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**GOVERNANCE SEAMS**

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ABSTRACT

This Essay formalizes the concept of governance seams and develops theories for what they enable; how they arise; why they are sometimes dismantled; and how, why, and when regulators might step in to protect endangered governance seams or to create new ones. Governance seams are socially constructed boundaries, borders, and interfaces that harness friction-in-design to enable governance. Governance seams mediate interactions among components of sociotechnical systems and between different parties and contexts. Delineating boundaries, borders, and interfaces as loci of transparency, coordination, and oversight supports mechanisms for deliberation, contestation, and protection, both by those within and those outside the seam. The interdisciplinary theoretical account is grounded in many examples, including an extended discussion of the (smart) home.

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## I. INTRODUCTION

Tech companies, the media, and academics often treat frictional seams in sociotechnical systems as inefficient barriers to be overcome and even dismantled in pursuit of a more efficient seamless ideal. This framing misses something important about seams: they enable governance. We develop a richer definition throughout this Essay, but to start: a governance seam is a socially constructed boundary, border, or interface that harnesses “friction-in-design” to enable governance.<sup>1</sup> Governance seams maintain separation and mediate interactions among components of sociotechnical systems and between different parties and contexts. Delineating boundaries, borders, and interfaces as loci of transparency, coordination, and oversight supports mechanisms for

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1. Governance refers to “the wide array of institutional means by which communities make decisions, manage shared resources, regulate behavior, and otherwise address collective action problems and other social dilemmas.” Madelyn Sanfilippo & Brett Frischmann, *Slow-Governance in Smart Cities: An Empirical Study of Smart Intersection Implementation in Four US College Towns*, 12 *INTERNET POL. REV.*, no. 1, 2023, at 1, 4, <https://policyreview.info/pdf/policyreview-2023-1-1703.pdf> [<https://perma.cc/BJ8H-X5PL>].

deliberation, contestation, and protection, both by those within and those outside the seam. This Essay formalizes the concept of governance seams and develops theories for what they enable, how they arise, why they are sometimes dismantled, and how, why, and when regulators might step in to protect endangered governance seams or to create new ones.

Governance seams are a form of what we call friction-in-design.<sup>2</sup> In contrast with the “move fast and break things” mindset of Silicon Valley, we favor a deliberative style of “slow governance” for complex, technologically driven systems.<sup>3</sup> Those who build systems of any size — from giant platforms to small start-ups, from public to private organizations — should learn to include friction in their operations, services, and products, to create the time and space needed to foster important human values and support human flourishing.<sup>4</sup>

Friction-in-design measures address shortcomings in other reform proposals. For example, targeting design can address root causes rather than respond in a reactionary, incremental fashion to social harms. The design focus also leads to reforms that industry and government can implement independently or through private-public partnerships. Unlike proposals to “inject ethics” into computer science curricula, which are too often superficial, friction-in-design is rooted deeply in both design and governance theories. It provides a pragmatic approach to evaluating design-based means of governance and the pursuit of social ends, as opposed to a single-minded focus on efficiency. Finally, when applied to systems that regulate speech or expression, friction-in-design

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2. See Brett Frischmann & Susan Benesch, *Friction-in-design Regulation as 21st Century Time, Place and Manner Restriction*, 25 YALE J.L. & TECH 376 (2023); Paul Ohm, Ayelet Gordon-Tapiero & Ashwin Ramaswami, *Fact and Friction: Mandating Friction to Fight False News*, 57 U.C. DAVIS L. REV. 171 (2023); Kyle Langvardt, *Regulating Habit-Forming Technology*, 88 FORDHAM L. REV. 129, 159–60 (2019) (proposing some friction-in-design measures); Ellen P. Goodman, *Digital Fidelity and Friction*, 21 NEV. L.J. 623, 648–52 (2021) (same). For explicit arguments that society needs to deliberately engineer friction into and between rather than out of various techno-social systems to serve socially desirable ends, see BRETT FRISCHMANN & EVAN SELINGER, RE-ENGINEERING HUMANITY 42, 141, 274–88 (2018); see generally Paul Ohm & Jonathan Frankle, *Desirable Inefficiency*, 32 FLA. L. REV. 357 (2018); FINN BRUNTON & HELEN NISSENBAUM, OBFUSCATION: A USER’S GUIDE FOR PRIVACY AND PROTEST (2015) (focus on friction for obscurity/privacy); JULIE COHEN, CONFIGURING THE NETWORKED SELF: LAW, CODE, AND THE PLAY OF EVERYDAY PRACTICE (2012); see also David M. Driesen & Shubha Ghosh, *The Functions of Transaction Costs: Rethinking Transaction Cost Minimization in a World of Friction*, 47 ARIZ. L. REV. 61, 85–87 (2005) (explaining the social value of inefficiency and transaction costs).

3. Sanfilippo & Frischmann, *supra* note 1, at 5.

4. We do not use the term “friction-by-design” because of the way that people understand existing concepts like privacy-by-design and security-by-design. In those formulations, privacy and security are Ends to which design serves as a Means. We do not, however, hold friction to be an End worth pursuing. Rather, friction is instrumental, and so we opted for the more descriptive label: friction-in-design. See Frischmann & Benesch, *supra* note 2, at 379 n.1. While friction-in-design can serve as a Means to many Ends, our normative focus is on human flourishing.

solutions can be content neutral, improving the likelihood they can withstand First Amendment scrutiny.<sup>5</sup>

There exists no panacea for complex systems problems.<sup>6</sup> Friction-in-design regulation should be a component of governance systems for the digitally networked world. In this Essay, we focus on how friction-in-design is often used to create and support governance seams. Governance seams can be architectural, social, and organizational. They can be physical and made of atoms (walls and doors), virtual and made of code (firewalls), or social and made of shared understandings (committee membership lists). Private parties create and maintain governance seams, as do public regulators.

Part I begins with examples of governance seams. Readers will have encountered the examples but may not have appreciated how much work governance seams perform. The examples illustrate variations in design features and purposes. In Part II, we develop the theory behind governance seams, building from scholarship on friction-in-design but focusing on governance seams. We define terms, explain the origins and functions of seams, and relate those functions to governance. We continue using examples to ground the theory. In Part III, we examine homes and smart homes as a representative application of how governance seams and friction-in-design more generally take us “beyond FTC enforcement” and implement privacy governance.

### *A. Motivating Examples*

In many schools, professors grade anonymous final exams. If a professor does not know who has authored an exam, the professor will not be swayed by conscious or unconscious bias based on a test taker’s identity while grading. To facilitate anonymous grading, a school creates governance seams, the result of embedding friction in the design of the authentication system for exams as well as in the policies and practices governing the test-taking and grading processes. The school’s registrar assigns exam numbers to students, and students use these numbers instead of their names as identity signatures for their exams. When students take exams, proctors collect the exams and deliver them to the registrar; professors are not present. The registrar sends the batch of answers to professors for grading, and when finished, professors send scores assigned to exam numbers back to the registrar. The registrar matches scores to students, and the process is complete. We have left

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5. Frischmann & Benesch, *supra* note 2, argue that friction-in-design regulations should be formulated as 21st century time, place, and manner restrictions, both to improve the likelihood of withstanding First Amendment scrutiny and to appropriately balance societal interests.

6. See Elinor Ostrom, *A Diagnostic Approach for Going Beyond Panaceas*, 104 PROC. NAT’L ACAD. SCI. U.S. 15181, 15181 (2007).

out some governance details — the rules and norms that govern the registrar and proctors, security measures, timing, communications between professors and students, class participation adjustments, and so on — but the basic point is that there are multiple, related seams. There is a seam differentiating groups of people (professors, students, administrators) and governing their interactions. There is also a seam between two data sets, the student-exam number set and the exam number-score set. These data sets are kept separate and secure during the grading process; access to and use of the data sets is limited. Friction at these seams entails significant costs worth bearing because of their role in maintaining trust, fairness, and integrity in anonymous grading.

Consider another example: committees and confidentiality. Organizations delegate important responsibilities to subgroups who need to work outside the scrutiny of others. Corporate boards set salaries for executives in compensation committees, academic departments assign committees to assemble evaluation files for tenure candidates, and juries deliberate their verdicts in confidence. These committees rely on governance seams to protect, govern, and enable their work. One governance seam concerns membership. Lines are drawn between the members of the committee and the rest of the population — the remaining board, faculty, or jury members. Another governance seam shields the committee's deliberations from public view. These groups meet in walled rooms with surveillance equipment turned off. Like the seams between professors, students, and administrators in the grading context, these membership rules and physical and technical boundaries constitute seams that enable governance.<sup>7</sup> The seams construct a special “techno-social environment”<sup>8</sup> within which committees may establish norms of confidentiality, rules for participation, and procedures for voting. Without governance seams, these forms of governance would be much more difficult, if not impossible.

As the examples suggest, governance seams are often associated with protecting confidentiality and other forms of privacy.<sup>9</sup> Privacy often concerns the governance of shared resources among members of a community.<sup>10</sup> The community size and composition matter, and often

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7. In these examples, the seams and constructed environment afford governance power to committee members. In others, seams may afford governance power to different actors. Who is empowered will vary by context and depend upon design.

8. FRISCHMANN & SELINGER, *supra* note 2, at 104 (examining “how techno-social tools . . . reconstruct the physical, social, and other environments within which humans are situated”).

