Digital sovereignty as an ill-structured (or wicked?) problem

Christian Herzog, Daniela Zetti*, and Robin Preiß*
**Both the first and second authors contributed equally*

Abstract: In this chapter, we discuss digital sovereignty as an ill-structured problem negotiated within democratic and participative discourses in public and private organisations. We argue that even though ill-structured problems describe challenges that cannot be solved in a formally structured way, tensions between knowledge and practice within discursive attempts at solutions and theoretical foundations may gradually lead to (increasingly) well-structured problem formulations. We first invoke Herbert Simon's analytical take on ill-structured problems to then apply the concept to digital sovereignty, the conception of which oscillates between the individual and the collective (inter-)national level. In light of issues and transgressions related to digital practices in violation or absence of digital sovereignty, however, we voice a call to resiliently pursue and engage in spaces of negotiations rather than succumbing to defeatism. Identifying digital sovereignty as an ill-structured problem can only emphasise the relevance of attempts to determine whether a transformation into a well-structured problem is possible. Accordingly, we contend that the discourse about digital sovereignty confirms an 'ill-structured problem' as a timely analytical term that helps enhance our understanding of problems shaped by the conditions of (digital) societies.

Keywords: digital sovereignty, ill-structured problem, wicked problem, democratic discourse, digital societies, digital transformation

1. Introduction

Digital sovereignty is often expressed as a nation or community's capacity for digital self-determination (Pohle & Thiel, 2020). Digital sovereignty is, as Keysar et al. (2012, p. 371) put it:

> a prescriptive normative term to describe various forms of autonomy, self-determination and independence in relation to digital infrastruc-

> tures, technologies and data. While territorial perspectives on the term are prevalent, understandings of digital sovereignty as digital self-determination and autonomy through collective control are increasingly articulated by civil society entities and social movements.

However, protecting citizens from the repercussions of digital transformation – especially in terms of preserving the capacity for self-determination – needs framing within contexts associated with caring for individual citizens' digital sovereignty. The individual and the territorial concepts are intimately and intricately connected (cf. Floridi, 2020). It is not yet entirely clear how approaches to preserve one contribute to safeguarding the other – and even if it would be – possible enactments involve several public and private stakeholders and powerful actors. Floridi (2020) portrays citizens and residents as being caught in the middle:

> Today, the fight is … over corporate and political power over the digital, yet the roots of this clash are very old. But most importantly … whoever will win the fight for digital sovereignty will determine the lives of all people on both sides of the digital divide. (p. 377)

Digital sovereignty is a complex topic involving power plays among resourceful multinational enterprises, public administration officials, and citizens, including political minorities and marginalised and disproportionally affected, yet mostly powerless, communities (Birhane, 2021; Bory & Zetti, 2022; Heikkilä, 2022). The topic is difficult to understand, explain, and contribute to by academia, non-government actors, industry, and – perhaps above all – individual citizens and residents. Debates on linguistic terms structure discourses favouring one party or another (cf., e.g. Fetzer, 2013). Emphases on the territorial meaning of digital sovereignty may hence draw attention from the representational deficit suffered by minorities and marginalised communities despite their epistemic privilege to voice legitimate concerns (cf. Bar On, 1992).

This chapter contributes to dissolving a potentially dichotomous interpretation, where one side may claim superior significance and discursive dominance over the other. Digital sovereignty can neither be solved as an exclusively (inter-)national nor as an individual problem, leading us to conceptualise the issue of digital sovereignty as a **wicked** – an **ill-structured** – **problem**. Ill-structured problems lack a clear definition. They are open-ended, and epistemic iterations are required to arrive at a more precise formulation of the problem or related sub-problems. From an inter-

disciplinary, ethical-historical perspective, we will attempt to render this conceptual understanding of the digital sovereignty discourse conducive to addressing and mitigating epistemic injustice (cf. Fricker, 2007). The notion of the ill-structured problem bears options for making all voices heard inclusively. We understand digital sovereignty as an issue that requires constant and shared deliberation, and we ask how actors can be empowered to contribute.

By evoking digital sovereignty as an ill-structured problem that requires an **iterative approach** to epistemically advance in understanding its nature and potential solution, we would like not to be mistaken as stating that a proper way to advance is to just go ahead by trial and error. There is too much at stake, as irretrievable attempts at implementations could lead to sustained power asymmetries. Instead, we offer a hopeful perspective: By understanding digital sovereignty as an ill-structured problem, we argue that pursuing digital transformation guided by proper inclusive deliberation will gradually lead to an understanding. We will primarily be adopting the notion of an 'ill-structured problem' as originally proposed by Herbert Simon (1973), rather than referring to 'wicked problems', which may be deemed synonymous but carry with them the idea that they are problems so severe that any attempt at a solution is futile. Or as Sandra Batie (2008, p. 1,176) puts it: 'wicked problems tend to be intractable'.

