# Revisiting Code-as-Law: Regulation and Extended Reality

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**ABSTRACT**

*In the wake of Judge Frank Easterbrook's critique of the development of specific laws for cyberspace, Lawrence Lessig's 1998 proposition of "code-as-law" framed the internet's regulatory landscape through the interplay of four modalities—law, norms, market, and architecture. Today, at the start of the era of spatial computing, also known as extended reality (XR), it is timely to reassess Lessig's insights for this burgeoning digital frontier. This Article seeks to (1) update Lessig's framework to suit 3D computing, (2) envision governance for these novel systems, and (3) reimagine technological governance amidst failing traditional institutions.*

*Revisiting code-as-law, the dynamic interplay of Lessig's modalities in digital governance shows how norms have played a central role. The internet's formative years echo today's nascent XR landscape in terms of legal ambiguity and technical volatility, as the parallel between the 1990s internet and current XR statistics underscores.*

*Leading corporations' large investments in XR suggests that immersive technology will dominate future computing. XR demands new governance models due to its layering of digital environments onto real spaces, its profound sensory and psychological impact on users, and the commercial drive for content within virtual worlds, contrasting with the origins of the internet, with the impetus coming from outside the private sector.*

*The uniqueness of XR, and more explicitly the differences from traditional flat screen computing, presents new governance challenges. When traditional modalities fail, society often reverts to hard law for*

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*intervention. This Article ponders the inflection points that could lead to such demands within XR pertaining to privacy concerns and the reemergence of online harms in a new medium. It questions the adequacy of Lessig's model in addressing systemic inefficiencies and the renegotiation of modalities in light of power imbalances.*

*In sum, the study of cyberspace—and by extension, spatial computing—should transcend technical specifics and consider how emerging technologies can become inclusive or exclusionary. Drawing parallels with the early internet, this Article advocates for deliberate creation of networked spaces that embrace new modes of governance, thereby shaping a more equitable digital future.*

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## I. INTRODUCTION

In 1998, in a response to Judge Frank Easterbrook's comment that a separate body of law for cyberspace was unnecessary, just as a separate law of the horse was unnecessary,[1] Lawrence Lessig famously proposed "code-as-law" to signify how the cyberlaw could teach about the law's regulation of human behavior through a negotiation of four modalities—law, norms, market, and architecture.[2] At that time, society was on the cusp of the emergence of the internet.[3] Today we similarly stand at the onset of the next computing paradigm, spatial computing or extended reality (an umbrella term for the combination of augmented reality (AR) and virtual reality (VR), collectively known as XR). This moment offers a particular opportunity to revisit Lessig and develop an updated understanding of what code-as-law has demonstrated over the past generation about effective digital governance.

This Article has three main aims. First, it updates Lessig's framework for what comes after the internet in the move to 3D computing. Second, it applies this Article's updated framework to illustrate what governance models could look like for new computing systems. Finally, it asks a question borne of practical experience with online paradigms: how can technological governance be reimagined in a world of failing institutions of governance?

The analysis begins by revisiting Lessig's seminal theory of code-as-law to reveal what parts of his analysis endure and what parts should be reconsidered. Importantly, while Lessig focused on describing the modalities, this Article describes the ways they interact with each

1. Frank H. Easterbrook, *Cyberspace and the Law of the Horse*, 1996 U. CHI. L.F. 207, 207–08 (1996).

2. *See* Lawrence Lessig, *The Law of the Horse: What Cyberlaw Might Teach*, 113 HARV. L. REV. 501, 510 (1999).

3. *See* Brittany Levine Beckman, *What Apple, Google, and Amazon's Websites Looked like in 1999*, MASHABLE (Aug. 5, 2023), https://mashable.com/article/90s-web-design [https://perma.cc/87JV-Y523].

other: directly influencing digital governance and indirectly shaping each other. Norms, which Lessig glossed over in favor of code and law, emerge at the heart of this interconnected system.

Similarities across time are also important and emphasize why it is vital to revisit Lessig's theory today. Lessig shaped the dialogue about governance in the early days of the internet.[4] The legal treatment of technologies that are newly entering the consumer market consists of more unknowns than knowns, just as with the internet of the 1990s. From a technical development standpoint, XR in the 2020s is in a similar position to the 1990s to early 2000s internet, where the hardware floor, or the basic form factor of computer devices, was on the cusp of solidifying, but was still volatile. For example, in 1998, around the time Lessig was crafting his seminal code-as-law framework, there were approximately 150 million internet users.[5] Statistics from 2023 show about 171 million XR users.[6]

If the largest companies' investments shape how users engage in technology adoption, then immersive technology looks like the future of computing. This is a move to a pervasive, spatial computing network that users participate in for commerce, learning, entertainment, and communication. It is designed to replace your laptop and your cell phone.[7] This Article will describe how these new forms of spatial computing to underscore why regulators should evaluate them differently from preexisting web-based technology.

Three differences between XR and flat screen-based computing emerge as important. First, while thinkers in the 1990s were grappling with whether to consider cyberspace a distinct realm[8] necessitating new rules, today's XR stacks layers of digital environments upon real spaces, meaning that its rules must necessarily have a more direct interaction with those spaces' preexisting law. This is true with augmented reality overlays, mixed reality, and even virtual reality's reliance on physical input to make XR headsets work.

Second, XR systems have a visceral effect on users because of the fundamental physicality of XR interfaces that far surpasses reading

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4. Viktor Mayer-Schonberger, *Demystifying Lessig*, 2008 WIS. L. REV. 713, 714 (2008).

5. *Internet Growth Statistics*, INTERNET WORLD STATS, https://www.internetworldstats.com/emarketing.htm [https://perma.cc/38T6-NSDT] (last visited Mar. 3, 2024).

6. Demond Cureton, *Virtual Reality Statistics to Know in 2023*, XR TODAY (Feb. 28, 2023), https://www.xrtoday.com/virtual-reality/virtual-reality-statistics-to-know-in-2023 [https://perma.cc/BA9D-KH8L].

7. Tushar Mehta, *How AR Glasses Are Going from Niche Gadget to Smartphone Replacement*, DIGITALTRENDS (June 30, 2022), https://www.digitaltrends.com/mobile/ar-glasses-replace-smartphones-future-how/ [https://perma.cc/23GC-DW5U].

8. *See* Lessig, *supra* note 2, at 504.

words on a web page. To restate: Because of psychological characteristics, like presence, immersion, and embodiment, the impact of XR on our minds and bodies differs from the impact of flat screen-based technologies.

Third, a different type of organic content is finding its way into virtual worlds. The drivers of the internet were academic and government forces; this differs substantially from the commercially driven metaverse.[9] The disparate role of education and public goods in the metaverse reflects the different philosophies taking root in XR, and examining how companies can be nimble provides insight into some of the overlooked user benefits from market-driven technological development.

When we consider Lessig's theory applied to XR, there is more to explore about how his four modalities interact. Knowledge of differences and similarities illuminates our assumptions about the functioning of law, the role of norms, the limitations of the market, and the plasticity of what Lessig termed "the architecture of code."[10] His theory defines governance or "net regulation" as "the sum of the regulatory effects of the four modalities together."[11] But it is unclear if Lessig's descriptive schema contemplated what would happen in inefficient systems. In other words, if politics breaks the functioning of law enforcement and the legislative process, if market forces are ineffective, if new architectures embed preexisting biases, and if norms do not allow for rebalancing due to preexisting power dynamics—then how does the negotiation of the modalities break down?

Code, unlike law, is self-executing. Considering this difference, it is unclear what happens when a modality fails and balancing results in ineffective digital governance. This Article proposes that such an inflection point calls for interventions based on hard law, especially in light of the public's waning faith in self-regulation. Such calls are already present in XR's hybrid physical-digital reality.

To explore this dynamic, this Article turns to the challenges with XR privacy and the reemergence of online harms in XR as a lens to examine when and how Lessig's factors create a tipping point. What happens when self-regulation of new technology fails? When do societies demand a return to the baseline of traditional law as regulator? What institutions do we turn to for this realignment? When do negotiations between modalities result in such a return?