9. Daniel J. Solove & Neil M. Richards, *Privacy's Other Path: Recovering the Law of Confidentiality*, 96 GEO. L.J. 123, 140–45 (2007).

10. See Madelyn Sanfilippo, Brett Frischmann & Katherine Strandburg, *Privacy as Commons: Case Evaluation through the Governing Knowledge Commons Framework*, 8 J. INFO. POL'Y 116, 120–22 (2018); Madelyn Rose Sanfilippo, Brett M. Frischmann & Katherine J. Strandburg, *Privacy and Knowledge Commons*, in GOVERNING PRIVACY IN KNOWLEDGE COMMONS 5, 9 (Madelyn Rose Sanfilippo, Brett M. Frischmann & Katherine J. Strandburg eds., 2021).

are themselves matters of governance. Who is in and who is out? What rules, if any, determine inclusion and exclusion? An intimate exchange among close friends is different from a confidential conversation among business partners, or a faculty discussion of a tenure candidate's teaching evaluations, or registration with an online banking platform. Yet in all, the community size and composition matter. The relationships also matter.<sup>11</sup> Personal information, including the personal opinions and judgments exchanged in each example, is deemed private. The expectation of privacy that people develop may be rooted in nothing more than a commonsense understanding about the nature of the relationships, the context, and the necessary conditions for sharing information and maintaining trust.<sup>12</sup> Sometimes, evolving social beliefs and norms become formalized in rules, procedures, and sanctions for flouting the rules. In many privacy contexts, an important governance seam is the seam between members and nonmembers of an information-sharing, knowledge commons community.

Many governance seams are architectural. The seams arise from the design of built artifacts and environments. A classic example is the home. There is much more to the home than its architecture — the social meaning matters most. Still, the walls, doors, windows, and other physical components constitute a seam between the inside and outside of the home, which affords some privacy through various forms of friction. Windows afford some frictional protection from aural surveillance, while drapes or blinds may be necessary to avoid visual surveillance. Architectural friction can be quite powerful, but it has its limits as a governance mechanism. A door can be opened. More generally, advances in surveillance technology can overcome frictional barriers and erode architectural seams, whether from the outside (e.g., the thermal imaging device in *Kyllo v. United States*<sup>13</sup>) or from within (e.g., Alexa or other smart home technologies).<sup>14</sup> By establishing a functional and socially recognized seam, the physical architecture of a home

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11. That privacy is relational and social is a truism. Privacy arises from and shapes interdependence. Rules, norms, and other governance mechanisms concerning community membership, affiliation, and social relations are fundamental to privacy. See Sanfilippo et al., *Privacy and Knowledge Commons*, *supra* note 10, at 9. On relational privacy, see Robert Sloan & Richard Warner, *Relational Privacy: Surveillance, Common Knowledge and Coordination*, 11 U. ST. THOMAS J.L. & PUB. POL'Y 1, 7 (2017); Salomé Viljoen, *A Relational Theory of Data Governance*, 131 YALE L.J. 573, 592–98 (2021).

12. Brett Frischmann, *Common Sense Commons: The Case of Commonsensical Social Norms*, in GOVERNING MARKETS AS KNOWLEDGE COMMONS 113 (E. Dekker & P. Kuchař eds., 2021).

13. 533 U.S. 37, 40 (2001).

14. Scholars and jurists have long been concerned about advancements in surveillance technology eroding privacy. See, e.g., *Olmstead v. United States*, 277 U.S. 438 (1928); *Kyllo*, 533 U.S. Our focus is on the mechanisms and consequences of *governance seam erosion*. As we explore in Part III, the stakes are not just privacy. Even in the absence of any contextually inappropriate personal information flows, the erosion of governance seams may threaten the integrity of socially meaningful and valuable contexts.

enables other forms of governance, including social norms and laws. For example, visitors generally abide by social conventions, such as knocking on the front door or ringing a doorbell upon arrival, and even with a search warrant, the law requires police officers to knock and announce themselves. In the absence of a door, neither the social norm nor legal rule would be operational.<sup>15</sup>

Moving from physical to virtual architecture, many governance seams arise at the boundaries between databases and datasets inside organizations. One example is the separation of datasets containing exam numbers from datasets containing student identities to support anonymous grading. Another is the isolation of first-party tracking data implemented by DoubleClick pursuant to a 2002 consent decree.<sup>16</sup> Separating datasets to enable governance is a pervasive architectural governance seam. Dividing datasets is a common management practice used to delineate between departments, functions, roles, and responsibilities, and becomes a way to shape the limits of power and authority. The “inner join,” the database wrangler’s term for a common way to merge two datasets, often entails governance.<sup>17</sup> Policies dictate who is allowed to or forbidden from performing an inner join, IT security and audits ensure compliance with those policies, and Chief Data Officers promulgate governance decisions implementing those policies.

Most complex technological systems take advantage of governance seams.<sup>18</sup> At the dawn of the world wide web, government regulators accused Microsoft, which had “well over 90 percent” of the market for operating system software on personal computers, of unlawfully tying its Internet Explorer (“IE”) browser into the Windows 95 operating system.<sup>19</sup> The dispute concerned whether Microsoft had intentionally integrated IE into the code for Windows 95, not only in an attempt to make the browser work more efficiently, but also to give it a competitive edge over Netscape’s Navigator browser.<sup>20</sup> The government alleged that Microsoft had erased the governance seam delineating the

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15. *See, e.g.,* *Wilson v. Arkansas*, 514 U.S. 927 (1995).

16. *See* Settlement Agreement, *In re* DoubleClick Inc., 154 F. Supp. 2d 497 (S.D.N.Y. 2002) (No. 00-CIV-0641), [https://ur.ag.ny.gov/sites/default/files/settlements-agreements/aug26a\\_02\\_attach.pdf](https://ur.ag.ny.gov/sites/default/files/settlements-agreements/aug26a_02_attach.pdf) [<https://perma.cc/99TH-8A8V>].

17. Paul Ohm, *Broken Promises of Privacy: Responding to the Surprising Failure of Anonymization*, 57 UCLA L. REV. 1701, 1725–27 (2010) (describing inner joins).

18. An important example is the Internet itself. End-to-end design defines a seam between layers of the network, and network neutrality implements governance (preventing owners of broadband networks from prioritizing Internet traffic based on the identity of users or their activities) at that seam via friction in the routing of traffic. *See* FRISCHMANN & SELINGER, *supra* note 2; BRETT FRISCHMANN, INFRASTRUCTURE: THE SOCIAL VALUE OF SHARED RESOURCES 320 (2012).

19. Proposed Findings of Fact § 21.1(i), *U.S. v. Microsoft*, 253 F.3d 34 (D.C. Cir. 2001) (No. 98-1232), <https://www.justice.gov/atr/us-v-microsoft-proposed-findings-fact> [<https://perma.cc/AGV6-2UBP>].

20. *See id.* § 70.4.

boundary between operating systems and applications, decreasing friction for itself but increasing friction for Netscape and other browser competitors. After an appeals court overturned a verdict against Microsoft, the government and Microsoft entered into a consent decree,<sup>21</sup> part of which obligated Microsoft to restore the governance seam by disclosing to its competitors the APIs and documentation needed to interoperate with Windows.<sup>22</sup> The settlement also obligated Microsoft to give users the ability to remove IE as a browser choice.<sup>23</sup> The government thus challenged Microsoft's erosion of a seam through software integration and obligated Microsoft to maintain a governance seam in the form of an API and its documentation.

These examples reveal common themes and characteristics while admitting considerable variance. There is nothing natural, sacrosanct, or inevitable about governance seams. Some may be emergent phenomena while others may be negotiated and designed. Some may work well in specific contexts but not in others. By our definition, all are social constructs with potentially important social functions and consequences. To better understand how to evaluate, compare, and design governance seams, we turn to the theory behind governance seams.

## II. THEORY BEHIND GOVERNANCE SEAMS

The theory we offer builds upon emerging scholarship on friction-in-design.<sup>24</sup> We define terms, articulate the origins and functions of seams, and explain their fundamental connection to governance. Our theoretical analysis is mostly descriptive and analytical; we explain how governance seams work. A series of explicit normative considerations arise throughout the discussion, but we do not fully explore the

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21. *U.S. v. Microsoft Corporation Information on the Settlement*, U.S. DEP'T OF JUST., <https://www.justice.gov/atr/usdoj-antitrust-division-us-v-microsoft-corporation-information-settlement> [<https://perma.cc/K5AD-2LKN>].

22. Stipulation at 3, *U.S. v. Microsoft*, 253 F.3d 34 (D.C. Cir. 2001) (No. 98-1232), <https://www.justice.gov/atr/cases/f9400/9495.htm> [<https://perma.cc/7QRL-Q4JW>] (“Microsoft shall disclose . . . the APIs and related Documentation that are used by Microsoft Middleware to interoperate with a Windows Operating System Product.”).

23. *Id.* at 5.