The paper is structured as follows: Section 2 introduces a historical perspective on so-called ill-structured problems, the concept's emergence, and recent adaptations. This section elucidates the core characteristics of ill-structured problems, which we will then apply to analysing the discourse around digital sovereignty in section 3. Section 4 draws conclusions and points to future work on understanding the strife to enact digital sovereignty as an ill-structured problem.

2. Ill-structured problems

From the beginning, Herbert A. Simon's 'ill-structured problem' (ISP) has been an analytical concept that allows for observing social problems in a world shaped by technology. Simon was trained in social sciences in the 1930s, which led him to work in such diverse fields as public administration, political science, computer science, psychology, sociology, and economics. Being a social scientist, Simon was also the founder of the Department of Computer Science at Carnegie Mellon University. He published

extensively on the topic of decision-making and problem-solving in 'modern' organisations. In 1973, he published a paper entitled 'The structure of ill structured problems' in a journal called *Artificial Intelligence* (Simon, 1973). At this time, Simon had been co-developing computer programs for 20 years and had developed many close contacts with computer scientists (Crowther-Heyck, 2015).

In his 1973 seminal paper, he described a concept he witnessed emerging as a by-product of the '**well-structured problems**' **(WSPs)** that mathematicians and computer scientists were producing. They were eager to define problems that then could be handed over and processed 'autonomously' by computers in nicely structured ways. Yet, according to Simon, something else always remained – something was left over while structuring problems for automated processing, a residual. The '**ill structured problem**' **(ISP)** is a residual concept. An ISP is usually defined as a problem whose structure needs definition in some respect. More simply, a problem is an ISP if it is not a WSP (Simon, 1973, p. 181).

The observation that there is such a thing as a residual of the unstructured problem led Simon to conclude that it was impossible to draw a sharp boundary between ISPs and WSPs. The computer's way of solving problems fundamentally affected the (human) perception of human problem-solving: 'The boundary between well structured and ill structured problems is vague, fluid, and not susceptible to formalization. Any problem-solving process will appear ill structured if the problem solver is a serial machine' (Simon, 1973, 181). Simon emphasised that this was good news. Computing sciences were obviously capable of handling the emerging **fluid boundaries** by readjusting to the 'external real world', by testing feasibilities, and by elaborating the details of a plan. There was no need to 'introduce mechanisms that are qualitatively different from the ones already introduced in artificial intelligence schemes' (Simon, 1973, p. 200).

Simon was convinced that technological progress would not inhibit computer scientists from actually – if unknowingly – solving ISPs. 'There appears to be no reason to suppose that concepts as yet uninvented and unknown stand between us and the fuller exploration of those problem domains that are most obviously and visibly ill structured' (Simon, 1973, p. 200). In the end, Simon disproved the assumption that pure WSPs existed: computer scientists always had worked and would work on ISPs.

Since 1973, computing technology has developed in hitherto unprecedented ways. Standalone machines in computing centres soon would give way to computing networks. So-called personal computers entered house-

holds, and – last but not least – artificial intelligence (AI) has become a ubiquitous technology. While we should still agree that pure scientific and technological formalisation is fiction, we should also ask: Is Simon's **optimism** about future developments still appropriate? There are good reasons why it could be **outdated**. Perhaps computer scientists did not follow Simon's advice to rely on problem-solving skills to compensate for computing's by-effects? Maybe human problem-solving skills stagnated? Are computers still organised in the same way they once were? It might even be that the 'real world' in which computers operate and adapt has changed dramatically.

How has Simon's concept of the ISP developed? For some decades now, it has been adapted and refined by social scientists. Here are three recent definitions. In 2011, ethicists of technology van de Poel et al. built on and departed from the concept of WSPs and thus from the same point as Simon. But their interpretation also emphasises a) the definition of the ISP and b) the **process of problem-solving** as an open condition that iteratively defines and transforms the ISP into a WSP:

> Whereas well-structured problems (such as basic arithmetical calculations) usually have clear goals, fixed alternatives to choose from, usually maximally one correct answer and rules or methods that will generate more or less straightforward answers, ill-structured problems have no definitive formulation of the problem, may embody an inconsistent problem formulation, and can only be defined during the process of solving the problem. (Van de Poel et al., 2011, p. 136)

