorithmic accountability succeeds or falls short through different practices. Taking the Dutch System Risk Indication (SyRI) as an empirical case, the author argues that different fora enact different, and somewhat incompatible types of accountability, by asking different kinds of medium-specific questions about SyRI from different perspectives with varying power relations. Wieringa argues that the current way of enacting accountability in practice hinges predominantly on an ex ante responsiveness of political fora such as parliament and court, making mitigation of harms as they occur very difficult to mitigate for other actors. According to Wieringa, strengthening ex ante political accountability fora could help alleviate these shortcomings.

Kersing, van Zoonen, Putters, and Oldenhof's article contributes to studies on the impact of data-driven tools on frontline bureaucrats with an exploration of how daily work practices, role identities, and norms of frontline bureaucrats change in situ when working with new data tools. Their article "The changing roles of frontline bureaucrats in the digital welfare state: The case of a data dashboard in Rotterdam's Work and Income department" offers an empirical study about the impact of a data dashboard in the Work and Income Department of the municipality of Rotterdam. Through a mix of interviews, on-site observations, and document analysis, the authors describe a contested shift of role identities among frontline bureaucrats from a client coach toward a caseload manager. In the absence of established practical norms, the authors identify that the dashboard implementation is contested on the basis of data quality, service delivery quality, and what the dashboard's data representations mean.

How practitioners involved in data innovation programs could develop good judgment of and sensitivity to ethical issues was explored in the contribution by Lähteenoja and Karhu. Their commentary "The virtuous smart city: Bridging the gap between ethical principles and practices of data-driven innovation" asked what a virtue-based approach could contribute to translate abstract normative principles into the daily work of practitioners who engage in and with data-driven innovation processes. Using a dialogic case-study approach, the authors explore in two cases of data-driven innovation in the city of Helsinki, Finland, and how such an approach could foster ethical sensitivity in practical situations of dealing with data-intense technologies. The authors argue that such an approach to sensitizing practitioners may be helpful for those cases of data-driven innovation in which novel and unknown contexts are explored in practice.

## 3. Analysis

By comparing the different concerns of the contributions, we can discern the following thematic clusters: the making of ethical and normative values in practice; organizational collaborations with and around data; and methodological innovations of studying data practices.

A practice-based perspective on data innovation initiatives suggests that the analytical value of data is often acknowledged as promissory future use, but it can be unclear in the existing situations studied. This finding applies to private company data shared with public institutions, to citizen-generated data for air pollution monitoring, as well as to data tools adopted in welfare departments. Several authors suggested that in order to understand value creation, the making of norms, ethics, and accountability must be understood in practice. Contributions approached these topics focusing on different units of analysis, including the moral

improvisation work of frontline workers who must develop new roles in interaction with a dashboard (Kersing et al., 2022), the practical activities of public institutions and media to reconstruct the origins and effects of algorithmic harms (Wieringa, 2023), a method for developing reflexive practices for data scientists (Lähteenoja and Karhu, 2023), or public–private collaborations that use citizen-generated data to address public issues (Thuermer et al., 2024). For instance, Thuermer et al. highlight a lack of institutional rules, such as professional norms or funding requirements, that would align data practices with the actual needs of citizens. In the absence of such rules, data innovation programs may create value for some other actors, such as the innovators themselves, while off-loading costs of ethical decision-making to frontline civil servants. Other authors (Lähteenoja and Karhu, 2023) emphasize the critical capacities of data and AI practitioners and methods for translating values into data-intense technologies. This perspective considers the role of data scientists as moral actors and develops reflexive methods that can foster their ethical sensitivity in practical situations of dealing with data in novel and unknown contexts. The contributions attest to the importance of studying the making of different values in practice—such as through ethical decision-making, the establishment of shared frames for action (i.e., norms), or accountability fora—and the effects and challenges different practices of realizing values bring about. Collectively, the contributions stress that existing data practices realize certain kinds of values. For instance, Kersing et al. show how the absence of formalized norms requires frontline staff to improvise moral decisions in practice. Taking a different example, Wieringa's study of how algorithmic accountability is done in practice shows how different ways of practicing accountability create different *kinds* of accountability and different normative values associated with them. Based on these findings, we can extend the call by van Maanen to politicize the morality of data practices and call for a study of how data practices involve practices of valuation (Dussauge et al., 2015). This may broaden our perspective on what kinds of norms and ethics are currently highlighted in the field and which ones are neglected.