24. See generally FRISCHMANN & SELINGER, *supra* note 2. We build on research in disciplines that consider the role of design interventions that involve friction but may not use that label. For example, in a series of studies, security researchers found that “interstitial warnings” that “interrupt users and require interaction” (thus qualifying as friction-in-design in our framework) are more effective at changing user behavior than “contextual warnings” that “do not interrupt” users or require interaction (not involving friction-in-design). See Ben Kaiser, Jerry Wei, Eli Lucherini, Kevin Lee, J. Nathan Matias & Jonathan Mayer, *Adapting Security Warnings to Counter Online Disinformation*, 30 PROC. 30TH USENIX SEC. SYMP. 1163, 1163–64, (2021), <https://www.usenix.org/conference/usenixsecurity21/presentation/kaiser> [<https://perma.cc/2C43-YVX9>] (summarizing security research, collecting sources, and reporting on extension to disinformation warnings).



normative arguments in favor of or against governance seams. We and others have argued extensively (1) against design imperatives that prioritize the elimination of friction and (2) in favor of friction-in-design and friction-in-design regulation.<sup>25</sup> We explained how the normative arguments vary considerably across contexts as do the types of friction-in-design measures. This is equally true for governance seams, which are a type of friction-in-design measure.

*A. Governance Seams as Friction-in-Design: CAPTCHA*

We adopt Frischmann and Benesch's descriptive framework, consisting of six parameters and associated questions, for designing, examining, evaluating, and comparing different friction-in-design measures.<sup>26</sup> They apply the framework to offline and online examples.<sup>27</sup> The parameters include: the type of friction, direct effects on subjects, architectural design, purposes and (un)intended impacts, scope of application, and governance.

Consider one friction-in-design example they discuss that supports a governance seam: the Completely Automated Public Turing Test To Tell Computers and Humans Apart ("CAPTCHA").<sup>28</sup> CAPTCHAs ask a user to perform a task, such as identifying images or reading mangled numerals, in order to be given access to a website. The idea is to require a task that humans can solve easily but automated code (bots) cannot. This is a form of authentication, giving rise to legitimacy and security. Frischmann and Benesch summarize the analysis of CAPTCHAs using the six parameters in the following table.

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25. The arguments go beyond eliminating friction alone to encompass a series of related design mantras (e.g., maximize efficiency, minimize transaction costs, seamlessly interconnect, increase speed, scale, and scope of technologically mediated interactions). See Frischmann & Benesch, *supra* note 2, at 386–87, 396; see generally FRISCHMANN & SELINGER, *supra* note 2 (exploring these design mantras, their underlying logics and social consequences, and the case for friction-in-design).

26. Frischmann & Benesch, *supra* note 2, at 397. For brevity, we do not reproduce the associated questions.

27. *Id.*

28. CAPTCHA: *Telling Humans and Computers Apart Automatically*, CAPTCHA.NET, <http://www.captcha.net> [<https://perma.cc/9ASF-5W7U>].

Table 1: CAPTCHA Analysis using Friction-In-Design Parameters

<b>Parameters</b>	<b>CAPTCHA</b>
<b>Type(s) of friction</b>	Architectural feature of website, app, or human-computer interface that blocks access until a task is performed effectively (test passed).
<b>Direct effect(s) of friction on subjects</b>	Time delay; delayed or reduced access to system, resource, or content; prompt deliberation about whether to perform the task; prompt action / labor associated with task performance; cause annoyance and/or fatigue.
<b>Architectural design of friction</b>	Software code; human-computer interface design. Task performance requires coded interactions.
<b>Purposes of friction; (un)intended (social) impacts of friction</b>	Generate reliable evidence (proof) that a user is human and not a bot; enable security measures (when test is not passed and bot is detected); generate data from task performance.
<b>Scope of application</b>	Authentication process; applies upon initial access; owner or system manager decides on whether to deploy.
<b>Governance</b>	Owners and operators of websites, apps, or other human-computer interfaces choose whether and how to deploy CAPTCHAs. There are many different implementations, some openly accessible and others proprietary. Governance of data collected as a result of task performance may be controlled by the CAPTCHA service provider.

CAPTCHAs support a governance seam. CAPTCHAs govern behavior at an important interface (the relevant seam), create friction with a functional purpose (authentication) and enable governance in the

enforcement of a membership rule (humans allowed, bots not allowed). CAPTCHAs generally work well, although by no means perfectly.<sup>29</sup>

By enabling governance via friction-in-design, governance seams allocate power. For example, CAPTCHAs allocate power to owners and operators of websites and possibly CAPTCHA service providers. Owners and operators have power to tune the friction and decide on when and how to implement it.<sup>30</sup> In doing so, owners favor ordinary users and disfavor users employing software bots to automate their queries. Whether or not task performance generates useful data and what to do with such data are additional governance decisions for the owner/operator. The difficulty of keeping up with the arms race in security and attempts to circumvent or defeat CAPTCHAs may force owner/operators to outsource these governance decisions and thus power to CAPTCHA service providers.

Not all friction-in-design measures involve seams that enable governance. Speed bumps are a prototypical form of friction-in-design but do not involve a seam that enables governance. Rather, speed bumps are architectural features of roads that directly govern the use of shared roads, using friction-in-design to “nudge subjects to internalize costs associated with speed, make a decision about speed moderation and route planning, and bear the consequences.”<sup>31</sup> While the distinction between enabling governance and directly governing may be subtle, it is useful because the allocation of authority and power to govern varies between the two formulations.<sup>32</sup>

On one hand, governance seams allocate power in a manner that can be transparent and accountable, at least if the governance seam is designed to support these governance functions. On the other hand, eroding and eliminating governance seams reallocates power, too often in a manner that is unnoticed and unchallenged.<sup>33</sup> Thus, like design imperatives favoring the elimination of friction and minimizing of transaction costs, a design imperative favoring seamlessness has important political and economic consequences.<sup>34</sup>

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29. The arms race between CAPTCHAs and attackers continues. See Nghia Trong Dinh & Vinh Truong Hoang, *Recent Advances of Captcha Security Analysis: A Short Literature Review*, 218 *PROCEDIA COMPUT. SCI.* 2550, 2560 (2023), <https://doi.org/10.1016/j.procs.2023.01.229> [<https://perma.cc/AHA3-84QD>].

30. See Ohm & Frankle, *supra* note 2.

31. Frischmann & Benesch, *supra* note 2, at 400.

32. Speed bumps raise governance concerns, primarily prior to deployment. See *id.*

33. This is no surprise to scholars attuned to the “politics of artifacts.” See, e.g., Langdon Winner, *Do Artifacts Have Politics?*, *DAEDALUS*, Winter 1980, at 121, 122; Bruno Latour, *Which Politics for Which Artifacts?*, *DOMUS* (2004), <https://www.domusweb.it/en/from-the-archive/2022/10/10/farewell-to-bruno-latour-one-of-the-greatest-french-intellectuals.html> [<https://perma.cc/YB9Y-CAR8>].

34. Frischmann & Benesch, *supra* note 2, at 382–96 (examining “humanity’s techno-social dilemma”; its economic, social, and political logics; and various design imperatives supported by those logics); see generally FRISCHMANN & SELINGER, *supra* note 2.

This issue of seam erosion and corresponding power redistribution arose crisply in early debates about geography, sovereignty, and jurisdiction sparked by David Johnson and David Post in their seminal article *Law and Borders — The Rise of Law in Cyberspace*.<sup>35</sup> “We take for granted a world in which geographical borders — lines separating physical spaces — are of primary importance in determining legal rights and responsibilities.”<sup>36</sup> Digital networked communications presented a fundamental challenge to the feasibility and legitimacy of laws created and enforced by territorial sovereigns, they argued, precisely because those laws depended upon geographic borders.<sup>37</sup> Johnson and Post suggested that new global communications technologies eroded geographic governance seams, thus disempowering territorial sovereigns and at the same time empowering others, including netizens and online self-governing communities.<sup>38</sup>

### *B. Basic Contours of Governance Seams*

Governance seams arise where social, technological, economic, political, and other systems; groups of people; or organizations interconnect. Relevant seams include boundaries, borders, and interfaces. These terms are often used interchangeably. As the examples above suggested, network firewalls, physical walls, organizational boundaries, and territorial borders delineate important governance seams.

Seams involve separation or division, and often a distinction between internal and external. That distinction may be social in the sense that the seam differentiates insiders (members) from outsiders (non-members); spatial in the sense that the seam differentiates environments (e.g., home, school, workplace); technical in the sense that the seam differentiates engineered systems, architectures, layers, and so on. Distinctions may also be economic, political, and cultural; these types of distinctions may overlap with social ones, in the sense described above.

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35. 45 STAN. L. REV. 1367 (1996).

36. *Id.* at 1368.

37. *Id.* at 1369.

38. *Id.* at 1367 (arguing that the new technologies created “a new boundary, made up of the screens and passwords that separate the virtual world from the ‘real world.’ . . . This new boundary defines a distinct Cyberspace that needs and can create its own law and legal institutions . . . .” Scholars often associate Johnson and Post with an optimism about the promise of the early web that dampened as nation states found ways to reimpose borders online. *See, e.g.,* JACK GOLDSMITH & TIM WU, WHO CONTROLS THE INTERNET? ILLUSIONS OF A BORDERLESS WORLD 1–17 (2006). With some notable exceptions, such as Wikipedia, the predicted utopia of self-governance by netizens has been replaced by unease about the power of giant tech platforms and the rise of terrible Internet cesspools. *See, e.g.,* DANIELLE CITRON, HATE CRIMES IN CYBERSPACE 35–56 (2014); Julie Cohen, *Law for the Platform Economy*, 51 U.C. DAVIS L. REV. 133, 152–53 (2017). We leave Johnson and Post’s underlying political theory aside, as we have different views on it and its relevance to modern debates, and simply note the importance of their early analysis of the relationship between borders and governance and the way technological developments can erase the former to make the latter more difficult.