Ge et al. recently highlighted the process of learning and the **cognitive and communicative skills** involved in iterative problem-solving:

> Although ill-structured problem solving and well-structured problem-solving share similarities, problem solvers need to rely more on metacognitive skills in solving ill-structured problems, especially in interpreting the state or essence of the problem, defining the goals of a problem, comparing and selecting solutions, and generating defensible arguments. In addition, solving ill-structured problems takes more iterations between various processes in comparison to solving well-structured problems. (Ge et al., 2022, p. 97)

In another article, Love (2015) asks 'Why Herbert Simon matters for policy-making'. Ill-structured problems, or similarly, 'wicked problems', refer

> to questions like climate change, immigration, international trade and so on. … no agreement exists about what the problem is. Each attempt to create a solution changes the problem. The solution is not true or false – the end is assessed as 'better' or 'worse' or 'good enough'. The problem changes over time. … Solution(s) to the problem is (are) based on 'judgments' of multiple stakeholders. The problem is associated with high uncertainty as to system components and outcomes. There are no shared values with respect to societal goals. (Love, 2015, p. 930–931)

Love heavily emphasises the difficulty of even defining (i.e. agreeing on) the problem, the **openness of problem-solving processes**, and, last but not least, the multiple perspectives involved in processes that can result in agreements but do not have to. Love fuses Simon's ISP with the similar notion of the 'wicked problem', first introduced by Horst Rittel and Melvin Webber in 1973 (Gruendel, 2002; Hou et al., 2022; Oswald, 2022; Reznich, 2017; Rittel et al., 1973). Rittel and Webber reflected on problems that characterised planning processes and expert knowledge vis-à-vis the general public. For professionals, there were no more 'easy problems' to solve:

> The streets have been paved, and roads now connect all places, houses shelter virtually everyone, the dread diseases are virtually gone, clean water is piped into nearly every building, … and so on. … But now that these relatively easy problems have been dealt with, we have been turning our attention to others that are much more stubborn. The tests for efficiency, that were once so useful as measures of accomplishment, are being challenged by a renewed preoccupation with consequences for equity. (Rittel et al. 1973, p. 156)

In parallel to Herbert Simon, Rittel and Webber developed a concept to reflect on and optimise the relationship between technology and society. Their account today reminds us that history is sometimes a **wicked process**: problems solved bear new problems. Some problems persist. ISPs and wicked problems – analytical categories to describe social problems – are such persisting problems. There is no 'solution' to social problems, Rittel and Webber insist: 'Social problems are never solved. At the best, they are only re-solved – over and over again' (Rittel et al. 1973, p. 160). While these problems are not well-structured, in the words of Herbert Simon, they are nevertheless intimately linked with acts of formulation, communication, and negotiation: 'The formulation of a wicked problem is the problem.

The process of formulating the problem and of conceiving a solution (or re-solution) are identical' (Rittel et al. 1973, p. 161).

What can we take away from these conceptual works? ISPs and wicked problems are both analytical terms for social problems in societies characterised by technology. The focus is on the fact that only the treatment of a problem makes a definition possible. Authors today point out that the definition and treatment of a wicked problem or ISP does not have to be based on unity to resolve the problem. It is Herbert Simon, sitting in the shadow of a computer that back then, in the mid-20th century, was conceived to be accurate to the highest degree, who insisted that well-structured and ill-structured problems are neither identical nor do they resemble antagonistic poles. Instead, they share a 'boundary' that 'is vague, fluid, and not susceptible to formalization' (Simon, 1973, p. 181). Acknowledging this fluidity seems to be the precondition for further thoughts, negotiations, and acts.

3. Digital sovereignty as an ill-structured problem?

Digital transformation is one of the most pressing concerns of Western societies today. Many quantitative and qualitative advances are expected and hoped for, especially by introducing digitalisation into public administration systems (cf. Twizeyimana & Andersson, 2019). In addition, a shortage of skilled workers (cf. Müller, 2023), reduced public spending capacities (Gründler et al., 2023), and an obligation to responsibly allocate taxpayers' money may all seem to necessitate an increase in digitally supported and automated processes – at least in Germany. However, it has become clear that the introduction of digital means (AlgorithmWatch & Bertelsmann Stiftung, 2019), such as artificial intelligence (AI)-based algorithms in social welfare allocation (Heikkilä, 2022; Oravec, 2019), digital interfaces for interacting with public administration (Preiß et al., 2023), and predictive analytics for supporting police work (Amnesty International UK Section, 2018) all have the potential to put citizens' autonomy and flourishing at risk (Mittelstadt et al., 2016). Protecting citizens from these repercussions of digital transformation – especially in terms of preserving the capacity for self-determination – is often framed within contexts that are also associated with caring for individual citizens' digital sovereignty.