Another set of contributions was interested in organizational collaborations with and around data. The pieces dedicated to this topic shared an interest in values actors associated with different kinds of data, organizational, technological, and legal arrangements to access, distribute, and reuse data, as well as the sustainability and justice of these efforts over time. It is noteworthy that these studies consider *practices* by reconstructing these arrangements through interviews, rather than employing on-site observations of how policymakers, designers, technologists, public servants, or other groups are involved in these activities. Regarding the value of accessing, distributing, and reusing data, the articles suggest a general tendency of public sector bodies to find data from within the public sector more valuable than from the private sector data. The study by Gangneux and Joss suggests that data originating from organizations outside of the public sector are perceived as less relevant due to the practical needs of public sector bodies. The studies confirm the argument made by Datta Burton et al. (2022) that the valuation of different data is relative to the practice in which data is used. Liva et al., for instance, suggest that while senior public sector officials suggest that private data may hold promissory value in the future, their usefulness is not clear in the current situation. Thuermer et al. suggest a similar finding for quadruple helix collaborations involving citizens on a municipal level in citizen science activities. Their study argues that municipal and private actors involved in soliciting air quality data envisioned benefits for citizens to accrue as a downstream effect. Value for citizens remained unfulfilled and without a clear pathway for realizing it, because these benefits were not integrated into the project architecture. These studies also considered the infrastructural setup of collaborating around data, mostly by surveying existing information infrastructure. This approach is less grounded in micro-perspectives of people's practical activities, or how the materiality of infrastructure affects practices, but rather in mapping what we might call the "infrastructural situatedness" (Gerlitz et al., 2019) of data sharing infrastructure—that is, the relations and connections of data infrastructures to other technologies. Importantly, several of our contributions thematized the (lack of) sustainability of data infrastructures. The studies suggest that this may be related to a lack of investments to sustain the practices of staff to work with data infrastructure (Gangneux and Joss, 2022), but it is also reflected in a lack of investments in norms and the adoption of technologies (Kersing et al., 2022).

A third insight concerns how practices of data innovation can be researched, bringing new methodological opportunities and challenges. It is noteworthy that several pieces in our collection, particularly

those concerned with data sharing arrangements, took a rather conventional approach to qualitative research, such as surveys, expert interviews, or focus groups. While these are suitable for the reconstruction of people's experiences, rationalizations, and explanations of everyday life phenomena, they may be less suited for observing (inter-)actions unfolding in process (as on-site observations would, for instance, do), and they rely on the ability of interviewees to verbalize areas of interest. The choice of methods may be related to how scholars conceptualize practices. If we consider the idea that practices are activities of accomplishing social order that include speech acts, material artifacts, and routine activities, we broaden the idea of a data practice. Some studies favored certain aspects of practices, including infrastructures, actor relations, and broad-term descriptions of activities (e.g., Liva et al., 2023), while bracketing policy promises from "actual practice." However, following van Maanen's commentary, we may argue that rather than separating discourse from practice, discourse is an important practice in its own right that frames goals and organizes activities that can stabilize the practice over time and give it durability. Some of our contributions offer promising avenues to reconstruct data innovation practices, for instance, by employing the ethnographic strategy of "scavenging" material (Wieringa, 2023) to assemble a variety of empirical sources that account for the different symbolic and material aspects constitutive of data innovation practices. Another promising route is by employing novel digital methods approaches that shed light on the material aspects of data infrastructure, how they envision and enact particular kinds of good social relations, and how these material aspects can be repurposed to study data practices (Gray, 2023). As Gray argues, the material traces of digital infrastructures and changes to these infrastructures may offer empirical insights into how conventions and imaginations of public value and public life are materialized and may enable or constrain certain actions with data and among actors.

## 4. Moving forward

These insights confirm that a practice-based approach adds value to the debate about data-driven innovation. However, what are possible future areas of study to advance the understanding of data policies and their translation into data innovation initiatives?