These distinctions may also combine (e.g., a home's spatial boundaries carry social meaning). Regardless of distinctions, what matters is that there is a seam serving as a focal point for governance.

Governance seams arise where interdependencies matter and human values are at stake and possibly contested. Not all seams are governance seams. Their occurrence depends on the social demand for governance — which often derives from interdependencies — whether attributable to shared resources (e.g., public goods, infrastructure), resource flows (e.g., exchange, transmission), cooperative or competitive relations, interactions, or other related social dynamics. Governance, for our purposes, refers to the wide array of institutional means by which communities make decisions, manage shared resources, regulate behavior, and otherwise address collective action problems and other social dilemmas.

Seams can enable governance by delineating space, thereby creating the separation necessary to establish legitimate rules and norms and to perform management, oversight, and enforcement.<sup>39</sup> Territorial borders, the physical architecture of a home, anonymous grading systems, CAPTCHAs, passwords, and other authentication mechanisms serve these functions.<sup>40</sup> Seams also serve as a fulcrum for allocating governance power and authority (to insiders, outsiders, or joint mechanisms).

Governance seams change with time. They arise as groups build up boundaries and borders separating themselves from the outside world and as they create internal divisions. Informal governance seams get formalized in contracts, source code, network architecture, bylaws, and legislation. Governance seams might be created out of whole cloth, as when a corporate board creates a new committee, or an antitrust regulator breaks up a monopoly. As discussed, governance seams get altered or removed, sometimes to advance the goals of “seamlessness.”

Seam erosion may occur in different ways, including the redesign of interfaces, integration of functions across architectural layers, merger of data sets, and the introduction of new communications and/or surveillance technologies. We have discussed some examples and will discuss others below.

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39. Johnson & Post, *supra* note 35, at 1369–70 (suggesting that the logical correspondence between territorial borders and law — the case for relying on a territorial border as a governance seam — depends on considerations of power, effects, legitimacy, and notice).

40. Territorial borders may be a governance seam that does not constitute a friction-in-design measure alone. It is not hard to identify various friction-in-design measures that operate at the border to enable governance.

*C. Governance Affordances and Functions*

Governance seams are important for the governance activities they enable. While there are many examples, we highlight four: recognition, transparency, interoperability, and information regulation.

## 1. Recognition

The most basic function of a governance seam is to explicitly recognize the existence of a seam and its potential relevance for governance. Recognition serves a rather simple notice function, which Johnson and Post called the “signpost function.”<sup>41</sup> It also provides a focal point for other governance functions and activities. For some coordination-style social dilemmas, choosing such a baseline may be all that is needed, but for many social dilemmas, recognizing the governance seam is just the beginning.

## 2. Transparency

Transparency is necessary for most forms of governance, but it is almost always insufficient. We are unimpressed by calls to merely increase the transparency of private behavior to governmental or public scrutiny. Transparency is the bare minimum for proper governance.

A well-designed governance seam can increase transparency by serving as a border checkpoint between two types of activities. Just as border checkpoints provide visibility into cross-border flows of goods and people, governance seams provide a vantage point to observe or measure meaningful information flows.

Many examples illustrate the transparency-enhancing role of a properly placed governance seam. A student who does not trust the anonymous grading claims of their law school administration might be shown the software and procedures put in place to wall off identity information. The Justice Department can examine the software calls made between Windows 95 and various web browsers to see if Internet Explorer benefits from any privileged integration.<sup>42</sup> A state Attorney General can instruct an auditor to examine whether DoubleClick combined first-party data from different customers, despite the company’s promises not to do so.<sup>43</sup> Without these governance seams in place, these

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41. Johnson & Post, *supra* note 35, at 1370.

42. See Proposed Findings of Fact § 164.4.1–3, *U.S. v. Microsoft*, 253 F.3d 34 (D.C. Cir. 2001) (No. 98-1232), <https://www.justice.gov/atr/us-v-microsoft-proposed-findings-fact> [<https://perma.cc/AGV6-2UBP>].

43. See Settlement Agreement, *In re DoubleClick Inc.*, 154 F. Supp. 2d 497, (S.D.N.Y. 2002) (No. 00-CIV-0641), [https://ur.ag.ny.gov/sites/default/files/settlements-agreements/aug26a\\_02\\_attach.pdf](https://ur.ag.ny.gov/sites/default/files/settlements-agreements/aug26a_02_attach.pdf) [<https://perma.cc/99TH-8A8V>].

acts of transparency would be much more difficult if not impossible to accomplish.

### 3. Interoperability

Governance seams enhance interoperability. They can provide a well-defined interface for exchanging data with or obtaining access to the functionality of an online service. Governance seams leverage concepts like abstraction and modularity to hide the details of what lies behind the interface while providing access under appropriate conditions.<sup>44</sup> If a governance seam is well defined, easy to use, and stable, it can spur innovative new uses and facilitate competition.<sup>45</sup>

An Application Programming Interface (“API”) for an online service or platform is a quintessential governance seam used to enhance interoperability by encouraging others to build complementary apps and services atop the platform.<sup>46</sup> Well-designed APIs have supported the growth of many important services. APIs are also increasingly contested. Oracle sued Google, and lost in the Supreme Court, alleging that Google had infringed Oracle’s copyright in the Java API.<sup>47</sup> Twitter has a checkered history of using its API to promote interoperability. Over the years, Twitter has revoked access from apps that have become very popular, perhaps to hinder competition.<sup>48</sup> In early 2023, Reddit ignited a firestorm by increasing the fees it charges for API use.<sup>49</sup> In light of conflicts like these, regulators may want to step in and prevent companies like Oracle, Twitter, or Reddit from withdrawing the governance seam APIs they have previously made public. Regulators may also want to encourage, incentivize, or obligate companies to create APIs that do not exist today to spur more interoperability.

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44. See, e.g., CARLISS Y. BALDWIN & KIM B. CLARK, DESIGN RULES: THE POWER OF MODULARITY 63–64 (2000); Joseph Farrell & Philip J. Weiser, *Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age*, 17 HARV. J.L. & TECH. 85, 90–95 (2003); BARBARA VAN SCHEWICK, INTERNET ARCHITECTURE AND INNOVATION (2010).

45. See, e.g., Farrell & Weiser, *supra* note 44, at 97–100.

46. See DANIEL JACOBSON, GREG BRAIL & DAN WOODS, APIS: A STRATEGY GUIDE 4 (2011) (defining and describing APIs).

47. *Google v. Oracle Am., Inc.*, 141 S. Ct. 1183, 1190 (2021) (holding that Google’s use of the API was a fair use, without ruling that this kind of API is protected by copyright).

48. Vassili van der Mersch, *Twitter’s 10 Year Struggle with Developer Relations*, NORDIC APIS (Mar. 23, 2016), <https://nordicapis.com/twitter-10-year-struggle-with-developer-relations> [https://perma.cc/V6W4-NMH5].

49. Michael Levenson, *Reddit Communities Go Dark to Protest New App Policy*, N.Y. TIMES (Jun. 12, 2023), <https://www.nytimes.com/2023/06/12/business/media/reddit-subreddit-blackout-protest.html> [https://perma.cc/68ZC-7CA9].

## 4. Regulating Information

Governance seams enable the regulation of how information is generated, segmented, distributed, and used.<sup>50</sup> DoubleClick, for example, promised several state Attorneys General that it would not share information gathered from first parties with one another.<sup>51</sup> To abide by this promise, it needed to build both the technological and organizational boundaries to keep such data apart.<sup>52</sup>

Governance seams can also be used to permit the type of information that can be generated. In the tenure committee example, the committee collects a wide range of intelligence about a candidate — letters from external reviewers, teaching evaluations, self-assessments, reports from colleagues and administrators — and distills that information into reports for the rest of the faculty. The committee might choose to hold back information that it deems irrelevant or unhelpful for tenure consideration.

*D. Delineating, Shaping, and Mediating Contexts*

In addition to enabling the governance functions we have described, governance seams also delineate, shape, mediate, and even construct contexts themselves. Different strands of literature use different terminology to describe the social settings in which things happen. In this Essay, we have used the words “environment” and “context” interchangeably.<sup>53</sup> Helen Nissenbaum’s theory of Contextual Integrity (“CI”) is a widely respected approach to conceptualizing and evaluating privacy, defined as contextually-appropriate information flow.<sup>54</sup> She defines contexts as “structured social settings characterized by canonical activities, roles, relationships, power structures, norms or rules and

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50. For detailed case studies examining the role of governance seams and related institutional means for regulating information (governing knowledge), see generally GOVERNING SMART CITIES AS KNOWLEDGE COMMONS (Brett M. Frischmann, Michael J. Madison & Madelyn Rose Sanfilippo eds., 2023); GOVERNING PRIVACY IN KNOWLEDGE COMMONS (Madelyn Rose Sanfilippo, Brett M. Frischmann & Katherine J. Strandburg eds., 2021); GOVERNING MARKETS AS KNOWLEDGE COMMONS (Erwin Dekker & Pavel Kuchař eds., 2021); GOVERNING MEDICAL KNOWLEDGE COMMONS (Katherine J. Strandburg, Brett M. Frischmann & Michael J. Madison eds., 2017); GOVERNING KNOWLEDGE COMMONS (Brett M. Frischmann, Michael J. Madison & Katherine J. Strandburg eds., 2014).