Digital sovereignty is commonly interpreted as referring to a state, an economy, or an individual's autonomous control over digital means and

data, as well as over the structures and practical ways of governing them (Floridi, 2020; Moerel & Timmers, 2021). A recent scoping review by Müller et al. (2022) highlights the **various interpretations and aspects of digital sovereignty** and their interaction with individuals, collective actors, and structures. Their analysis of almost 50 scientific papers and non-scientific position papers shows that many interpretations of digital sovereignty focus on competencies such as self-determination and control but also on decision-making ability, security, autonomy, independence, participation, and co-creation (Müller et al., 2022, pp. 17–22).

Generally speaking, digital sovereignty is about being able to make concrete decisions based on, about, or with the digital. Even though this may be an apt synthesis of the different descriptions found in the literature (e.g. Floridi, 2020; Lambach & Oppermann, 2022; Moerel & Timmers, 2021; Pohle & Thiel, 2020; Wessel et al., 2023), it is also insufficient, for it is precisely the distinction between a state and an individual's digital sovereignty which appears to be fluid. For instance, by introducing the concept of cyberspace sovereignty, Couture and Toupin (2019) have indicated that fixing digital sovereignty to a nation's boundaries appears inherently complex, perhaps even problematic. They have further disambiguated the digital sovereignty of social movements, Indigenous communities, and individuals, suggesting that these taxonomies – though indeed useful in discourses to highlight the needs of disproportionally and often negatively impacted marginalised groups – may amount to almost arbitrary stratifications of the concept.

To be clear, in this chapter, we are not pursuing a single, unifying perspective on digital sovereignty out of the motivation to consolidate and structure its associated discourse in some particular way. This may be regarded as a fruitful undertaking (cf. e.g. Pohle & Thiel, 2020, 2021), but it is not ours. Rather, we would like to take an outside view, comment on the digital sovereignty discourse, and hopefully suggest an insightful perspective that is primarily inspired by Herzog and Zetti's (2022, p. 10) observation that 'often sovereignty *about* the digital is, in fact, a prerequisite for the realisation of sovereignty *via* the digital'. In fact, we would like to even regard **sovereignty *about* and *via* the digital** as co-requisites, meaning that we deem sovereignty in deciding over and sovereignly engaging with digital matters to be intimately connected. The latter, of course, also includes the need for individuals to be empowered to aptly apply digital tools as means conducive to their political sovereignty. Both Pohle and Thiel (2020) and Bekkers and Zouridis (1999) have criticised how modern approaches to the

digital transformation of public administration often treat citizens as consumers, undermining their political engagement. In turn, Funke (2022, p. 190) surmises that 'public services in the digital era require that citizens as customers become the focal point of administrative activities, supplanting administrative traditions that were centered around the state's own needs and intrinsic logics'. This begs the question: What is digital sovereignty about – the state or the citizen's needs? Or is – and should – there be a difference? We suggest that this discourse and many others highlight the intricate but subtle correlations between digital and political sovereignty both on an individual and national scale.

Especially when going further along the lengths of the digital transformation, we postulate that, at least to some degree, we cannot and should not have one without the other: **national and individual concepts** of digital sovereignty are intimately connected. The fact that emphases in addressing digital sovereignty oscillate between the national and individual interpretation (Pohle, 2020) adds to this suspicion. In addition, scientific and political communities are discussing an aspect that is both highly relevant and is to be enacted in an ever-changing environment. The digital transformation more than just casts its shadow – it already has had a tangible impact and, at the same time, remains inherently open-ended. For example, people can only decide to share their data if they understand the importance and possibilities of general data use. However, it should be noted that managing your data protection is only possible to a limited extent, following Solove's (2020) observation, for example, that 'even totally rational people can't succeed at privacy self-management' (p. 27). Therefore, infrastructure regulations must ideally be congruent with citizens' demands, digital skills, and needs and should, hence, be designed accordingly.