To start with, there is an opportunity to invite more social scientific and humanities contributions and to draw from their efforts to cross-pollinate between practice theories and topics such as infrastructure development and its effects on users. Such topics are longstanding concerns in STS and recently also emerging in fields like media and communication studies, as well as (critical) data studies (Leonelli, 2020). The different disciplinary contributions in this collection attest to the fruitfulness of practice perspectives on data and policy, both to inform future policy interventions and to better conceptualize what kinds of practices assemble and stabilize data policies and innovation initiatives.

We furthermore suggest that future studies could expand concepts and methods for studying data practices. While future works may usefully adopt micro-sociological research methods to reconstruct the daily activities of frontline staff, we note that the study of "larger" phenomena beyond micro-sociological settings, such as "data ecosystems" or "algorithmic systems" does not have to rely on micro-sociological concepts and methods (Nicolini, 2016, see also Gray, 2023; Wieringa, 2023). A practice-oriented study of these phenomena—for instance, how data ecosystems are done in practice—could take inspiration from recent studies of media practices that take patterns of media consumption as an entry point into the infrastructural constraints that matter for practical action (Magaudda and Piccioni, 2019; Dencik, 2020). Another promising approach could include the ethnographic method of following actors and data around as they circulate through organizational settings (Garnett et al., 2022). Rather than applying actor mappings or relying on the reconstructions of senior staff members in public institutions, such a perspective explores how people's interactions with specific elements of data infrastructure—a database, a dashboard, a dataset—can help explore their dependencies from infrastructures, but also other constraints, such as norms regulating actions.

How data become valuable (or not) when it is circulated across settings is another intensely debated topic (Hoeyer, 2019; Leonelli, 2019; Leonelli, 2020) that practice-theoretical studies could explore further. Past studies have argued that the value of data circulation and reuse is realized through expectations of future value (Datta Burton et al. 2022), professional recognition (Gonzalez-Betancor

and Dorta-Gonzalez, 2021), as well as epistemic and material constraints (Tempini, 2020). The studies in our collection suggest that the perceived value of data is an influencing factor for whether data is acquired and used, highlighting the importance of its practical usefulness for public sector bodies. Future studies could further systematize the practices through which data become meaningful and actionable when it circulates across organizations, and explore how specific material and symbolic constraints may influence its circulability.

Another opportunity for future investigations may consider what types of investment could formalize different kinds of data practices, and explore the effects of these investments. The studies in our collection suggest that data innovation initiatives and policies may be informed by certain kinds of investment while also lacking particular symbolic investments (such as efforts to routinize and train frontline staff for new dashboards), as well as material investments (when innovation initiatives are not supported by enough staff or budgets). The studies suggest that a lack of investments in normative formalization may lead to contestation among frontline workers over what roles they should adopt (a type of "investment" done by frontline workers themselves). Future studies could explore the establishment of normative guidelines and material resources (staff size, material infrastructure, budgets) that could structure different kinds of data practices. These studies could approach investments in a broad sense, including beyond monetary resources also the formulation of codes of conduct, opportunities for ethical reflection at work, and other symbolic and material forms (Thévenot, 1984).

## References

**Baibarac-Duignan C and de Lange M** (2021) Controversing the datafied smart city: Conceptualising a 'making-controversial' approach to civic engagement. *Big Data & Society 8*(2), 20539517211025557. https://doi.org/10.1177/20539517211025557.

**Blakemore M and Craglia M** (2006) Access to public-sector information in Europe: Policy, rights, and obligations. *Information Society 22*(1), 13–24. https://doi.org/10.1080/01972240500388180.

**Borgesius FZ**, **Gray J and van Eechoud M** (2015) Open data, privacy, and fair information principles: Towards a balancing framework. *Berkeley Technology Law Journal 30*(3), 2073–2131.

**Burckhardt M**, **van Geenen D**, **Gerlitz C**, **Hind S**, **Kaerlein T**, **Lämmerhirt D and Volmar A** (eds) (2021) *Interrogating Datafication. Towards a Praxeology of Data*. Bielefeld: Transcript Publishing. https://www.transcript-verlag.de/978-3-8376-5561-2/interrogating-datafication/.

**Christin A** (2020) What data can do: A typology of mechanisms. *International Journal of Communication 14*, 20.

**Datta Burton S**, **Kieslich K**, **Paul KT**, **Samuel G and Prainsack B** (2022) Rethinking value construction in biomedicine and healthcare. *BioSocieties 17*, 391–414. https://doi.org/10.1057/s41292-020-00220-6.