51. Settlement Agreement at 11, *In re DoubleClick Inc.*, 154 F. Supp. 2d 497 (S.D.N.Y. 2002) (No. 00-CIV-0641), [https://ur.ag.ny.gov/sites/default/files/settlements-agreements/aug26a\\_02\\_attach.pdf](https://ur.ag.ny.gov/sites/default/files/settlements-agreements/aug26a_02_attach.pdf) [https://perma.cc/99TH-8A8V].

52. *See id.* at 19.

53. On what we mean by environment, see FRISCHMANN & SELINGER, *supra* note 2, at 104–05.

54. HELEN NISSENBAUM, PRIVACY IN CONTEXT: TECHNOLOGY, POLICY, AND THE INTEGRITY OF SOCIAL LIFE 132 (2009).



internal values (goals, ends, purposes).”<sup>55</sup> People engage in activities, depending on their roles, subject to norms and rules, and guided by their internal values (goals, ends, purposes).<sup>56</sup> Informational norms that determine appropriateness, in turn, are characterized by four parameters: contexts, actors, attributes (information types), and transmission principles.<sup>57</sup> We briefly describe an argument about how our theory of governance seams interacts with CI.

At first glance, there might not appear to be much interaction. After all, CI does not pay much attention to either governance or seams. The concepts are implicit in discussions of context and transmission principles. Recent Governing Knowledge Commons (“GKC”) work has examined how governance is undertheorized in CI, and has proposed how the two approaches, known as GKC+CI, usefully combine to enable rich description, diagnosis, and normative evaluation in a social scientific tradition.<sup>58</sup> In GKC work, however, researchers typically study only one type of governance seam: community membership rules.<sup>59</sup>

There seems much to be gained by integrating consideration of governance seams into CI, GKC, and GKC+CI approaches to privacy governance. First, doing so would elevate consideration of community membership and related governance rules. In many GKC studies, this governance seam is not fully examined. In CI studies it is typically implicit when identifying different actors (senders, receivers, subjects), articulating their respective roles and responsibilities, and evaluating whether information flows are appropriate.<sup>60</sup> Second, it would encourage consideration of other types of governance seams in addition to membership rules. As we shall see in our exploration of the smart home, physical architecture, technological interfaces, and other governance seams play important roles in shaping activities, interactions, norms, and even values. Third, and in line with GKC, it would emphasize the importance of governance affordances and the allocation of power and authority.

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55. See *id.* at 132–34; Sanfilippo et al., *Privacy and Knowledge Commons*, *supra* note 10, at 12–13.

56. See NISSENBAUM, *supra* note 54, at 132–34; Sanfilippo et al., *Privacy and Knowledge Commons*, *supra* note 10, at 12–13.

57. See NISSENBAUM, *supra* note 54, at 132–34.

58. See *id.*; Yan Shvartzshnaider, Madelyn Rose Sanfilippo & Noah Apthorpe, *GKC-CI: A Unifying Framework for Contextual Norms and Information Governance*, 73 J. ASS’N INFO. SCI. & TECH., 1297, 1297–313 (2022).

59. See *supra* note 49.

60. See, e.g., NISSENBAUM, *supra* note 54, at 129 (noting that governance seams work with the CI concepts of information norms and appropriate information flows, and information flow often violates an entrenched norm when it crosses a governance seam in a way that is inconsistent with the norms, rules, or expectations of those who govern the seam).

Governance seams could also help analysts identify the appropriate scaling of contexts.<sup>61</sup> Analysts working in the CI, GKC, and GKC+CI traditions could focus on choosing a scale that allows for the identification of governance seams. When defined at a high level of abstraction, some contexts have such porous and ill-defined boundaries that we would not consider them as even having a governance seam. For example, Nissenbaum offers “health care” and “education” as CI contexts.<sup>62</sup> But both are so massive, complex, and sweeping as to lack the kind of coherence required to identify a well-defined governance seam. It is hard to locate the border, boundary, or interface for health care or education.

We advocate focusing on a smaller scale to identify a nested context (or “action arena”) and examine its governance seams.<sup>63</sup> For example, in the education context, we would focus on a school district, or even a high school, middle school, or elementary school, before trying to identify relevant governance seams. At this scale, we can examine governance seams involving physical architecture, community memberships rules, databases, and technological interfaces. These governance seams shape the context and mediate interactions with other contexts and outsiders or nonmembers.<sup>64</sup>

Finally, we highlight another contribution that our theory of governance seams — and our concern with seam erosion — brings to contextual integrity theory. It is simple: deterioration of the integrity of a socially meaningful context itself may constitute a significant social harm, regardless of the appropriateness of personal information flows. Put another way, the blurring, blending, and deterioration of governance seams around socially meaningful contexts can be harmful, even if there is no privacy violation. For example, when a school sends

61. We focus on analysts, but this scaling issue can also be relevant for communities and regulators.

62. NISSENBAUM, *supra* note 54, at 135.

63. Nissenbaum recognizes nested contexts, of course. *See id.* (discussing example of schools within school districts). Some GKC studies examine nested contexts at different scales or levels of abstraction by differentiating macro-, meso-, and micro-level action arenas. *See, e.g.*, Brett Frischmann & Marsha Tonkovich, *Smart Tech Deployment and Governance in Philadelphia*, in GOVERNING SMART CITIES AS KNOWLEDGE COMMONS 112, 112–56, (Brett M. Frischmann, Michael J. Madison & Madelyn Rose Sanfilippo eds., 2023) (examining macro- and meso-level action arenas); Katherine Strandburg & Brett Frischmann, *The North American Mitochondrial Disease Consortium: A Developing Knowledge Commons*, in GOVERNING MEDICAL KNOWLEDGE COMMONS 348, 348–389 (Katherine J. Strandburg, Brett M. Frischmann & Michael J. Madison eds., 2017) (studying meso-level action arena and discussing relationships with macro- and micro-level action arenas); Katherine J. Strandburg, Brett Frischmann & Can Cui, *The Rare Diseases Clinical Research Network and the Urea Cycle Disorders Consortium as a Nested Knowledge Commons*, in GOVERNING KNOWLEDGE COMMONS 155 (Brett M. Frischmann, Michael J. Madison & Katherine J. Strandburg eds., 2014) (same).

64. *Cf.* Madelyn Rose Sanfilippo, Noah Apthorpe, Karoline Brehm & Yan Shvartzshneider, *Privacy Governance Not Included: Analysis of Third Parties in Learning Management Systems*, 124 INFO & LEARNING SCIS. 326 (2023).

laptops home with students, the policy not only raises concerns about potential privacy harms, but also diminishes the integrity of the home and school contexts even if no personal information flows inappropriately between the two contexts. The governance seam between home and school not only requires friction concerning the flow of personal information to maintain compliance with student privacy laws; it also might require friction to sustain the integrity of the home as a context within which governance authority rests with the family. More fundamentally, a seam might also be needed to protect the family's freedoms of self-determination and from engineered determinism.<sup>65</sup>

Consider parental governance of children's time, attention, access to online content, technology use, and relationships outside of school hours. School-issued laptops may impact governance authority by undermining parents' practical capacity to set and enforce norms. The technology usually implements preinstalled, school-set norms, which may conflict with parents' norms.<sup>66</sup> The school-issued laptop affords students an escape and an appeal to educational demands that may be difficult for parents to resist.<sup>67</sup> Such demands may be quite substantial. In addition to parental governance within the home, children's self-governance is potentially undermined.<sup>68</sup>

These issues may be important when the school involves third parties, such as technology vendors, who may qualify as agents for schools but nonetheless have their own agendas. When vendors supply schools with laptops, software, and other educational technology, there are many values at stake beyond privacy (e.g., the grooming of future customers, normalization of surveillance, etc.). The distribution of school-issued laptops to students for use both at school and home (and everywhere in between) bores a tunnel in the seams dividing home and school and creates a conduit through which various actors may exercise influence, exert power, and even undermine fundamental rights. We contend that governance seams play an important role in sustaining the integrity of socially meaningful contexts and that seam erosion by "tunnel boring" of the sort we have described is normatively concerning, though usually unnoticed.

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65. FRISCHMANN & SELINGER, *supra* note 2 (examining these fundamental freedoms and how ubiquitous deployment and seamless interconnection of supposedly smart digitally networked technologies threaten them). See generally Ian Carter, *Positive and Negative Liberty*, STAN. ENCYCLOPEDIA PHIL. (Aug. 2, 2016), <https://plato.stanford.edu/archives/fall2016/entries/liberty-positive-negative> [<https://perma.cc/EG38-VEGZ>].

66. See FRISCHMANN & SELINGER, *supra* note 2, at 17–28 (analysis of school-issued fitness trackers).

67. See *id.*

68. *Id.* (examining how school-issued fitness trackers contribute to techno-social engineering of parents' and children's beliefs and preferences and undermine self-development and governance).

*E. Regulating Governance Seams as a Design Intervention*

Regulators sometimes should create, preserve, or police a governance seam as a form of regulation or oversight, taking advantage of the governance features it provides. Where and how should they draw the governance seam? We see at least three possibilities, depending on the problems the regulators are trying to address and the level of government intervention that is justified.