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9. *A Brief History of NSF and the Internet*, U.S. NAT'L SCI. FOUND. (Aug. 13, 2003), https://www.nsf.gov/news/news_summ.jsp?cntn_id=103050 [https://perma.cc/33EL-6GSG].

10. Lessig, *supra* note 2, at 508–09.

11. *Id.* at 508.

Part II discusses the debate between Easterbrook and Lessig regarding the need for a separate legal regime for cyberspace and introduces Lessig's code-as-law theory. Part III compares early internet systems with today's spatial computing, emphasizing the evolution and societal impact of technology. Part IV introduces spatial computing or extended reality technologies, explaining their operation, impact, and how they differ from traditional flat-screen computing. Part V describes the impact of spatial computing hardware on users' bodies and minds. Part VI describes how Lessig's code-as-law theory results in a turn to calls for harm law, when the four modalities fail to balance. Part VII examines Lessig's four modalities in the context of XR, discussing their interplay and influence on digital governance. Part VIII focuses on the role and challenges of law in governing emerging technologies like XR, addressing specific issues such as non-consensual intimate imagery and cyberharassment and examining how regulation should approach the challenges of spatial computing.

There continues to be reason to study cyberspace beyond the technical nuances of cyberspace.[12] When technical systems, both old and new, do not allow for norm setting, communities can be disproportionally impacted. Members of these groups may consider "the law of the horse" to be a horse of a different color. It is important to study the anthropology of the internet to determine rules of governance for the spatial web. It is also important to study the architecture of XR to understand how inclusive—or exclusionary—emergent technologies can be. This moment presents a rare chance to implement the lessons from the early internet in the emerging space of XR. With more awareness and deliberation, new networked spaces can avoid the issues encountered in the early days of the internet.

## II. "THE LAW OF THE HORSE"

In 1995, Frank Easterbrook wrote *Cyberspace and the Law of the Horse* to explain that a separate legal regime would not be necessary to govern property in cyberspace, just as a new class of laws was unnecessary for torts specifically related to horses.[13] According to Easterbrook, to create a regime specific to cyberspace would be to lose the value of the broader context of law.[14] Lawrence Lessig's 1999 response, *The Law of the Horse: What Cyberlaw Might Teach*, countered

12. *See id.* at 502 ("I agree that our aim should be courses that 'illuminate the entire law,' but unlike Easterbrook, I believe that there is an important general point that comes from thinking in particular about how law and cyberspace connect.").

13. Easterbrook, *supra* note 1.

14. *Id.*

that studying cyberspace could elucidate the very fundamentals of governance.[15] In his work, Lessig provided the foundation for his theory of code-as-law, detailing what cyberlaw itself could teach about how law operates as a negotiation of four modalities in largely ungoverned spaces like the then-emerging world of the internet.[16] Although the architecture of cyberspace, or "the hardware and software that make each cyber-space the way it is," is more malleable than physical architecture, Lessig argued that this digital architecture nevertheless similarly places practical constraints on human behavior.[17] Essentially, Lessig contended that the architectural design of online spaces can shape and control the actions of individuals and communities, just as law does.[18] As a result, the consideration of code's policy implications is of equal importance as the analysis of the regulatory impacts of legislation.

Specifically, Lessig argues that code regulates behavior in three ways.[19] The first is what Lessig calls code-as-law, which occurs when software code explicitly restricts or permits certain actions.[20] In doing so, it functions as a direct form of regulation. For example, access controls like passwords or user interface design choices can determine the actions available to users while they are within a system. Code that requires users of a social network to use their real name—or, conversely, code that permits users to operate under pseudonyms—has significant and far-reaching implications for the social environment on that network, and even with respect to the enforceability of laws against transgressors.[21]

Next, "architectural constraints," which Lessig defines as the design of digital systems and the choices developers make, both of which can impose implicit constraints on user behavior.[22] These constraints may be unintentional but nonetheless have regulatory effects. For instance, the structure and ranking algorithm of a social media feed

15. *See* Lessig, *supra* note 2, at 502.

16. *See* LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBERSPACE 6 (1999); *see also* Lessig, *supra* note 2, at 507.

17. Lessig, *supra* note 2, at 503, 509. For example, the properties of physics prevent people from walking through the walls instead of through doors. Similarly, people use log-in credentials as an entry portal to access a website—hacking into one's own "access point" is no more efficient or subtle than taking an axe to drywall.

18. *Id.* at 509.

19. *Id.* at 503, 510.

20. *Id.* at 510.

21. COMPUTER SECURITY HANDBOOK §§ 70.1–70.37 (S. Bosworth, M.E. Kabay & E. Whyne eds.,6th ed. 2015).

22. Lessig, *supra* note 2, at 509.

influences the content that is promoted or the available privacy settings.[23]

Finally, Lessig considers affordances and defaults.[24] These are the features and options platforms provide that can shape user behavior by rendering certain actions easier or more difficult via the addition or lessening of friction.[25] Defaults, which are preselected settings or options when users first interact with a system, can significantly influence user behavior.[26] For example, setting the default of a financial service to publicly share transaction information can help build the social element of that service, but it could also expose its users to privacy risks and fraud.[27]

Lessig's code-as-law theory highlights the importance of understanding and critically analyzing the impact that technology and digital infrastructure have on society.[28] Governments create and enforce laws, social norms emerge from collective values, and the market operates through economic incentives.

## III. COMPUTING SYSTEMS OF THE 1990S AND TODAY

Computing systems are increasingly ubiquitous; digital devices and platform use mediate the quotidian.[29] The broader theory of code-as-law has become canonical in technology policy, emphasizing the profound social, political, and economic consequences that code design and implementation can have.[30] But to analyze and update this analysis, it is essential to ground one's thinking in both the technology that Lessig considered and the emerging technology with which society is presently experimenting.

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23. Karen Hao, *The Facebook Whistleblower Says Its Algorithms Are Dangerous. Here's Why.*, MIT TECH. REV. (Oct. 5, 2021), https://www.technologyreview.com/2021/10/05/1036519/face-book-whistleblower-frances- haugen-algorithms/ [https://perma.cc/CWJ3-VEJD].

24. *See* Lessig, *supra* note 2, at 510.

25. *Id.*

26. Eugen Eşanu, *How to Influence Choice Through Default Effect*, PHASE MAG., https://phase.com/magazine/how-to-influence-choice-through-default-effect/ [https://perma.cc/7KSR-2WND] (last visited Mar. 3, 2024).

27. *E.g.*, Heather Kelly, *Facebook Privacy Settings to Change Now*, WASH. POST (Jan. 31, 2024, 10:00 AM), https://www.washingtonpost.com/technology/2021/09/23/venmo-privacy-settings/ [https://perma.cc/PEH5-HEG2].

28. Lessig, *supra* note 2, at 502.

29. *Cf.* John DiGiacomo, *Internet Law: Everything You Need To Know*, REVISION LEGAL (June 7, 2019), https://revisionlegal.com/internet-law/internet-law-everything-you-need-to-know/ [https://perma.cc/7VXN-RDHH].

30. *See, e.g.*, Alicia Solow-Niederman, *Emerging Digital Technology and the "Law of the Horse,"* UCLA L. REV. (Feb. 19, 2019), https://www.uclalawreview.org/emerging-digital-technology-and-the-law-of-the-horse/. [https://perma.cc/23LG-F4FT].

### *A. Internet of the 1990s–2000s*

Lessig and Easterbrook's debate occurred at a critical moment of technological development. Important hardware elements of the computer of the 1990s were still in flux.[31] The 1998 introduction of the iMac revolutionized the personal computer: a self-contained, all-in-one monitor and desktop computer designed for simple connectivity to the internet.[32] The iMac ushered in Steve Jobs's return to Apple and a new era of profitability for the company.[33] Another user interface development that hit the mainstream at the time was the laptop, which first emerged in the late 1980s and gained commercial success during the 1990s.[34] Consequently, Apple streamlined its product line into consumer and professional models of laptops and desktop iMacs.[35]

During this same period, computing capabilities greatly improved. Annual processor power increases grew from 25 percent in the early 1980s to more than 50 percent every year by the late 1980s and through the 1990s, demonstrating the ability for computing systems to continuously revolutionize their technical potential.[36] Each year, new technological feats were possible that mere years before would have been regarded as within the realm of science fiction.