Perhaps it is only in an idealised setting that individual and national digital sovereignty can be genuinely separate. For instance, at the very outset of digitally transforming some aspect of our lifeworlds, we may be in a position to autonomously decide whether to pursue the introduction of some specific digital technology or not. However, even then, society – and by this, we refer to non-expert citizens most commonly – will not be entirely sure about what it is getting into. Vallor (2016) denotes this kind of inability to assess, and perhaps even envision, the socio-ethical impact of technologies as ***socio-technical opacity*** and attests to our 21st-century societies suffering from it. While Vallor takes this to be valid grounds for refuting utilitarianism in favour of a virtue ethics approach more broadly, we would like to acknowledge this assessment in light of the digital sover-

eignty discourse. Society's inability to predict the implications of its own transformation basically prompts it to establish ways to continually assess what kind of digital transformative activities best suit its democratic ideals. Now that societies have already arrived at digital realities, we may have to adjust our conceptual and societal understanding of the precise meanings and implications that digital sovereignty carries with it. Digital sovereignty as an ill-structured problem refers to uncertainties and openness created through and shaped by **decision-making processes** with stakeholders that 'are likely to have differing ideas about what the "real" problem is and what its causes are' (OECD, 2017, p. 29).

The quest for digital sovereignty hence shows the basic features of an Ill-structured problem – we can only begin to fathom a more concise nature of the problem as we attempt to solve it. Disappointing as this is from an ethical perspective adhering to a rational foundationalist approach (cf. Whitbeck, 2011), it is also a call to action to continuously and tirelessly address the most pressing and current issues – and adopt a design approach to the digital transformation that carefully weighs the implications on questions of sovereignty (cf. Dorst and Royakkers, 2006). As national conceptions of digital sovereignty have guided the introduction of algorithmic techniques – mainly under the auspices of more efficient public spending (Dobrolyubova et al., 2019; Finger & Montero, 2021), disastrous failures affecting the most vulnerable, e.g. children (Heikkilä, 2022), the unhealthy (Obermeyer et al., 2019), and ethnic or other minority groups (Bélanger & Carter, 2006; Rosenberg, 2019), highlight the need to realign practices in advancing the digital transformation and promoting digital sovereignty towards solving issues for minorities or even for the disproportionally affected (e.g. Birhane, 2021). Without individual digital sovereignty that could amount to the effective notification of the algorithmic processing at play, the right to object to these practices, the right to demand human reevaluation on principle, as well as proper rights to an explanation of the conditions and parameters that influenced an algorithmic decision – and how, vulnerabilities amount.

The case documented extensively by Hadwick and Lan (2021) is cautionary: administrative practice made it possible for the algorithmically mediated detection of benefit frauds to harm thousands of families. This case – the so-called '*toeslagenaffaire*' – shows how a deterministic stance on techno-solutionism challenges citizens' digital sovereignty in multiple ways: The scandal did not just involve a reliable algorithm corrupted by administrative malpractice. Nor did it simply involve a biased algorithm.

Instead, the scandal illustrates how a strong but ultimately unjustified belief in algorithmic efficiency encouraged less tolerance towards presumptive fraudsters, including 'a lack of transparency of the norms regulating the algorithm' and 'the impossibility for welfare recipients to access the data retained by the administration' (Hadwick & Lan, 2021, p. 625). Hadwick and Lan (2021, p. 614) conclude: 'The assumption that it makes no difference to individual taxpayers whether a task is carried out by a human agent or an AI system, as often claimed by EU tax administrations is proven false by the *toeslagenaffaire*'.

Still, regional governments may focus on covering as much ground as possible in the pursuit of digitalisation with proclamations 'to leave nobody behind' being but shallow lip service as concrete actions are lacking. Take, for instance, Germany's call in Schleswig-Holstein for digital – first and only – as the principle in the e-government transformation (AöR & Schleswig-Holstein, 2023). This **digital strategy** firmly interprets digital sovereignty as independent of big-tech multinationals. However disappointing this may seem for big-tech multinationals and, more importantly, considering caring for those at risk of being negatively affected, it may be understandable from the perspective of a region that is trying to make headway and has, admittedly – to our knowledge, avoided failings anywhere near as dramatic as the Dutch children's welfare scandal (Heikkilä, 2022). A country's ability to commission, develop, maintain, and modify its digital solutions is an essential prerequisite to keeping it this way. Reviving the concept of sovereignty in this light can be called a minimum programme that allows the state as a sovereign to uphold basic functionalities.

We do not intend to suggest that we should make up our minds as we go along by analysing digital sovereignty as an ill-structured problem. However, only experience from implementing technological advances allows us to understand the **potentialities** both in the negative and positive sense, forcing us to realign our ethical priorities. Hence, we believe that by embracing digital sovereignty as an ill-structured problem, we are guided to do three things:

We should look for **experiences** made with digital technologies beyond our regional, national, and cultural boundaries, evaluate similarities and risks, and learn from them.

By considering the limitations of our own experience with the matter, we should recognise the need for **inclusive deliberation** involving a wide range of communities.