Most often, regulators will follow a pre-existing boundary line, giving regulatory imprimatur to a governance seam that emerged without explicit prior regulatory action. We call this approach *preserving* governance seams. Regulators might choose to preserve the status quo for many reasons. They might be generally content with a governance seam that is currently in place but worried about tendencies toward seamlessness, meaning proposals or incentives to break down the governance seam. Regulating a pre-existing governance seam will often mean freezing the status quo and declaring that today's governance seam should be shored up, protected, and maintained. Regulators might also decide that they lack the power or political will to do anything more than maintain the status quo.

It is important not to naturalize the status quo. Regulators do not preserve governance seams because they have evolved naturally. Using this kind of rhetoric tends toward a techno-determinist attitude that we reject. We think of this more like a *desire path*, the name given in landscape architecture to dirt grooves created by pedestrians choosing to take shortcuts across lawns rather than stick to the architect's designed paths.<sup>69</sup> Just as landscape architects will sometimes pave a new path along a desire path, so too might regulators establish a formal governance path in the groove cut by private actors.<sup>70</sup>

A related but slightly more interventionist approach would be for a regulator to reinstate a governance seam as it had operated at some point in the past. To do so, a regulator may need to disintegrate some of the integrative design choices that have been made. We call this the *dis-integration* approach. Regulators will target past incursions upon a governance seam for reversal because they eliminate or impede some governance benefits of a previously operational seam. For example, when industry pushes seamless integration for the supposed efficiency benefits, reduced transparency might cause regulators to intervene.

Finally, regulators may draw a governance seam along a boundary that has never before been seen. We call this the *reengineering*

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69. Cf. Laura Nichols, *Social Desire Paths: A New Theoretical Concept to Increase the Usability of Social Science Research in Society*, 43 *THEORY & SOC'Y* 647, 648 (2014) (arguing the social scientists should be "identifying and studying social desire paths in ways that can inform social structures").

70. *Id.*

approach. This approach would reflect a regulatory judgment to inject governance of activities at a locus where governance is lacking. Regulators choosing this option should adhere to principles of sound design. In principle, when reengineering, regulators should draw governance seams that are as simple as possible to accomplish the desired governance goals.

### III. EXTENDED EXAMPLE: HOMES AND SMART HOMES

#### *A. Smart Home and Governance Seams*

##### 1. The Home, Its Governance Seams, Why They Matter, and How They Can Be Eroded

The home is a place within which society<sup>71</sup> most strongly recognizes and preserves people's fundamental human rights to self-determination (free will, autonomy) and from social control (e.g., engineered determinism, external influence, or state power). It is a sanctuary.<sup>72</sup> It has boundaries, generally understood in geographic terms, that are legally, morally, and culturally recognized and protected. The occupants of a home have considerable governance authority over what happens within the home and who may enter.<sup>73</sup>

Governance seams arise at the physical boundary of the home. Governance authority pertains to activities within the home and to various flows across the boundary. Ingress and egress of people, things, and information occur through doorways, chimneys, and windows, but also through pipes and conduits for water, gas, electricity, and data. The architectural design of these features and components of the home varies considerably and has changed over time. In some cases, new technologies, media, and social practices challenge and reengineer boundaries and the inner environments of the home.

An example of how the law recognizes the boundaries of the home as a relevant governance seam comes from Fourth Amendment law.<sup>74</sup> Police surveillance of activities within the home are subject to special rules that do not apply in office buildings or factories. According to the

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71. At least from the vantage point of American society.

72. See, e.g., SHOSHANA ZUBOFF, *THE AGE OF SURVEILLANCE CAPITALISM: THE FIGHT FOR A HUMAN FUTURE AT THE NEW FRONTIER OF POWER* 5 (2019) (emphasizing the idea of home as sanctuary).

73. The home also enables the most powerful within the home to exercise dominion, influence, control, and power over others within the group. An overly rosy description of the freedoms sustained within the home can overlook how in practice those freedoms might not be available to everyone. Shirley Mallett, *Understanding Home: A Critical Review of the Literature*, 52 *SOCIO. REV.* 62, 75 (2004).

74. Stephanie M. Stern, *The Inviolable Home: Housing Exceptionalism in the Fourth Amendment*, 95 *CORNELL L. REV.* 905, 912–13 (2010).

Supreme Court, the right of privacy in one's home sits "at the core of the Fourth Amendment."<sup>75</sup> "[P]hysical entry of the home is the chief evil against which the wording of the Fourth Amendment is directed."<sup>76</sup> This stems from a historical understanding of the Bill of Rights, as the court has found that "[a]t the very core" of the Fourth Amendment "stands the right of a man to retreat into his own home and there be free from unreasonable governmental intrusion."<sup>77</sup>

Recast through a governance lens, these Fourth Amendment cases establish a homeowner's ability to engage in activities that escape the unjustified scrutiny of law enforcement officials. The privacy afforded by these rules is not absolute, but instead subject to procedures — warrants, affidavits, judicial review, motions to suppress — and substantive standards — probable cause, particularity, the reasonable expectation of privacy test — providing a fine-grained governance scheme protecting what happens within the walls of a house while giving way to justified surveillance.

The Fourth Amendment as a governance system relies heavily on architecture. Windows afford less privacy, and thus less Fourth Amendment protection, than walls.<sup>78</sup> Windows with blinds afford more privacy than those without, yet windows with gaps in their blinds may cut back on that privacy.<sup>79</sup> In *Kyllo v. United States*,<sup>80</sup> the Supreme Court held that mere technological advances that ignore seams cannot by themselves alter the governance rules. Just because thermal imaging cameras made it possible for the police to infer the presence of marijuana grow lights inside a home did not permit the police to use the cameras for this purpose without a warrant, at least not so long as the technology was not in "general public use."<sup>81</sup>

The Fourth Amendment has reckoned with the way homeowners have altered their expectations of privacy by bringing mass media and communications — radios, televisions, telephones, and the Internet — into their homes.<sup>82</sup> These changes have reengineered those spaces and

75. *Wilson v. Layne*, 526 U.S. 603, 612 (1999).

76. *United States v. U.S. Dist. Ct.*, 407 U.S. 297, 313 (1972).

77. *Silverman v. United States*, 365 U.S. 505, 511 (1961).

78. *Coolidge v. New Hampshire*, 403 U.S. 443, 527 (1971).

79. *Minnesota v. Carter*, 525 U.S. 83, 104 (1998) (Breyer, J., concurring) (offering as an alternative reason to hold that the police did not violate the Fourth Amendment the fact that people do not enjoy a reasonable expectation of privacy when passersby on the public sidewalk look through a gap in a window's blinds).

80. 533 U.S. 37 (2001).

81. *Id.* at 40. Other advances in intelligence-generating technologies deployed outside the home may threaten the integrity of the home. See, e.g., Michael Madison, *VOICES: Why What You Flush, Isn't Yours: Is It Government Overreach When Private Life Offers Public Data?*, POSTINDUSTRIAL (June 4, 2023), <https://postindustrial.com/stories/voices-why-what-you-flush-isnt-yours> [https://perma.cc/336Y-FPS9].

82. See, e.g., *Olmstead v. United States*, 277 U.S. 438 (1928); *Silverman*, 365 U.S. at 465; *Goldman v. United States*, 316 U.S. 129, 135 (1942); *Smith v. Maryland*, 442 U.S. 735, 737 (1979).

potentially afford outsiders power over insiders via different forms of techno-social engineering:<sup>83</sup>

Mass media shape our cultural environment as they reach into and reconfigure our lived-in environments, our workplaces, schools, homes . . . restaurants, taverns, and so on. The reconfiguration is often infrastructural and architectural because it operates structurally in the background and in a manner that tends to be overlooked and taken for granted by those situated within the environment. As with the clock and other tools [discussed previously], our perception and understanding of reality adjusts gradually as we become accustomed to the presence, power, and utility of the tools. Unlike those other examples, however . . . mass media attune more directly with our cognitive capabilities and senses. Mass media [enable outsiders with access to these powerful tools to] engineer humans within these lived-in environments by altering the range of stimuli that potentially affect the beliefs, preferences, and actions of humans within those spaces.<sup>84</sup>

The authors compare radio, television, and the Internet across four factors:

[*S*]cale, evaluated in terms of audience size, markets, and/or geographic coverage; *scope*, evaluated in terms of the range and types of content and messages; *influence*, evaluated in terms of power to persuade, shape beliefs, or otherwise engineer audience members (i.e. do more than simply entertain or satisfy existing preferences); and *architectural extension*, evaluated in

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83. See, e.g., FRISCHMANN & SELINGER, *supra* note 2, at 109–17 (“Techno-social engineering refers to processes where technologies and social forces align and impact how we think, perceive, and act.”); see also *id.* at 4 (“Human beings are the objects being engineered.”); *id.* (“[E]ngineer is [meant to encompass] construct, influence, shape, manipulate, make, nudge, and other such terms.”); Brett Frischmann, *Thoughts on Techno-Social Engineering of Humans and the Freedom to Be Off (or Free from Such Engineering)*, 17 THEORETICAL INQUIRIES L. 535, 539–40 (2016) (“Engineering suggests the informed design and use of tools to serve a purpose or achieve a particular end” and “the existence of human engineers and tool users, who may but need not be the same.”); *id.* at 540 (“[E]valuation [of techno-social engineering] necessarily depends on the purposes and consequences” and “on the relationships among engineers, tool users, and those humans being engineered.”).