Similarly, the user experience of the internet was in great flux during the 1990s. Tim Berners-Lee created the first graphical web browser, the World Wide Web, at CERN in 1990, leading to mass adoption.[37] Internet access speeds also grew rapidly from an average of

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31. *See* Christopher Sirk, *Computing Evolves. Part V: Jacked in (1990–1999)*, CRM.ORG (May 28, 2023), https://crm.org/articles/computing-evolves-part-v-jacked-in-1990-1999 [https://perma.cc/ZDL2-HLKB].

32. Evan Comen, *Check out How Much a Computer Cost the Year You Were Born*, USA TODAY (Oct. 3, 2018, 11:04 AM), https://www.usatoday.com/story/tech/2018/06/22/cost-of-a-computer-the-year-you-were-born/36156373/ [https://perma.cc/8KL7-E8UV].

33. Alyson Shontell, *The Greatest Comeback Story of All Time: How Apple Went From Near Bankruptcy to Billions in 13 Years*, BUS. INSIDER (Oct. 26, 2010, 11:13 AM), https://www.businessinsider.com/apple-comeback-story-2010-10 [https://perma.cc/GMG6-TYYG].

34. Sirk, *supra* note 31.

35. Comen, *supra* note 32.

36. Tyler Perry, *How Did Computings Change During the 1990s?*, INTO THE 90S (Jan. 18, 2023), https://www.intothe90s.com/90s-nostalgia/how-did-computers-change-during-the-1990s [https://perma.cc/ES54-975D].

37. *The History of Web Browsers*, MOZ://A, https://www.mozilla.org/en-US/firefox/browsers/browser-history/ [https://perma.cc/8UZH-J326] (last visited Mar. 3, 2024). CERN, the European Organization for Nuclear Research, is one of the world's largest and most respected centers for scientific research. CERN, https://home.cern/ [https://perma.cc/7K3X-RZHU] (last visited Mar. 4, 2024).

10kbit/s in 1990 to 100kbit/s in 2000.[38] Banners laid the foundation for online advertising and business models.[39] Internet usage similarly grew dramatically.[40] According to the World Wide Web Consortium, the initial numbers of internet users doubled yearly from 1995–1998 with the earliest adopters, and then the growth curve flattened slightly to accommodate mass markets.[41] Ultimately, usage grew from 2.6 million consumers in 1990, around the time that Lessig published his "Law of the Horse" response, to 400 million by 2020.[42]

In other words, the 1990s were not merely a period of rapid growth and constant disruption for the web-based "cyberspace" that Lessig and Easterbrook were debating.[43] Rather, it was a critical decade marking the inception of the modern experience for most users—that is, an interactive, graphical experience one browses from a local device, driven by increasingly instantaneous user feedback.[44] Later, the rise of smartphones and mobile technology continued to shape the modern experience, but the technical essentials and foundational user experience for online worlds materialized in the 1990s.

### *B. Spatial Computing Today*

Almost thirty years later, the heyday of early internet service providers—like America Online and Netscape—that Lessig and Easterbrook used to demonstrate their technical points had passed.[45] The technological advancements of the 1990s are noteworthy because today XR sits at the same technical transformative moment that the web went through during that decade.

This transition brings opportunities and risks alike for the new medium. Section VII.B details how the noncommercial nature of the internet gave it a particular character, making certain types of code and online structures flow more logically from their creators.

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38. Will Fox, *Global Average Internet Speed, 1990-2050*, FUTURETIMLINE.NET (Aug. 25, 2022), https://www.futuretimeline.net/data-trends/2050-future-internet-speed-predictions.htm [https://perma.cc/2P8N-DM5Z].

39. Adrienne LaFrance, *The First-Ever Banner Ad on the Web*, ATLANTIC (Apr. 21, 2017), https://www.theatlantic.com/technology/archive/2017/04/the-first-ever-banner-ad-on-the-web/523728/ [https://perma.cc/RN5N-WKTA].

40. *See Internet Growth Statistics*, *supra* note 5.

41. *Id.*

42. Hannah Ritchie, Edouard Mathieu, Max Roser & Esteban Ortiz-Ospina, *Internet*, OUR WORLD IN DATA, https://ourworldindata.org/internet [https://perma.cc/58WV-7LYQ] (last visited Mar. 3, 2024).

43. *See generally* Lessig, *supra* note 2, at 502.

44. Sirk, *supra* note 31.

45. Lessig, *supra* note 2, at 508–09, 530; Easterbrook, *supra* note 1, at 214.

Educational and experimental spaces flourished under this regime.[46] But this also made the early web more susceptible to viewpoint bias and a lack of diversity that is more apparent in retrospect.[47] The university environment that incubated the web meant its earliest creators had similar levels of education, along with shared demographics and life experiences.[48]

Early XR spaces are different because they are commercially driven.[49] A key impetus of XR is profitability, and platforms want as broad an audience as possible to increase market viability.[50] As such, these platforms have attracted users and content creators from a variety of backgrounds, resulting in early XR experiences ranging from mass market first-person shooter and exercise games[51] to first-person examinations of racial microaggressions[52] and explorations of civil rights history.[53]

Legally, uncertainty persists akin to what fomented the "Law of the Horse" debate. Some legal scholars have already sought to reassess Lessig's framework regarding emerging technology like artificial intelligence and blockchain technologies.[54] Some early assessments of how existing law impacts XR technologies have proliferated[55] in a similar manner to 1990s debates about the application of legal fundamentals to cyberspace. Specifically, courts and regulatory bodies have yet to determine foundational applications of XR to jurisdiction,

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46. *See generally* Barry M. Leiner, Vinton G. Cerf, David D. Clark, Robert E. Kahn, Leonard Kleinrock, Daniel C. Lynch, Jon Postel, Larry G. Roberts & Stephen Wolff, A BRIEF HISTORY OF THE INTERNET, INTERNET SOC'Y (1997), https://www.internetsociety.org/internet/history-internet/brief-history-internet/ [https://perma.cc/B7CT-YBLX].

47. *See id.* at 10.

48. *Id.*

49. Jon Quast, *Here's How Much Meta Platforms Spent on the Metaverse in 2022*, THE MOTLEY FOOL (Feb. 8, 2023, 6:05 AM), https://www.fool.com/investing/2023/02/08/how-much-meta-platforms-spent-on-metaverse-2022/#:~:text=Mark%20Zuckerberg's%20%2413.7%20billion%20bet&text=This%20%2413.7%20billion%20is%20in,revenue%20of%20just%20%244.4%20billion [https://perma.cc/DCW3-ZRNU].

50. *Id.*

51. *Creating at Cline Library*, N. ARIZ. UNIV. CLINE LIBR. (Feb. 13, 2024, 2:03 PM), https://libraryguides.nau.edu/creating/xr-experiences [https://perma.cc/ZMD4-4PHY].

52. C.D. Cogburn, J.N. Bailenson, E. Ogle, T. Asher & T. Nichols, *1,000 Cut Journey (2018)*, VIRTUAL HUM. INTERACTION LAB, https://vhil.stanford.edu/downloads/1000cut [https://perma.cc/ETK7-AQCG] (last visited Mar. 3, 2024).

53. Emory Craig, *"I Am A Man" VR Experience Puts You Inside the Civil Rights Movement*, DIGIT. BODIES CONSULTING (Feb. 7 2020), https://www.digitalbodies.net/i-am-a-man-vr-experience-puts-you-inside-the-civil-rights-movement/ [https://perma.cc/65VJ-7ZNN].

54. *See* Solow-Niederman, *supra* note 30.