**Dencik L** (2019) Situating practices in datafication – From above and below. In Stephansen H and Treré E (eds), *Citizen Media and Practice*. Oxfordshire: Routledge, pp. 243–255.

**Dencik L** (2020) Mobilizing media studies in an age of datafication. *Television & New Media 21*(6), 568–573. https://doi.org/10.1177/1527476420918848.

**Denis J and Goëta S** (2017) Rawification and the careful generation of open government data. *Social Studies of Science 47*(5), 604–629. https://doi.org/10.1177/0306312717712473.

**Dorta-Gonzalez P**, **Gonzalez-Betancor SM, and Dorta-Gonzalez MI** (2021) To What Extent Is Researchers' Data-Sharing Motivated by Formal Mechanisms of Recognition and Credit? *Scientometrics 126* (3), 2209–25. https://doi.org/10.1007/s11192-021-03869-3.

**Dussauge I**, **Helgesson C-F and Lee F** (2015) Valuography. In Isabelle Dussauge, Claes-Fredrik Helgesson, and Francis Lee (eds), *Value Practices in the Life Sciences and Medicine*. Oxford: Oxford University Press, pp. 267–286.

**European Commission** (2022) Open Data in Europe 2022. Available at https://data.europa.eu/en/publications/open-data-maturity/2022 (accessed 2nd October 2023).

**Fiske A**, **Degelsegger-Márquez A**, **Marsteurer B and Prainsack B** (2022) Value-creation in the health data domain: A typology of what health data help us do. *BioSocieties*, April. https://doi.org/10.1057/s41292-022-00276-6.

**Galasso G**, **Montino C**, **Gori M**, **Rasmussen M**, **Roman L**, **Mccolgan O**, **Liva G**, **Rebesco E**, **Brynskov M**, **Mulquin M**, **Micheli M**, **Schade S**, **Smith R and Kotsev A** (2022) *Sandboxing. How to Use it to Strengthen our Local Data Ecosystem*. Luxembourg: Publications Office of the European Union. https://doi.org/10.2760/779684.

**Gangneux J and Joss S** (2022) Crisis as driver of digital transformation? Scottish local governments' response to COVID-19. *Data & Policy 4*, e26. https://doi.org/10.1017/dap.2022.18.

**Garnett E**, **Ruckenstein M**, **Venturini T**, **Ziewitz M**, **Van Geenen D and Lämmerhirt D** (2022) Doing data ethnography: A moderated conversation and reflection. In Burkhardt M, Van Geenen D, Gerlitz C, Hind S, Kaerlein T, Lämmerhirt D, and Volmar A (eds), *Interrogating Datafication. Towards a Praxeology of Data*. Bielefeld: transcript Verlag, pp. 85–114. https://doi.org/10.14361/9783839455616-004.

**Gerlitz C**, **Helmond A**, **Nieborg DB and van der Vlist FN** (2019) Apps and infrastructures – A research agenda. *Computational Culture 7*, 1–27. http://computationalculture.net/apps-and-infrastructures-a-research-agenda/.

**Gray J** (2014) Towards a genealogy of open data. SSRN Scholarly Paper. Rochester, NY. https://doi.org/10.2139/ssrn.2605828.

**Gray JWY** (2023) What Do Data Portals Do? Tracing the Politics of Online Devices for Making Data Public. *Data & Policy 5* (January), e10. https://doi.org/10.1017/dap.2023.7.

**Hoeyer K** (2019) Data as promise: Reconfiguring Danish public health through personalized medicine. *Social Studies of Science 49* (4), 531–555. https://doi.org/10.1177/0306312719858697.

**Kersing M**, **van Zoonen L**, **Putters K and Oldenhof L** (2022) The changing roles of frontline bureaucrats in the digital welfare state: The case of a data dashboard in Rotterdam's work and income department. *Data & Policy 4*, e24. https://doi.org/10.1017/dap.2022.16.

**Knorr-Cetina KD**, **Schatzki T and Von Savigny E** (2001) *The Practice Turn in Contemporary Theory*. London: Routledge. https://www.taylorfrancis.com/books/e/9780203977453.

**Lähteenoja V, and Karhu K** (2023) The Virtuous Smart City: Bridging the Gap between Ethical Principles and Practices of Data-Driven Innovation. *Data & Policy 5* (January), e15. https://doi.org/10.1017/dap.2023.9.