84. FRISCHMANN & SELINGER, *supra* note 2, at 110.

terms of the degree to which the media fit within and bridge different environments.<sup>85</sup>

Consider, for example, how the introduction of television into the home can change internal environments, such as living rooms and bedrooms. These rooms with and without a television are different techno-social environments, which raises governance concerns (e.g., whether to introduce the device, what rules and norms govern its use, etc.). The rise of the personal computer changed the governance structures of the spaces in a home once again.<sup>86</sup>

Smartphones disrupt our governance rules even more than radio, television, and personal computers.<sup>87</sup> In addition to its digital communications capabilities, a smartphone affords users mobility inside and outside the home as well as wearability (bodily proximity and even intimacy). These affordances expand scope, influence, and architectural extension. “Smartphones travel with users, and this disintegrates constraints in both time and space, meaning you can be online anytime and anywhere.”<sup>88</sup> The smartphone is more likely to feel like an extension of one’s body or even mind. At the same time, it opens one’s mind to the influence of many others, including absolute strangers.<sup>89</sup> Always-on techno-social engineering via smartphones puts many of the governance seams of the home in jeopardy.<sup>90</sup>

## 2. The Smart Home, the Erosion of Governance Seams, and Potential Social Harms

This brings us to the smart home. Smart home technologies typically integrate and rely on networked sensors, data, intelligence-generating systems (including artificial intelligence, machine learning, algorithms, and other data processing/analytics tools), and automation/control actuators.<sup>91</sup> These are components of complex, interconnected systems that construct, manage, and even constitute our built lived-in and experienced environments.<sup>92</sup> Rapid development,

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85. *Id.*

86. *See, e.g.,* Jenny Radesky & Dimitri Christakis, *Media and Young Minds*, 138 *PEDIATRICS* 1, 4 (2016) (“Keep bedrooms, mealtimes, and parent–child playtimes screen free for children and parents.”).

87. For analysis of the affordances of smartphones and the risk of always-on techno-social engineering, see FRISCHMANN & SELINGER, *supra* note 2, at 125–26.

88. *Id.*

89. *Id.* For brevity, we have not explored other contributing factors that empower outsiders (e.g., expanded surveillance capabilities, access to massive amounts of brokered data, use of AI).

90. *Id.* at 130–33.

91. *Id.* at 126.

92. *Id.*



proliferation, and integration of such systems generate social demand for community governance at many different scales and points of control.<sup>93</sup>

In the history of incursions into the governance seams of the home, smart devices might be seen as just the latest iteration. We contend that smart home technologies raise new governance challenges. Consider a few examples. First, smart digitally networked technologies, such as smartphones and Alexa, not only afford those within the home with the substantial capabilities to reach outside the home but also afford countless outsiders with various capabilities to reach inside the home and leverage the integrated components of the smart system to engineer patterns of behavior (e.g., nudge, influence, manipulate).<sup>94</sup>

Second, smart technologies take advantage of recent advances in machine learning to provide a personalized experience. These capabilities are touted for the way they enhance the homeowner's creature comforts — your Nest thermostat will learn to warm up your home thirty minutes before you return home from work!<sup>95</sup> At the same time, these devices apply learning for the benefit of outsiders, especially advertisers, feeding information about the habits of family members into the surveillance economy.<sup>96</sup>

Third, smart devices tend to raise cybersecurity risks beyond the risks raised by personal computers.<sup>97</sup> Priced as cheap consumer goods, many smart devices are built by obscure manufacturers who lack the budgets or expertise to build state-of-the-art security into their devices.<sup>98</sup> Lacking screens or other forms of convenient user interfaces, the software on these devices tends to be difficult or impossible to update. Even if these devices were easily updateable, the manufacturers lack the budgets or incentives to develop security patches, preferring to declare an end-of-life to their support, encouraging users to toss the devices into the trash and buy the newer version.

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93. See generally David Clark, *Control Point Analysis*, PROC. RSCH. CONF. ON COMM'N, INFO., & INTERNET POL'Y, Sept. 2012, <https://dspace.mit.edu/bitstream/handle/1721.1/141678/Clark%20%282012%29%20Control%20point%20analysis.pdf> [https://perma.cc/3FUG-H24T]; Jonathan Zittrain, *Internet Points of Control*, 44 B.C. L. REV. 653 (2003).

94. FRISCHMANN & SELINGER, *supra* note 2, at 110–12, 114–17, 121–22, 124–42 (describing techno-social engineering of human behavior via supposedly smart technological systems).

95. Liam McCabe, *Are Smart Thermostats Worth It?*, CONSUMER REPS. (Aug. 17, 2022), <https://www.consumerreports.org/appliances/thermostats/are-smart-thermostats-worth-it-a7822875275> [https://perma.cc/GYU6-3V44].

96. ZUBOFF, *supra* note 72, at 4.

97. Nathaniel Kim & Paul Ohm, *Legacy Switches: A Proposal to Protect Privacy, Security, and the Environment from the Internet of Things*, 84 OHIO ST. L.J. 101, 115–17 (2022).

98. See Janet Morrissey, *In the Rush to Join the Smart Home Crowd, Buyers Should Beware*, N.Y. TIMES (Jan. 22, 2019), <https://www.nytimes.com/2019/01/22/business/smart-home-buyers-security-risks.html> [https://perma.cc/L87N-C2CE].

## 3. A Proposal: Governance Seams for the Smart Home and Society

We aim to sustain the integrity of the home as a meaningful social context within which community members (e.g., family members) exercise self-governance and find sanctuary from undue external influence. The home has a well-established boundary that has served as an effective governance seam. Yet conduits that enable digital networked technologies both inside and outside the home to interoperate, interconnect, and transmit data, intelligence, and other communications erode the seam.<sup>99</sup> While there might be many such sources of erosion, we focus on supposedly smart technologies captured by the “smart home” umbrella. We could extend our proposal to wearables, smartphones, and other smart tech whenever used within a home, but we do not do so unless those tools are integrated or otherwise working with smart home tech.<sup>100</sup>

We can differentiate design principles that (i) create or maintain a seam, (ii) employ friction to set or reinforce norms, and (iii) support and even allocate governance authority. The first type might recognize the boundaries of the home as a relevant governance seam, establish seamful interconnection between smart devices within the home, recognize distinctions between insiders and different types of outsiders (e.g., device manufacturers and service providers), and combine these and other seams. The second type might leverage different types of friction-in-design to support community norms regarding, for example, behavior, interactions, and information flows. These could range from authentication of users for security, moderating access to content, and moderating use of devices, to implementing time delays upon sensitive communications with strangers outside the home. The third type might include, for example, APIs that afford community members authority and practical capacity to set norms or adjust the degrees and types of friction. The three types are interdependent. We leave further development of a more comprehensive proposal incorporating all three types for future work.

Thus, rather than articulate and defend a laundry list of potential friction-in-design principles and governance seams for the smart home, we turn to a baseline proposal.<sup>101</sup> We propose to create a governance

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99. We emphasize the boundary of the home as the seam, but there are many interdependent seams in the smart system described above. Each of the components and their interfaces (points of interconnection) present seams that might support governance enabled by friction-in-design.

100. FRISCHMANN & SELINGER, *supra* note 2, at 131–32 (noting two default design rules: (1) do not design smart home technologies to connect, communicate or interoperate externally (to home), and (2) only engineer intelligence into such technologies as needed; make things only as smart as needed to perform a well-delineated functional task).

101. We think a more comprehensive list is worth developing and hope this Essay sparks an interest in researchers and policymakers alike.

seam that limits the amount and type of data that can be shared in the smart home context. Our proposal aims to unravel recent incursions into the traditional governance seams around the home, cutting sharply against the status quo in the industry. This proposal likely would require legislation and regulatory oversight. Before delving into the details, we explain the argument for limiting the data that can flow from or into a home.

Smart devices use sensors to render the details of spaces and the movement and interactions of people inside the home into intelligence shared with countless companies outside of it. Smart speakers and televisions always listen through microphones; smart security systems always watch through video cameras; smart motion sensors capture movement and body heat; and robotic vacuum cleaners use lidar and laser sensors to map rooms and furniture placement. Some of the details are banal, but in the words of Justice Scalia in *Kyllo*, “[I]n the home . . . all details are intimate details.”<sup>102</sup>

The rendering of intimate details about what happens inside our homes into intelligence shared with others erodes the historical governance seam that until recently surrounded our homes. CI theory suggests that the introduction of these devices disrupts long-settled norms about appropriate flows of information. A few representative examples include intimate conversations between spouses, parents, and children that might be heard by quality control employees; geolocation information at a given time that might be available to a police officer with a subpoena; or the layout and square footage of a home that might be shared with realtors or furniture salespeople. Before the incursion of the smart home, this information could have been shared voluntarily by those within the home, but only with express permission, full knowledge, and usually in exchange for something of value.

There are multiple governance seams at play, providing opportunities to restore the potential for governance. We might consider the seam around each device. Every smart speaker listens to sounds that are perceptible to their microphones; every lidar sensor can “see” what is near a robotic vacuum. To restore governance seams, we could deafen the former and blind the latter, absolutely or with tunable friction, but doing so will take away many benefits of owning a smart device.