55. *Existing Law and Extended Reality: A Research Symposium at Stanford Law School*, STAN. CYBER POL'Y CTR. (Jan. 6, 2023), https://sites.google.com/stanford.edu/xr-2023/home [https://perma.cc/D248-L7X8].

criminal statutes, and evidentiary codes.[56] Therefore, while spatial computing technology and the surrounding law bear important differences from the 1990s, the similarity of the current moment encourages revisiting how emerging technologies like XR fit into existing law and why their differences matter in forming new regulation. To proceed, it is important to outline what XR is, how it functions, and its similarities to and differences from the technology of the "Law of the Horse" debate.

## IV. ENTER XR TECHNOLOGIES

XR is fundamentally different than traditional flat-screen computing. Through computing in three dimensions and applying digital overlays in real places, XR technology injects digital information into the physical world at multiple layers. Examples of XR use include meeting participants convening in a VR conference room filled with other participants' photorealistic avatars, or surgeons-in-training wearing AR glasses to practice the right incision depth and pressure to apply in knee surgery while making cuts on a virtual body.

Furthermore, spatial computing platforms imbue users' bodies, senses, and intellects with digital information, which studies show can alter users' perceptions of what is real, who they are, what physical form they possess, what is safe, what is dangerous, and what is within their realm of physical possibility.[57]

### *A. How Does XR Work?*

Properly understanding the social impact of XR requires an understanding of its operation. This is especially important for legal analysis, which requires sufficient contacts with the tangible reality of the space it seeks to regulate to determine, for example, whether an action meets the threshold for establishing guilt or attaching liability. Thus, a brief general primer is important to distinguish XR from web-based computing interfaces and to explain why the use of specifically tailored platform policies is warranted, as these platforms operate

56. David Hoppe, *Can the Long Arm of the Law Reach into Extended Reality?*, GAMMA L. (Dec. 14, 2021), https://gammalaw.com/can-the-long-arm-of-the-law-reach-into-extended-reality/ [https://perma.cc/FAQ4-XGJQ].

57. Jiayan Zhao, Bernhard E. Riecke, Jonathan W. Kelly, Jeanine Stefanucci & Alexander Klippel, *Human Spatial Perception, Cognition, and Behaviour in Extended Reality*, 4 FRONTIERS IN VIRTUAL REALITY 1, 1–2 (2023), https://www.frontiersin.org/articles/10.3389/frvir.2023.1257230/full [https://perma.cc/8VLE-4KSP].

differently than traditional computing and impact users in unique ways.

### 1. Virtual Reality

VR technology combines traditional computing technology and user interfaces characterized by interactive experiences like gaming and motion pictures.[58] A VR headset (often called a head-mounted display or HMD) displays a computer-generated video feed within the headset itself.[59] It splits the visuals for each eye, creating a stereoscopic 3D effect with each image showing a slightly different perspective in the same way that a human eye generates depth.[60]

The farther a user can see to the left and right, the more immersive the VR experience will be. Foveated rendering, which is the blurring of the user's peripheral view, can also render the experience more realistic.[61] This technique saves computing power, enables more detail in the central field of vision, and comes at little to no experiential cost, as human vision is naturally blurred at the edges in any event.[62]

Another key technical challenge for HMDs is reducing latency, or "time lags," in display.[63] A minimum of sixty frames per second are needed to prevent "simulator sickness" (user nausea, disorientation, or physical discomfort), and too much latency compromises the realism and immersion in the virtual environment.[64]

HMDs are inset with a wide array of cameras, focused both inward at users' eyes and outward at the physical world around them.[65] The outward cameras help the device track a user's movement and adjust their perspective accordingly.[66] HMDs measure head position and rotation using spatial mapping techniques.[67] Sensors like

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58. Rebecca A. Penn & Michael C. Hout, *Making Reality Virtual: How VR "Tricks" Your Brain*, FRONTIERS FOR YOUNG MINDS (Nov. 28, 2018), https://kids.frontiersin.org/articles/10.3389/frym.2018.00062 [https://perma.cc/44AP-4Y38].

59. Zaynah Bhanji, *A New Reality: How VR Actually Works*, MEDIUM (Oct. 1, 2018), https://medium.com/predict/a-new-reality-how-vr-actually-works-663210bdff72 [https://perma.cc/3GFH-93MD].

60. Brittan Heller, *Watching Androids Dream of Electric Sheep: Immersive Technology, Biometric Psychography, and the Law*, 23 VAND. J. ENT. & TECH. L. 1, 13 (2020) [hereinafter Heller, *Watching Androids*].

61. *Id.* at 13–14.

62. *Id.* at 14.

63. *Id.* at 15.

64. *Id.*

65. *Id.* at 14–15.

66. *Id.*

67. *Id.*

accelerometers and gyroscopes track body movement.[68] Optical sensors and handheld controllers have historically accomplished hand tracking, while newer headsets allow for controllerless, gesture-based controls using their outward-facing cameras.[69]

Inward cameras enable eye tracking, which plays a vital role in VR.[70] HMDs use an infrared camera to monitor the user's gaze inside the headset, using techniques like pupil tracking and gaze vectors to determine where the user is looking, for how long, and with what intensity.[71] These techniques enable XR systems to create more precise and realistic reactions from avatars and other in-game content. Combined with foveated rendering, eye tracking can reduce simulator sickness, thereby enhancing the overall experience.[72] At the same time, eye tracking enables rich and privacy-invasive data collection through the use of biometric psychography by determining users' interests based on what they look at and how their body responds to those stimuli.[73]

### 2. Augmented Reality

AR technology differs from VR in its relationship with physical space. Rather than blocking the outside world, AR superimposes virtual layers onto the physical environment that surrounds the user in a non-immersive HMD.[74] Most smartphones are AR-enabled, a capability famously used for location-based gaming like Pokémon GO.[75] Using on-device cameras, AR analyzes the user's visual field and the locations of nearby objects to overlay imagery, text, or encoded effects onto the user's view.[76] Like VR, AR uses cameras and an algorithm called Simultaneous Location and Mapping (SLAM) to determine a device's position and movement.[77]

AR headsets use multiple wide-angle cameras to capture surroundings from different directions.[78] Like VR devices, eye tracking

68. *Id.*

69. *Id.*

70. Brittan Heller & Avi Bar-Zeev, *The Problems with Immersive Advertising: In AR/VR, Nobody Knows You Are an Ad*, 1 J. ONLINE TRUST & SAETY (2021).

71. *Id.*

72. Heller, *Watching Androids*, *supra* note 60, at 15.

73. *Id.* at 6.

74. *AR/VR*, PCMAG., https://www.pcmag.com/encyclopedia/term/69784/ar-vr [https://perma.cc/6TFB-2EE7] (last visited Mar. 3, 2024).

75. POKÉMON GO, https://pokemongolive.com/ [https://perma.cc/J5RY-3KAG] (last visited Mar. 3, 2024).

76. Heller, *Watching Androids*, *supra* note 60, at 16.

77. *Id.*

78. *Id.* at 17.

systems in AR employ cameras pointed at the users' eyes and new headsets allow users to display their iris pattern to log in to their glasses.[79] The AR cameras and sensors create a separate computing layer from the display system.[80] Once the device knows its location and orientation, it renders a virtual 3D world from users' perspectives and overlays it onto their visual display.[81]

Developers can combine AR and VR capabilities in the same device, making it a mixed reality (MR) headset that allows users to toggle between the two formats.[82] Newer HMDs like Apple Vision Pro and Meta's Quest 3 use MR.[83] This format may be the future of spatial computing, as it allows users to be a part of both virtual and physical worlds simultaneously.

## V. THE HUMAN BODY AND MIND ON XR

While in some ways XR mirrors the early state of the internet, XR's technological underpinnings are fundamentally distinct. In fact, the design of XR systems contradicts some of the basic assumptions of analysts from the 1990s. Authors and theorists of that era imagined the internet as built into a wholly different space: a "cyberspace."[84] Author William Gibson first coined the term, describing cyberspace in his celebrated science fiction novel *Neuromancer* as "[a] graphic representation of data abstracted from the banks of every computer in the human system."[85] Indeed, a new literary genre arose in tandem with the rise of the internet: cyberpunk.[86] Many of the genre's canonical works, such as *Snow Crash*, envision how the then-recent proliferations in technology would alter the human experience.[87]

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79. *About Optic ID Advanced Technology*, APPLE, https://support.apple.com/en-us/HT214051 [https://perma.cc/ZV6R-DBUD] (last visited Mar. 3, 2024).