Acknowledging the endeavour's ill-structuredness keeps one alert. It raises the significance of a **continuing debate** about the direction actors are taking and reminds one to be wary of adhering to overly reductionist concepts that risk diverting attention from the more intricate and detailed socio-ethical impacts that are likely to occur.

4. Conclusions

Our analysis of digital sovereignty discourses supports Gruendel (2022, p. 205), who observes that the term 'wicked problem' historically 'points us to moments when the relationship between technocratic and democratic elements of modern institutions was at stake'. She notes that today, the concept continues to alert 'us to the unsettled roles of expertise and of public participation in political decision-making, particularly in ostensibly democratic systems' (Gruendel, 2022, p. 205). Gruendel, therefore, sees knowledge, understood non-exclusively as **knowledge** in its different forms, in the centre of 'wicked' governmental processes.

To this, we can add that reflections on digital sovereignty can gather momentum whenever they tackle the principle-to-practice gap, i.e. when they address the challenge of working in the **trading zone** that opens between (inter-)national and individual negotiations. Knowledge and practice need not go hand in hand, but they are not opposite poles per se. Herbert Simon's highly analytical work can help researchers and practitioners remain attentive and sensitive to those fluid and **vague boundaries** between ill-structured and well-structured problems. Our contribution shows that the exploration of these boundaries and the future openness they bring about is a research desideratum. Acknowledging that digital societies have a history that includes individual and collective experiences can eventually help explain uncertainties and shape the future.

Finally, a thought on the **wicked or ill-structured problem** is tested and sharpened using the example of discourses on digital sovereignty. Both concepts are analytical, intended as heuristic tools that are nonetheless social and real. Neither an ISP nor a wicked problem is a 'tricky thing'. Their inventors were concerned with issues that were not easy to formulate, and they believed that this was precisely why social opportunities opened up. The term ill-structured seems more suitable for us to convey this than the term wicked problem, which is close to defeatism. This is (again) not a problem per se, but it does run the risk of opening additional gaps.

In light of the issues and transgressions we highlighted that are related to digital practices in violation or the absence of digital sovereignty proper, we voice a call to resiliently pursue and engage in spaces of **negotiations** rather than succumbing to defeatism. Identifying digital sovereignty as an ill-structured problem can only emphasise the relevance of attempts to determine whether a transformation into a well-structured problem is possible. Ill-structured problems may even require transdisciplinary approaches due to individual actors or groups' limited epistemic privileges and horizons. It appears that this insight is close to being a truism in sustainability science – the science and practice of digital transformations can only learn from that. Accordingly, we purport that the discourse about digital sovereignty confirms the 'ill-structured problem' as a timely analytical term that helps enhance our understanding of problems shaped by the conditions of (digital) societies.

References

AlgorithmWatch, & Stiftung, B. (2019). Automating society: Taking stock of automated decision-making in the EU. https://algorithmwatch.org/en/automating-society-2019/

AöR, Dataport, & Schleswig-Holstein, S. (2023). Digitalstrategie Schleswig-Holstein. https://www.schleswig-holstein.de/DE/landesregierung/themen/digitalisierung/digitalisierung-zukunftsthema/Digitale-Verwaltung/digitalstrategie/digitalstrategie_node.html

Bar-On, B. A. (1992). Marginality and epistemic privilege. In L. Alcoff & E. Potter (Eds.), *Feminist Epistemologies*. Routledge, 83–100.

Batie, S. S. (2008). Wicked problems and applied economics. *American Journal of Agricultural Economics*, *90*(5), 1176–1191. https://doi.org/10.1111/j.1467-8276.2008.01202.x

Bekkers, V. J. J. M., & Zouridis, S. (1999). Electronic service delivery in public administration: Some trends and issues. *International Review of Administrative Sciences*, *65*(2), 183–195. https://doi.org/10.1177/0020852399652004

Bélanger, F., & Carter, L. (2006). The effects of the digital divide on e-government: An empirical evaluation. *Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICS'06)*, Kauai, HI, USA, 1–7. https://doi.org/10.1109/HICSS.2006.464

Birhane, A. (2021). Algorithmic injustice: A relational ethics approach. *Patterns*, *2*(2), 100205. https://doi.org/10.1016/j.patter.2021.100205

Bory, P., & Zetti, D. (2022). Digital federalism: Balancing autonomy, authority and automation. Itinera. *Schweizerische Zeitschrift für Geschichte*, 49, 6–17.