**Leonelli S** (2019) Data — From objects to assets. *Nature 574*(7778): 317–320. https://doi.org/10.1038/d41586-019-03062-w.

**Leonelli S** (2020) Learning from data journeys. In Sabina Leonelli and Niccolò Tempini (eds), *Data Journeys in the Sciences*. Cham: Springer International Publishing, pp. 1–23.

**Liva G**, **Micheli M**, **Schade S**, **Kotsev A**, **Gori M and Codagnone C** (2023) City data ecosystems between theory and practice: A qualitative exploratory study in seven European cities. *Data & Policy 5*, e17. https://doi.org/10.1017/dap.2023.13.

**Madsen AK** (2018) Data in the smart city: How incongruent frames challenge the transition from ideal to practice. *Big Data & Society 5*(2), 2053951718802321. https://doi.org/10.1177/2053951718802321.

**Magaudda P and Mora E** (2019) The contamination of practices: How practice theories matter in multiple domains. *Sociologica 13*(3), 1–10. https://doi.org/10.6092/issn.1971-8853/10269.

**Magaudda P and Piccioni T** (2019) Practice theory and media infrastructures: 'Infrastructural disclosures' in smartphone use. *Sociologica 13*(3), 45–58. https://doi.org/10.6092/issn.1971-8853/9469.

**Mol A** (2002) *The Body Multiple. Ontology in Medical Practice*. Durham, NC: Duke University Press. https://www.dukeupress.edu/The-Body-Multiple/.

**Nicolini D** (2016) Is small the only beautiful? Making sense of 'large phenomena' from a practice-based perspective. In Hui A, Schatzki T and Shove E (eds), *The Nexus of Practices*. Oxfordshire: Routledge, pp. 98–113.

**Ruijer E**, **Grimmelikhuijsen S**, **van den Berg J and Meijer A** (2020) Open data work: Understanding open data usage from a practice lens. *International Review of Administrative Sciences 86*(1), 3–19. https://doi.org/10.1177/0020852317753068.

**Ruijer E and Meijer A** (2020) Open government data as an innovation process: Lessons from a living lab experiment. *Public Performance & Management Review 43* (3), 613–635. https://doi.org/10.1080/15309576.2019.1568884.

**Ruppert E**, **Law J and Savage M** (2013) Reassembling social science methods: The challenge of digital devices. *Theory, Culture & Society 30*(4), 22–46. https://doi.org/10.1177/0263276413484941.

**Schade S**, **Granell C**, **Vancauwenberghe G**, **Keßler C**, **Vandenbroucke D**, **Masser I and Gould M** (2020) Geospatial information infrastructures. In Guo H, Goodchild MF and Annoni A (eds), *Manual of Digital Earth*. Singapore: Springer, pp. 161–190. https://doi.org/10.1007/978-981-32-9915-3_5.

**Seaver N** (2017) Algorithms as culture: Some tactics for the ethnography of algorithmic systems. *Big Data & Society 4*(2), 2053951717738104. https://doi.org/10.1177/2053951717738104.

**Tempini N** (2020) The reuse of digital computer data: Transformation, recombination and generation of data mixes in big data science. In Leonelli S and Tempini N (eds), *Data Journeys in the Sciences*. Cham: Springer, 239–264.

**Thévenot L** (1984) Rules and implements: Investment in Forms. *Social Science Information 23*(1), 1–45. https://doi.org/10.1177/053901884023001001.

**Thuermer G**, **Walker J**, **Simperl E and Carr L** (2024) When data meets citizens: An investigation of citizen engagement in data-driven innovation programmes. *Data & Policy 6*, e12. https://doi.org/10.1017/dap.2023.43.

**Wieringa M** (2023) 'Hey SyRI, Tell Me about Algorithmic Accountability': Lessons from a Landmark Case. *Data & Policy 5* (January), e2. https://doi.org/10.1017/dap.2022.39.

**Zuiderwijk A**, **Pirannejad A and Susha I** (2021) Comparing open data benchmarks: Which metrics and methodologies determine countries' positions in the ranking lists? *Telematics and Informatics 62*, 101634. https://doi.org/10.1016/j.tele.2021.101634.