80. Heller, *Watching Androids*, *supra* note 60, at 17.

81. *Id.* at 17–18.

82. *Id.* at 5.

83. *Apple Vision Pro,* APPLE, https://www.apple.com/apple-vision-pro/ [https://perma.cc/WCF4-BYUL] (last visited Mar. 3, 2024); *Expand Your World with Meta Quest 3*, META, https://www.meta.com/quest/quest-3/ [https://perma.cc/J2SG-JDTT] (last visited Mar. 3, 2024).

84. *See, e.g.*, Lessig, *supra* note 2, at 501.

85. WILLIAM GIBSON, NEUROMANCER 51 (1984).

86. *See, e.g.*, NEAL STEPHENSON, SNOW CRASH (1992). Echo3D, *Top 10 Sci-Fi books on Augmented Reality and Virtual Reality*, MEDIUM (Apr. 30, 2020), https://medium.com/echo3d/top-10-sci-fi-books-on-augmented-reality-and-virtual-reality-21f3c9cd928d [https://perma.cc/E68H-B9N4].

87. *See, e.g.*, STEPHENSON, *supra* note 86; Echo3D, *supra* note 86.

This movement in speculative fiction lent the "Law of the Horse" debate particular salience: whether and how law applied in virtual environments hinged on the perception of these environments as separate spaces.[88] In fact, Lessig grappled with this question explicitly, asserting, with a nod to Easterbrook, that "one is always in real space while in cyberspace or, alternatively . . . cyberspace is not a separate place."[89] Essentially, how the law applies in cyberspace depends on whether one construes cyberspace as a "real" place.[90]

XR, on the other hand, is built to bring technology into—and layer technology onto—the physical world. Even VR embodies this transformation through a beautiful contradiction; by teleporting its user to an all-immersive, fully encompassing digital space, it fundamentally relies on physical spaces. For a user to be fully immersed in VR, able to walk through the walls of an actual house within a 3D virtual world, their device must track the physical world in minute detail to help prevent its user from walking into an actual wall or, for instances, tripping over a pet.[91] AR even more explicitly embeds its users in the physical world around them, layering features on top of what they can already see.[92]

Under the laws that determine jurisdiction, an internet server's location impacts privacy and electronic evidence in cyberspace—but the legal framework of one's physical location when in VR or AR has even more direct and far-reaching implications.[93] For example, a VR user who accidentally hits someone while using a headset will care very much indeed about how the local law treats assault and battery. Similarly, an AR service that lays virtual billboards on a user's field of view could potentially run afoul of local advertising laws.

XR systems also impact their users' bodies and minds, blurring actual and virtual realities in ways that the 1990s internet could not.[94] The technical aspects of XR create new interactions between physical and digital spaces and alter interpersonal interactions in these

88. *See* Lessig, *supra* note 2, at 502.

89. *Id.* at 502 n.5 (citing Lawrence Lessig, *The Zones of Cyberspace*, 48 STAN. L. REV. 1403, 1403 (1996)).

90. *See id.*

91. For a discussion of potential foreseeable liabilities in XR, *see* Mark Lemley & Eugene Volokh, *Law, Virtual Reality, and Augmented Reality*, 166 U. PA. L. REV. 1051 (2018).

92. Heller, *Watching Androids*, *supra* note 60, at 5.

93. *See* Lemley & Volokh, *supra* note 91.

94. *See* Heller, *Watching Androids*, *supra* note 60, at 18. This does not mean online narratives were not immersive and that actions in these environments could not have harmful impacts. *See* Julian Dibbell, *A Rape in Cyberspace*, VILLAGE VOICE (Oct. 18, 2005), https://www.villagevoice.com/2005/10/18/a-rape-in-cyberspace/ [https://perma.cc/N49D-7KL8].

environments.[95] A growing body of neuroscience and social science supports these assertions.[96] Thus, updating Lessig's theories for the next computing platform requires adapting them to reflect that new paradigm of interactivity.[97] To do that, the next section outlines the ways in which the current developments for XR parallels and contrasts the respective developments of the web.

### *A. XR's Similarities to the Internet*

The similarities undergirding the internet of the 1990s and the spatial computing systems of today run along parallel growth and social reaction curves. The growth of the technologies, as well as the public reaction to each medium, correspond to approximately the same place in the technology's adoption curve. These similarities showcase the importance of revisiting Lessig's theory in today's context.

#### 1. Adoption and Growth of the Technologies

Just as usage statistics for the web grew rapidly throughout the 1990s, XR adoption has proliferated exponentially in today's market.[98] Data on the adoption and growth curves of both the internet and XR point to early traction and mass adoption due to a corresponding rise in gaming and enterprise XR usage. The 2023 estimate of spatial computing users is roughly 400 million.[99]

Similarly, XR interfaces have undergone a rapid period of transformation reminiscent of the shift from text to graphical interfaces in the internet of the 1990s. The 2012 launch of the Oculus Rift headset ushered in a new era of VR-tethered HMDs that required connection to

95. *See* Heller, *Watching Androids*, *supra* note 60, at 18. One definition of social spatial computing, commonly known as the metaverse, is "a massively scaled and interoperable network of real-time rendered 3-D virtual worlds that can be experienced synchronously and persistently by an effectively unlimited number of users with an individual sense of presence, and with continuity of data, such as identity, history, entitlements, objects, communications, and payments." MATTHEW BALL, THE METAVERSE: AND HOW IT WILL REVOLUTIONIZE EVERYTHING 29 (2022). I will not apply this term throughout the paper, as it is branded and only one aspect of what spatial computing can encompass.

96. *See* JEREMY BAILENSON, EXPERIENCE ON DEMAND: WHAT VIRTUAL REALITY IS, HOW IT WORKS, AND WHAT IT CAN DO (2018).

97. Extended reality is also referred to as spatial computing. *See generally* Brittan Heller, *Reimagining Reality: Human Rights and Immersive Technology* (Carr Ctr. Discussion Paper Series, 2020) [hereinafter Heller, *Reimagining Reality*], https://carrcenter.hks.harvard.edu/files/cchr/files/ccdp_2020-008_brittanheller.pdf [https://perma.cc/Z5CM-7SEF].

98. Thomas Alsop, *XR Market Size 2021-2026*, STATISTA (Mar. 9, 2023), https://www.statista.com/statistics/591181/global-augmented-virtual-reality-market-size/ [https://perma.cc/AD2P-5RQS].

99. *Id.*

powerful gaming computers and used small stationary sensors called "lighthouses" to define the physical boundaries of one's virtual environment.[100] Since 2018, newer VR systems have untethered their HMDs from external computers, bringing processing onboard the device itself or offloading it to the cloud.[101] New AR glasses are lighter and more adaptable, resembling run-of-the-mill eyewear.[102]

Some key drivers of these design interface developments were the introduction of 5G, the rapid and drastic increases in computing power, and the miniaturization of processors.[103] 5G networks allow mobile XR devices to continue streaming content, just as faster internet networks improved the experience of early internet users.[104] Much as computers' processing speed doubled every year during the 1990s, HMDs' resolution and processor power have similarly expanded. This HMD advancement has persisted even as developers have battled to shrink systems into smaller and lighter wearable devices.[105]

XR thus sits at a similar transition point that the web navigated in the 1990s. The hardware is still transforming, but key baseline components—namely, an HMD with inputs of eye tracking and gestures—are coming into focus. The recent global pandemic increased focus on XR, as companies aggressively pushed for virtual presence capabilities and consumers looked for new ways to connect with friends and families.[106] Hardware developers are finding success promoting XR as a popular personal gaming device and as a new enterprise tool for improving industry and business applications.[107] If companies are

100. *See* Jonathan Strickland, *How Virtual Reality Works*, HOWSTUFFWORKS, https://electronics.howstuffworks.com/gadgets/other- gadgets/virtual-reality.htm [https://perma.cc/42CE-CM2Y] (last visited Mar. 3, 2024).