Couture, S., & Toupin, S. (2019). What does the notion of 'sovereignty' mean when referring to the digital? *New Media & Society*, *21*(10), 2305–2222. https://doi.org/10.1177/1461444819865984

Crowther-Heyck, H. (2005). *Herbert A. Simon: The bounds of reason in modern America*. Johns Hopkins University Press.

Dobrolyubova, E., Klochkova, E., & Alexandrov, O. (2019). Digitalization and effective government: What is the cause and what is the effect? In D. A. Alexandrov, A. V. Boukhanovsky, A. V. Chugunov, Y. Kabanov, O. Koltsova, & I. Musabirov (Eds.), *Digital transformation and global society* (Vol. 1038, pp. 55–67). Springer International Publishing. https://doi.org/10.1007/978-3-030-37858-5_5

Dorst, K., & Royakkers, L. (2006). The design analogy: A model for moral problem solving. *Design Studies*, *27*(6), 633–656. https://doi.org/10.1016/j.destud.2006.05.002

Fetzer, A. (2013). The structuring of discourse. In M. Sbisà & K. Turner (Eds.), *Pragmatics of speech actions* (pp. 685–712). de Gruyter. https://doi.org/10.1515/9783110214383.685

Finger, M., & Montero, J. (2021). Digitalization, efficiency and convergence. In J. Montero & M. Finger (Eds.), *A modern guide to the digitalization of infrastructure*. Edward Elgar Publishing. https://doi.org/10.4337/9781839106057.00017

Floridi, L. (2020). The fight for digital sovereignty: What it is, and why it matters, especially for the EU. *Philosophy & Technology*, *33*(3), 369–378. https://doi.org/10.1007/s13347-020-00423-6

Fricker, M. (2007). *Epistemic injustice: Power and the ethics of knowing*. Oxford University Press.

Funke, C. (2022). *Digitization, fast and slow – Comparing the creation of digital public services in Denmark, France and Germany* [Doctoral dissertation, European University Institute]. https://hdl.handle.net/1814/74971

Ge, X., Muftuoglu, A. C., & Brickell, S. (2022). Instructional design from the lens of self-regulated ill-structured problem solving. In J. Stefaniak & R. Reese (Eds.), *The Instructional Design Trainer's Guide* (pp. 77–89). Routledge. https://doi.org/10.4324/9781003109938-9

Gruendel, A. (2022). The technopolitics of wicked problems: Reconstructing democracy in an age of complexity. *Critical Review*, *34*(2), 202–243. https://doi.org/10.1080/08913811.2022.2052597

Gründler, K., Potrafke, N., & Weber, L. (2023). Ökonomenpanel zur 'fiskalischen Zeitenwende': Wie wollen Ökonomen die Zeitenwende im Haushalt realisieren? *Ifo Schnelldienst*, *76*(7), 68–71.

Hadwick, D., & Lan, S. (2021). Lessons to be learned from the Dutch childcare allowance scandal: A comparative review of algorithmic governance by tax administrations in the Netherlands, France and Germany. *World Tax Journal*, *13*(4), 609–645. https://doi.org/10.59403/27410pa

Heikkilä, M. (March 29, 2022). *Dutch scandal serves as a warning for Europe over risks of using algorithms*. Politico. https://www.politico.eu/article/dutch-scandal-serves-as-a-warning-for-europe-over-risks-of-using-algorithms/#

Herzog, C., & Zetti, D. (2022). Digitally aided sovereignty – A suitable guide for the e-government transformation? *Practicing Sovereignty*. Weizenbaum Conference, Berlin, Germany. https://doi.org/10.34669/wi.cp/4.1

Hou, X., Li, R., & Song, Z. (2022). A bibliometric analysis of wicked problems: From single discipline to transdisciplinarity. *Fudan Journal of the Humanities and Social Sciences*, *15*(3), 299–329. https://doi.org/10.1007/s40647-022-00346-w

Keysar, H., Calderón Lüning, E., & Unteidig, A. (2021). Prototyping digital sovereignty. *Design*, *1*, 371–396. https://doi.org/10.14361/9783839457603-021

Lambach, D., & Oppermann, K. (2022). Narratives of digital sovereignty in German political discourse. Governance, *36*(3), 693–709. https://doi.org/10.1111/gove.12690

Love, P. (2021). Why Herbert Simon matters for policymaking. *Computational Economics*, *57*(3), 923–933. https://doi.org/10.1007/s10614-018-9800-2

Love, P., & Stockdale-Otárola, J. (Eds.). (2017). *Debate the issues: Complexity and policy making*. OECD. https://doi.org/10.1787/9789264271531-en