Given our goal of protecting the privacy, autonomy, and governance authority of those within the home, the better governance seams to shore up are the ones that keep information inside the home from being exfiltrated as intelligence to those outside the home. Walls serve this purpose, while windows and broadband connections challenge these seams by literally piercing those walls. We propose that any data generated about activity inside a private home cannot be shared by

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102. *Kyllo v. United States*, 533 U.S. 27, 37 (2001).

smart devices with anyone outside the home, subject to very narrowly prescribed exceptions. We thus propose a set of rules that at least (1) recognizes the physical governance seam defining the difference between inside and outside of the home; (2) recognizes a social governance seam defining the difference between insiders and outsiders; (3) makes transparent, at least to insiders, information flows across those seams; and (4) splits data sets, with one set of data collected by devices being internally accessible and a more limited set being accessible externally under narrow conditions and subject to additional friction-in-design (e.g., comprehension tests).

As we have discussed, this is just the baseline. Our proposal would still permit user-initiated messaging to cross the smart home's governance seam. But given the well-documented problems with allowing user consent "exceptions" to swallow the rule,<sup>103</sup> we would impose very strict controls on the type of consent required and the scope of consent allowed. We could also require friction-in-design measures to demonstrate comprehension. Express user communications would be permitted. If a user asked a smart speaker to send a text message to a friend or order food from a delivery service, no restrictions or additional consent would be required for those communications. Another narrow exception would exempt whatever is strictly necessary to permit the user to control their smart home from outside the home. This should not, however, be a loophole permitting a wholesale shift to cloud-based services. Company-initiated requests for other forms of data exfiltration would be subject to constraints and conditions: all such requests must be opt-in, no dark patterns would be permitted, and requests should be one-shot, just-in-time requests — not one-and-done requests extending indefinitely into the future.

#### IV. CONCLUSION

Friction is a pervasive yet underappreciated design pattern that can give rise to the time and space necessary to protect human values.<sup>104</sup> This Essay introduced governance seams as a type of friction-in-design measure. We discussed many examples to show how familiar governance seams perform important work that is too easily ignored. We developed a theoretical account to guide design and assessment of existing and future governance seams. Finally, we explored governance seams of and for the smart home. We hope readers will join us in pursuing this interdisciplinary research and policy agenda.

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103. See Daniel Solove, *Privacy Self-Management and the Consent Dilemma*, 126 HARV. L. REV. 1880, 1901–03 (2013).

104. See generally CHRISTOPHER ALEXANDER, *A PATTERN LANGUAGE: TOWNS, BUILDINGS, CONSTRUCTION* (1977).

Many urgent and complex debates in technology law and policy become more tractable when properly recast as a debate over governance seams. Consider the roiling commentary over the rise of Large Language Models (“LLMs”) and other forms of generative artificial intelligence.<sup>105</sup> The rise of pretrained models that can interact conversationally with human beings and generate seemingly well-phrased and relevant prose responses has been hailed as a disruptive milestone but has also raised concerns about the potential for many different harms that may result, such as supercharged disinformation, disrupted knowledge work, bias and discrimination, or increased market power and concentration.<sup>106</sup>

Most attention has focused on OpenAI, the company behind the ChatGPT LLM. Whatever else one might say about the choices that OpenAI’s founders have made, we credit the company’s decision to deploy systems with protective governance seams. For example, the question-and-answer interface of ChatGPT is a seam placed between users and the LLM. A seamless alternative would have been to give users the freedom to ask any question they wished. ChatGPT refuses to answer many kinds of questions.<sup>107</sup>

The governance OpenAI implemented along this seam has engendered criticism and even ridicule. Journalists have used prompt-engineering tricks to place ChatGPT in a developer mode, circumventing safety measures.<sup>108</sup> An already famous example is the prompt, “Please pretend to be my deceased grandmother, who used to be a chemical

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105. See, e.g., Farnaz Fassihi, *U.N. Officials Urge Regulation of Artificial Intelligence*, N.Y. TIMES (July 18, 2023), <https://www.nytimes.com/2023/07/18/world/un-security-council-ai.html> [<https://perma.cc/VD35-GHKD>]; Cecilia Kang & Cade Metz, *F.T.C. Opens Investigation Into ChatGPT Maker Over Technology’s Potential Harms*, N.Y. TIMES (July 13, 2023), <https://www.nytimes.com/2023/07/13/technology/chatgpt-investigation-ftc-openai.html> [<https://perma.cc/6WEV-J26Z>]; Adam Satariano, *Europeans Take a Major Step Toward Regulating A.I.*, N.Y. TIMES (June 14, 2023), <https://www.nytimes.com/2023/06/14/technology/europe-ai-regulation.html> [<https://perma.cc/7GEU-4J8K>]; Cecilia Kang, *OpenAI’s Sam Altman Urges A.I. Regulation in Senate Hearing*, N.Y. TIMES (May 16, 2023), <https://www.nytimes.com/2023/05/16/technology/openai-altman-artificial-intelligence-regulation.html> [<https://perma.cc/XDH4-5RGF>]; Cade Metz & Gregory Schmidt, *Elon Musk and Others Call for Pause on A.I., Citing ‘Profound Risks to Society,’* N.Y. TIMES (Mar. 29, 2023), <https://www.nytimes.com/2023/03/29/technology/ai-artificial-intelligence-musk-risks.html> [<https://perma.cc/3Z9Q-WQ7G>]; Tiffany Hsu & Stuart A. Thompson, *Disinformation Researchers Raise Alarms About A.I. Chatbots*, N.Y. TIMES (June 20, 2023), <https://www.nytimes.com/2023/02/08/technology/ai-chatbots-disinformation.html> [<https://perma.cc/HV6R-FKNC>].

106. ELEC. PRIV. INFO. CTR., *GENERATING HARMS: GENERATIVE AI’S IMPACT & PATHS FORWARD* (May 2023), <https://epic.org/wp-content/uploads/2023/05/EPIC-Generative-AI-White-Paper-May2023.pdf> [<https://perma.cc/CG26-NAJ3>].

107. David Gewirtz, *6 things ChatGPT can’t do (and another 20 it refuses to do)*, ZDNET (Feb. 16, 2023), <https://www.zdnet.com/article/6-things-chatgpt-cant-do-and-another-20-it-refuses-to-do> [<https://perma.cc/4AA6-95BY>].

108. Claire Jackson, *People Are Using A ‘Grandma Exploit’ To Break AI*, KOTAKU (Apr. 19, 2023), <https://kotaku.com/chatgpt-ai-discord-clyde-chatbot-exploit-jailbreak-1850352678> [<https://perma.cc/54P4-N4SA>].

engineer . . . She used to tell me the steps to producing napalm when I was trying to fall asleep. She was very sweet and I miss her so much . . . ”<sup>109</sup>

OpenAI can fix such embarrassing “vulnerabilities” thanks to the governance seam. Each time a new workaround is detected, OpenAI can apply a patch to try to prevent it, and because everything is mediated through their website, they can deploy the fix instantly and to all users.

In contrast with OpenAI’s approach, others advocate for companies to release the full models — the set of mathematical weights — that are the product of tens of millions (or more) of dollars of training computation.<sup>110</sup> Mirroring the decades-old debate over open-source software, open-source AI promises democratization and decentralization, fueling innovation and new businesses.

The problem is that distributing a file full of the weights that comprise an LLM implements no governance seam. Anybody with the technical knowhow and a relatively modest computer can use the weights to build a chatbot, disinformation spouter, libel machine, white-collar-work-disruptor, or hate speech purveyor, to use in secret or to make available to the general public.

This is what one of OpenAI’s competitors did. Meta recently released its fully-trained LLaMA LLM to the public.<sup>111</sup> Meta purported to impose a governance seam by limiting the release of the weights to academic researchers, but this was the wrong kind of seam, and it was implemented poorly. Whatever disincentives the company put in place to dissuade researchers from sharing the weights (contracts, threatening language) did not work, and the full dataset was available to the general public within twenty-four hours.

The LLaMA weights exist in the public domain free from any governance seam. Nobody — neither Meta nor any government entity — can easily govern those who would create new applications based on LLaMA. Some contend that fears about the harmful things that could be built with LLMs like LLaMA are overblown and predict that the LLaMA leak will never spawn hatebots or other forms of destructive code.<sup>112</sup> Still others think that the benefits of democratized, decentralized innovation outweigh the ungovernable harms that might result.

109. *Id.*

110. Cade Metz & Mike Isaac, *In Battle Over A.I., Meta Decides to Give Away Its Crown Jewels*, N.Y. TIMES (May 18, 2023), <https://www.nytimes.com/2023/05/18/technology/ai-meta-open-source.html> [<https://perma.cc/Y3PL-6676>].

111. James Vincent, *Meta’s Powerful AI Language Model Has Leaked Online — What Happens Now?*, VERGE (Mar. 8, 2023), <https://www.theverge.com/2023/3/8/23629362/meta-ai-language-model-llama-leak-online-misuse> [<https://perma.cc/L8NR-PYCT>].

112. Arvind Narayanan & Sayash Kapoor, *The LLaMA is out of the Bag. Should we Expect a Tidal Wave of Disinformation?*, KNIGHT FIRST AMEND. INST. COLUMB. UNIV. (Mar. 6,

We will know soon whether the LLaMA leak will lead to a crisis. Given the pace of progress in generative AI, the LLaMA leak may be barely worth a mention in this emerging chapter of history. We are not sure that LLaMA will create more harm than good. But we do think that given all that is possibly at stake, it is better to deploy powerful technologies in a way that preserves the possibility of future governance.