101. Sam Machkovech, *Oculus Go Review: The Wireless-VR Future Begins Today for Only $199*, ARS TECHNICA (May 1, 2018, 12:30 PM), https://arstechnica.com/gaming/2018/05/oculus-go-review-the-wireless-vr-future-begins-today-for-only-199/ [https://perma.cc/VYJ8-PLS6].

102. *Shop Ray-Ban Meta Smart Glasses & Sunglasses*, META, https://www.meta.com/smart-glasses/shop-all/ [https://perma.cc/7PHV-8MYF] (last visited Mar. 3, 2024).

103. Chris Porter, *Why 5G Is Crucial for Enterprise XR*, XR TODAY (Dec. 8, 2022), https://www.xrtoday.com/virtual- reality/5g-for-enterprise-xr/ [https://perma.cc/VW2S-N9NZ].

104. *Id.*

105. *See Introducing Vive Tracker (3.0)*, VIVE, https://www.vive.com/us/accessory/tracker3/ [https://perma.cc/6Q62-BEBV] (last visited Mar. 3, 2024).

106. *The Pandemic Pushed XR Use Beyond Fun and Games*, AREA (Apr. 29, 2021) https://thearea.org/ar-news/the-pandemic-pushed-xr-use-beyond-fun-and-games/ [https://perma.cc/4VHF-V4V2].

107. *See Accenture Extended Reality (XR) Services*, ACCENTURE, https://www.accenture.com/us-en/services/technology/extended-reality [https://perma.cc/9ALJ-PJGG] (last visited Mar. 3, 2024).

successful, XR interfaces may eventually replace the functionalities of cell phones, gaming consoles, and laptops.

### 2. Reaction to the Technologies

As the technology continues to evolve, the policy and legal ramifications of XR are also materializing. This trajectory mirrors that of the 1990s, characterized by initial enthusiasm for and curiosity about the internet alongside claims of lawlessness and concerns over morality.[108]

Just as consumers embraced and popularized the internet, companies and the media met the recent commercial introduction of XR hardware with vigor, with many touting the medium as revolutionary.[109] Companies altered course—Facebook changed its name to "Meta," and CEO Mark Zuckerberg refocused the company's future plans to build out a spatial computing-based social network.[110] Even nations took action—countries like Barbados and South Korea began to open embassies in the metaverse.[111] While the hype has since died down and some initial players have scaled back their XR investments, Apple's announcement and impending release of its mixed reality Vision Pro headset evinces that the sector may be steadily progressing, and is neither as red-hot nor as dead as commentators proclaimed.[112] Furthermore, XR hardware does not need to be omnipresent to have the impact that this Article envisions.

Claims that XR is an inherently lawless space also mirror concerns from the early days of the internet. Such concerns focus on the lack of content moderation in social spaces, as Part VI explores in

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108. *See* Andrew K. Przybylski & Netta Weinstein, *Violent Video Game Engagement Is Not Associated with Adolescents' Aggressive Behaviour: Evidence from a Registered Report*, 6 ROYAL SOC'Y OPEN SCI. (2019). One such panic was about the impact of violence in video games, which research has shown does not lead to increased aggression in children. *Id.*

109. *See, e.g.*, BALL, *supra* note 95.

110. Mike Issac, *Facebook Renames Itself Meta*, N.Y. TIMES, https://www.nytimes.com/2021/10/28/technology/facebook-meta-name-change.html [https://perma.cc/F4R9-BD66] (Nov. 10, 2021).

111. Jim Wyss, *Barbados Is Opening a Dipolomatic Embassy in the Metaverse*, BLOOMBERG (Dec. 14, 2021, 8:00 AM) https://www.bloomberg.com/news/articles/2021-12-14/barbados-tries-digital-diplomacy-with-planned-metaverse-embassy [https://perma.cc/DX7J-QKBH]; Rebekah Carter, *Which Countries Have the Top Metaverse Strategies?*, XR TODAY (Mar. 24, 2023), https://www.xrtoday.com/mixed-reality/which-countries-have-the-top-metaverse-strategies/ [https://perma.cc/8C49-VSQV].

112. *See* Kellen Browning, *Apple Debuts Its Next Big Product, a Virtual Reality Headset*, N.Y. TIMES (June 5, 2023), https://www.nytimes.com/2023/06/05/technology/apple-headset-virtual-reality-wwdc.html [https://perma.cc/SZD4-2BPX].

greater depth.[113] Many journalists who report about XR describe the platforms as predominantly full of misbehaving youths,[114] sparking questions from online safety advocates about accountability.[115] Courts and the government have offered little clarification.[116] In 2022, the US General Services Administration (GSA) investigated whether it should integrate XR virtual presence into workspaces and projects, stating "[c]urrently, there are no existing policies or laws that govern the use of virtual reality, mixed reality, and augmented reality products."[117] Additionally, as previously noted, scholars see a lack of clarity regarding application of legal fundamentals including jurisdiction, evidentiary standards, applicability of torts and other protections against personal harms,[118] privacy laws, online harassment, and non-consensual intimate images or synthetic pornography.[119]

Finally, despite the great potential of XR to serve minority communities and vulnerable populations, the reality has so far proven much closer to the web in the 1990s. Challenges include limited access for minority communities due to connectivity concerns and cost and public concerns about the impact of XR on vulnerable populations, especially children.[120] XR has become a particular locus of fear because of initial media reporting and that the HMDs were age-graded for users age thirteen and above.[121] Indeed, more questions than answers exist

113. *Infra* Part VI.

114. Naomi Nix, *Meta Doesn't Want to Police the Metaverse. Kids Are Paying the Price*, WASH. POST (Mar. 8, 2023, 11:59 AM), https://www.washingtonpost.com/technology/2023/03/08/metaverse-horizon-worlds-kids-harassment/ [https://perma.cc/H2CE-UV3Q].

115. *Id.*

116. *See id.*

117. *Virtual Presence*, TECH AT GSA, https://tech.gsa.gov/techradar/technologies/virtual-presence/ [https://perma.cc/6JGH-2WQF] (last visited Mar. 3, 2024).

118. *See* Lemley & Volokh, *supra* note 91.

119. *See generally* Mary Anne Franks, *The Desert of the Unreal: Inequality in Virtual and Augmented Reality*, 51 U.C. DAVIS L. REV. 499 (2017).

120. Steven Vosloo, *What Happens to Children When the Physical and Virtual Worlds Merge*?, UNICEF (May 1, 2023), https://www.unicef.org/globalinsight/stories/metaverse-and-children [https://perma.cc/9EMJ-LYTW].

121. Yohji Jones, *Assessing the Impact of VR Headsets on Under 13-Year-Old*s, VISIONFOUNTAIN (Aug. 1, 2022), https://www.visionfountain.com/2022/08/01/assessing-the-impact-of-vr-virtual-reality-headsets-on-under-13-year-olds/ [https://perma.cc/HGD5-PLNS]. Oculus has now approved its devices for ages ten and above. Mike Issac, Adam Satariano & Natasha Singer, *Meta to Lower Age for Users of Virtual Reality Headset to 10 from 13*, N.Y. TIMES (June 16, 2023), https://www.nytimes.com/2023/06/16/technology/meta-virtual-reality-headset-children-safety.html [https://perma.cc/7NKW-P8GW].

about the impacts of long-term use of these devices on the social, spatial, emotional, and physical well-being of children.[122]

### *B. Differences from the Internet*

Looking back to Lessig's time, enthusiastic advocates claimed the novelty of computing made the internet a space wholly distinct from the physical.[123] The oft-quoted *Declaration of the Independence of Cyberspace* states:

> Cyberspace consists of transactions, relationships, and thought itself, arrayed like a standing wave in the web of our communications. Ours is a world that is both everywhere and nowhere, but it is not where bodies live . . . . Your legal concepts of property, expression, identity, movement, and context do not apply to us. They are all based on matter, and there is no matter here.[124]

But the internet did not emerge as a space exempt from the reach of law. At first glance, XR is closer to a place that digital rights activist John Perry Barlow describes, where a user's sense of embodiment creates a psychologically distinctive sense of person and place, as opposed to a user's engagement with the internet.[125] However, and importantly, XR remains dependent upon interactions between the physical and digital.