Mittelstadt, B. D., Allo, P., Taddeo, M., Wachter, S., & Floridi, L. (2016). The ethics of algorithms: Mapping the debate. *Big Data & Society 3*(2), 1–21. https://doi.org/10.1177/2053951716679679

Moerel, E. M. L., & Timmers, P. (2021). *Reflections on digital sovereignty. EU Cyber Direct, Research in Focus series 2021*, 1–33. https://ssrn.com/abstract=3772777

Müller, J., Tischer, M., Thumel, M., & Petschner, P. (2022). Unboxing digitale souveränität. Ein scoping review zu digitaler souveränität von individuen. *Medienimpulse*, *60*(4), 1–37. https://doi.org/10.21243/mi-04-22-19

Müller, M. (2023). *KfW-ifo skilled labour barometer December 2023* (KfW Research). https://www.kfw.de/PDF/Download-Center/Konzernthemen/Research/PDF-Dokumente-KfW-ifo-Fachkräftebarometer/KfW-ifo-Fachkraeftebarometer_2023-12_EN.pdf

Obermeyer, Z., Powers, B., Vogeli, C., & Mullainathan, S. (2019). Dissecting racial bias in an algorithm used to manage the health of populations. *Science*, *366*(6464), 447–453. https://doi.org/10.1126/science.aax2342

Oravec, J. A. (2019). Artificial intelligence, automation, and social welfare: Some ethical and historical perspectives on technological overstatement and hyperbole. *Ethics and Social Welfare*, *13*(1), 18–32. https://doi.org/10.1080/17496535.2018.1512142

Oswald, D. (2022). Cybernetics, operations research and information theory at the Ulm School of Design and its influence on Latin America. *AI and Society*, *37*(3), 1045–1057. https://doi.org/10.1007/s00146-021-01339-1

Pohle, J. (2020). Digital sovereignty – A new key concept of digital policy in Germany and Europe. Konrad Adenauer Stiftung. https://www.kas.de/de/einzeltitel/-/content/digitale-souveraenitaet

Pohle, J., & Thiel, T. (2020). Digital sovereignty. *Internet Policy Review*, *9*(4), 1–19. https://doi.org/10.14763/2020.4.1532

Pohle, J., & Thiel, T. (2021). Digitale Souveränität: Von der Karriere eines einenden und doch problematischen Konzepts. In *Digitale Gesellschaft* (Vol. 36, pp. 319–340). Transcript Verlag. https://doi.org/10.14361/9783839456590-014

Preiß, R., Zetti, D., & Herzog, C. (2023). Belonging as a relevant success factor for e-government? In *Proceedings of the STS Conference Graz 2023*, Graz, Germany, 2024, 200–220. https://doi.org/10.3217/978-3-85125-976-6-12

Reznich, C. (2017). Horst Rittel. Design Methodology / Wicked Problems Theory. *Medium*. https://medium.com/@creznich/1973-7921763949fd

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*(2), 155–169. https://doi.org/10.1007/BF01405730

Rosenberg, D. (2019). Use of e-government services in a deeply divided society: A test and an extension of the social inequality hypotheses. *New Media & Society*, *21*(2), 464–482. https://doi.org/10.1177/1461444818799632

Section, A. I. U. (2018). Trapped in the matrix – Secrecy, stigma, and bias in the Met's gangs database. Amnesty International United Kingdom Section.

Simon, H. A. (1973). The structure of ill structured problems. *Artificial Intelligence*, *4*(3–4), 181–201. https://doi.org/10.1016/0004-3702(73)90011-8

Solove, D. J. (2020). The myth of the privacy paradox. *SSRN Electronic Journal*, *89*(1), 1–51. https://doi.org/10.2139/ssrn.3536265

Twizeyimana, J. D., & Andersson, A. (2019). The public value of e-government – A literature review. *Government Information Quarterly*, *36*(2), 167–178. https://doi.org/10.1016/j.giq.2019.01.001

Vallor, S. (2016). *Technology and the virtues*. Oxford University Press.

van de Poel, I., & Royakkers, L. (2011). *Ethics, technology, and engineering: An introduction*. Wiley-Blackwell.

Wessel, D., Hanke, K., Preiß, R., Herzog, C., Wegener, C., Claudy, S., & Heine, M. (2023). *Improving citizens' digital sovereignty by supporting transparency in public administration*. 31st European Conference on Information Systems, Kristiansand, Norway.

Whitbeck, C. (2011). *Ethics in engineering practice and research* (2nd ed.). Cambridge University Press. https://doi.org/10.1017/CBO9780511976339