Although current developments may bear significant similarities to the Lessig and Easterbrook era, XR as a technology is quite different than the web of the 1990s. Looking beyond pure technical capability, there are three specific and related ways that XR is distinct from the web. First, psychological impacts show that users experience their interaction with XR as if they are "really there," which brings far-reaching consequences. The nature of the XR experience can have significant mental impacts, both positive and negative, on users. Second, while the web mostly creates a separate experience from the physical world, XR integrates its experience into and over the physical. These differences are key to understanding how Lessig's analysis should be updated to seamlessly map onto this new computing paradigm.

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122. *See* Jakki O. Bailey & Jeremy N. Bailenson, *Immersive Virtual Reality and the Developing Child*, *in* COGNITIVE DEV. IN DIGIT. CONTEXTS 181, 195 (Fran C. Blumberg & Patricia J. Brooks eds., 2017).

123. *See* John Perry Barlow, *A Declaration of the Independence of Cyberspace*, ELEC. FRONTIER FOUND. (Feb. 8, 1996), https://www.eff.org/cyberspace-independence [https://perma.cc/4LHK-3WN9].

124. *Id.*

125. *See id.*

1. Psychological Impacts: Presence, Immersion, and Embodiment

Professor Jeremy Bailenson, head of Stanford's Virtual Human Interaction Lab, describes three psychological characteristics of XR that distinguish it from other forms of computing: presence, immersion, and embodiment.[126] Presence means "the illusion of non-mediation"; in other words, a user feels like they are communicating without an interface.[127] This can occur even if the avatar is stylized or otherwise not in a photorealistic form. For an XR experience to feel immersive, users need a sense of active presence and a lack of awareness of the artificial nature of their virtual environment. Consequently, XR content needs to avoid cognitive dissonance between what users perceive from different sensory inputs, like what they see, feel, and hear. Should they neglect to do so, developers risk creating simulation sickness for the user.[128]

Immersion is another psychological characteristic that distinguishes XR, meaning that users feel like they are genuinely inhabiting an alternate environment. For instance, a virtual opera experience must have all the trappings of a performance in a physical theater, including different views from different seats, movement flows through aisles, spatially-oriented sound, and low light when the performance starts. This need stems from the use of sensory input to stimulate the user, including light, sound, scents, and tactile stimuli.[129]

The final psychological characteristic of XR is embodiment, or the feeling that the form of an avatar or virtual body is one's actual physical body. Professor Mel Slater demonstrated its importance by importing the "rubber hand illusion" into XR.[130] Researchers placed a toy hand in a user's field of vision within VR.[131] They found that people

126. Eric Johnson, *Full Transcript: Stanford Virtual Reality Expert Jeremy Bailenson on Too Embarrassed to Ask*, VOX (Aug. 4, 2016, 11:00 AM), https://www.vox.com/2016/8/4/12371450/jeremy-bailenson-stanford-university-virtual-reality-too-embarrassed-to-ask-podcast-transcript [https://perma.cc/BE7Y-7ARN]; *see* Heller, *Watching Androids*, *supra* note 60, at 20–22; Heller, *Reimagining Reality*, *supra* note 97, at 6–7.

127. Johnson, *supra* note 126; *see* Heller, *Watching Androids*, *supra* note 60, at 21; Heller, *Reimagining Reality*, *supra* note 97, at 8.

128. BAILENSON, *supra* note 96, at 17–20; *see* Heller, *Watching Androids*, *supra* note 60, at 21; Heller, *Reimagining Reality*, *supra* note 97, at 8.

129. Strickland, *supra* note 100; *see* Heller, *Watching Androids*, *supra* note 60, at 20; Heller, *Reimagining Reality*, *supra* note 97, at 7.

130. Michelle Cortese & Andrea Zeller, *Designing Safer Social VR*, MEDIUM (Nov. 1, 2019), https://immerse.news/designing-safer-social-vr-76f99f0be82e [https://perma.cc/CE44-Y4P6]; *see* Heller, *Watching Androids*, *supra* note 60, at 21–22; Heller, *Reimagining Reality*, *supra* note 97, at 8.

131. Cortese & Zeller, *supra* note 130; *see* Heller, *Watching Androids*, *supra* note 60, at 21–22; Heller, *Reimagining Reality*, *supra* note 97, at 8.

who watched a mallet hitting the toy hand interpreted the violence as if it were happening to their own hand, like a real bodily experience.[132] As this study evinces, embodiment is very influential.[133] It can be beneficial, like in medical applications where it helps alleviate phantom limb pain, or in educational contexts designed to engender empathy.[134] But the flip side of this can place XR users at risk, considering the violence and harassment that many users have reported in social environments.[135]

It is three chracteristics of immersive environments, immersion, presence, and embodiment, that combine to create an experience that is interpreted by users' brains as a distinct separate reality. The nature of XR has the potential to "awaken spatial memory like no other medium has," according to its earliest developers.[136] If presence, immersion, and embodiment are successful, no perceived separation lingers between users and the objects of their interaction. Dr. Tom Furness, one of the earliest inventors of HMDs, says XR experiences are retained like they are "drawn on the brain in permanent ink."[137]

Science agrees.[138] Using MRIs, scientists found that when an XR user has experienced an event and is asked to recall it, the brain's response in the hippocampus mirrors the brain's expected reaction to an actual event.[139] As a result, XR users can also respond to simulations

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132. Cortese & Zeller, *supra* note 130; *see* Heller, *Watching Androids*, *supra* note 60, at 21–22; Heller, *Reimagining Reality*, *supra* note 97, at 8.

133. *See* Cortese & Zeller, *supra* note 130; Heller, *Watching Androids*, *supra* note 60, at 21–22; Heller, *Reimagining Reality*, *supra* note 97, at 8.

134. DYLAN FOX & ISABEL GUENETTE THORNTON, EXTENDED REALITY (XR) ETHICS AND DIVERSITY, INCLUSION, AND ACCESSIBILITY, IEEE STANDARDS ASS'N 9 (2022), https://standards.ieee.org/wp-content/uploads/2022/04/Ethics_Diversity_Inclusion_Accessibility.pdf [https://perma.cc/R6B3-2M5G]; Aalborg Univ., *Virtual Reality Eases Phantom Limb Pain*, SCI. DAILY (May 31, 2017), https://www.sciencedaily.com/releases/2017/05/170531102921.htm [https://perma.cc/248C-NRKT]; *see* Heller, *Watching Androids*, *supra* note 60, at 22; Heller, *Reimagining Reality*, *supra* note 97, at 8.

135. Erick J. Ramirez, Shelby Jennett, Jocelyn Tan, Sydney Campbell & Raghav Gupta, *XR Embodiment and the Changing Nature of Sexual Harassment*, 13 SOC'YS 36 (2023), https://www.mdpi.com/2075-4698/13/2/36 [https://perma.cc/YXT3-NZMT]; *see* Heller, *Watching Androids*, *supra* note 60, at 22; Heller, *Reimagining Reality*, *supra* note 97, at 8.

136. Heller, *Watching Androids*, *supra* note 60, at 22; Heller, *Reimagining Reality*, *supra* note 97, at 8.

137. Heller, *Watching Androids*, *supra* note 60, at 22; Heller, *Reimagining Reality*, *supra* note 97, at 8.

138. *Memory Versus Media: Creating False Memories with Virtual Reality*, BRAIN WORLD (Mar. 21, 2020), https://brainworldmagazine.com/memory-versus-media-creating-false-memory-virtual-reality/ [https://perma.cc/75K4-DD56]; *see* Heller, *Watching Androids*, *supra* note 60, at 22; Heller, *Reimagining Reality*, *supra* note 97, at 9.

139. Thackery I. Brown, Valerie A. Carr, Karen F. LaRocque, Serra E. Favila, Alan M. Gordon, Ben Bowles, Jeremy N. Bailenson & Anthony D. Wagner, *Prospective Representation of*

in a similar manner to real situations. Of course, getting shot in an XR game will not kill you. However, scientific studies suggest users' experiences will impact them more viscerally than watching a character be shot in a video game.[140] Due to the impact of immersive content, it may lead users to question why the same regulatory and legal protections are seen to be sufficient.

### 2. A Blurring of Physical and Digital Spheres

XR is also different because of the novel way the hardware works. Networked computing is conceptually built on layers. Programmers leverage different models such as the Open Systems Integration ("OSI") model or the TCP/IP (transmission control protocol/internet protocol) model.[141] The details of these models are beyond the technical scope of this Article, but the foundational concept—that networked technology is built in layers—is useful to illustrate a fundamental difference between the traditional web and XR. In XR systems, the physical and virtual worlds intersect at more layers and with greater impact than on the traditional web.

In the traditional web, hardware interfaces are constructed such that the physical and virtual worlds intersect. For example, using a mouse or typing on a keyboard are points where the physical world intersects with the virtual. Similarly, data must be transmitted across physical wires or through the air to servers for processing, another clear point where the virtual and physical worlds meet.

For XR systems, on the other hand, the physical and virtual worlds interact across the entire stack, and those interactions are often more significant. VR users interact with the physical world to calibrate their headsets to display virtual worlds, position themselves within virtual worlds, position their bodies and move simultaneously within physical and digital spaces, and interact with programs.[142] Similarly, while a user playing a traditional video game might interact by clicking a mouse or moving a joystick, in a VR experience, one uses their body to turn, duck, jump, or punch, making richer and more complex physical and virtual interactions.

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*Navigational Goals in the Human Hippocampus*, 352 SCI. 1323, 1325 (2016); *see* Heller, *Watching Androids*, *supra* note 60, at 22–23; Heller, *Reimagining Reality*, *supra* note 97, at 9.

140. Lemley & Volokh, *supra* note 91, at 1066; *see* Heller, *Watching Androids*, *supra* note 60, at 23; Heller, *Reimagining Reality*, *supra* note 97, at 9.

141. Henrik Frystyk, *The Internet Protocol Stack*, W3.ORG (July 1994), https://www.w3.org/People/Frystyk/thesis/TcpIp.html [https://perma.cc/5J25-UC2N].

142. *See generally* Heller, *Reimagining Reality*, *supra* note 97.

In AR, where the physical world is explicitly part of the experience, even more applications exist. Virtual cups of milk can seem to sit on physical tabletops, and virtual cats can walk around the legs of physical tables. New innovations are designed to cross the boundary between the physical and virtual in novel ways. While handheld controllers already buzz to create a feeling of contact, haptic devices seek to make virtual experiences more tactile and visual by simulating touch and pressure on users' bodies when they are "hit" in a video game.[143] Commercially available scent technology even exists to bring smells into the experience.[144]

In other words, in spatial computing, virtual environments intersect with offline spaces in increasingly significant ways. As such, the information moving in and out of XR devices is continuously and necessarily tied to offline information.

The Future of Privacy Forum evaluated the types of data flows of XR devices, as identified in the chart below.[145] The majority of categories showed a connection between physical data and XR functionality, like the necessity of movement-based data, body-based data, biometrics, and location-based data.[146] Other processes and data flows are closer to traditional computing devices, data processing, and data sharing, along with using and transferring sensitive data.[147]

| | |
|---|---|
| Usage & Telemetry Data | Data from apps on a user's device, including time spent in an app and with what content they engage; telemetry is data related to bodily movement. |
| Location Data | Information that indicates the device's precise or approximate geographical position to enable shared experiences. |

143. *Internet of Senses*, ERICSSON, https://www.ericsson.com/en/6g/internet-of-senses [https://perma.cc/T7LN-MEP8] (last visited Mar. 3, 2024).

144. Shanna Finnigan, *Continuation of Olfactory VR: A Historical Perspective*, U.S.C. DORNSIFE (Nov. 4, 2022), https://scribe.usc.edu/continuation-of-olfactory-vr-a-historical-perspective/ [https://perma.cc/YM42-VBAA].

145. Jameson Spivack & Daniel Berrick, *New Infographic Highlights XR Technology Data Flows and Privacy Risks*, FUTURE OF PRIV. F. (Oct. 27, 2022), https://fpf.org/blog/new-infographic-highlights-xr-technology-data-flows-and-privacy-risks/ [https://perma.cc/A6KH-TZP9].

146. JOSEPH JEROME & JEREMY GREENBERG, AUGMENTED REALITY + VIRTUAL REALITY: PRIVACY AND AUTONOMY CONSIDERATIONS IN EMERGING, IMMERSIVE, DIGITAL WORLDS 2 (2021), https://fpf.org/wp-content/uploads/2021/04/FPF-ARVR-Report-4.16.21-Digital.pdf [https://perma.cc/NBP6-LXBK].

147. *Id.* ("Devices can include log files that include information about hardware and software, device identifiers, and IP addresses.").

| | |
|---|---|
| Technical Processes | Advanced data processing systems, such as simultaneous localization and mapping (SLAM) algorithms and machine learning, which map the user's environment and power other functions like object recognition and gesture- based controls. |
| Sensor Data | Information gathered from device sensors about the user's body and surrounding physical environment. This data enables positional tracking, which is central to basic XR functionality.<br>Many of the latest XR devices have embedded sensors to gather and process data. Here is an example of an XR sensor configuration:<br>Inertial measurement units (IMU) measure how fast and in what direction a device is moving, device orientation, and surrounding magnetic fields to facilitate positional tracking and other functions.<br>Inward-facing cameras may collect iris or retina features for user authentication. In the future, they could also gather gaze and pupil dilation data, which, when analyzed along with other information, could help make inferences about emotion.<br>Microphones capture the user's voice and their surroundings. This enables voice commands, user-to-user interactions, and in some devices, spatial mapping and realistic sound effects.<br>Outward-facing cameras capture the user's physical environment, which can include nearby individuals, personal property, and potential obstacles, to track a user's interactions with the surrounding space.[148] |

148. The chart is a summary of FPF's work, taken from their report and the infographic cited, and made with explicit permission from the author (via Daniel Berrick). Spivack & Berrick, supra note 145.

## VI. TIPPING POINT BACK TO LAW

### *A. Modalities Are Not a Sum, But Rather a Function*

"Techlash" or acute critique of the tech industry, is rampant, as advocates and concerned citizens are calling for regulation of emerging technology.[149] Legislators are exploring draft bills with bipartisan support.[150] Technology companies are publicly asking the government for clear legal doctrine to guide them.[151] This departure from self-regulation may facially seem to rebut Lessig's presentation of code-as-regulator, but a careful study reveals it is unsurprising. Indeed, an analysis grounded in contemporaneous technological advancements can better understand how Lessig's model applies to what comes after the internet, make key updates to that model, and explain what is driving the current societal debate as to the desirability of certain forms of new technology.

Thus far, this Article has described Lessig's code-as-law framework and outlined the technology at the rise of the internet as well as the new paradigms emerging today with spatial computing. The remainder of this Article examines each of Lessig's four modalities—code, law, norms, and the market—in action and demonstrates what can happen when a modality fails. It uses this lens to identify opportunities to refine and update Lessig's framework and explain how and why users seek alternatives to platform self-governance of online spaces.

Importantly, this Article expands Lessig's description to provide a more comprehensive theory of how the system works. Lessig's project was to describe the modalities and their balancing.[152] The present task is to understand more fundamentally how the system itself works via interactions among the modalities. It makes sense that Lessig's analysis would focus primarily on these direct governance methods, given his background as a constitutional scholar.[153] The other method

149. Darrell M. West, *Techlash Continues to Batter Technology Sector*, BROOKINGS (Apr. 2, 2021), https://www.brookings.edu/articles/techlash-continues-to-batter-technology-sector/ [https://perma.cc/3RUZ-L92Y].

150. Diane Bartz, *US Senators Warren, Graham Kick off Bipartisan Anti-Big Tech Push*, REUTERS, https://www.reuters.com/technology/us-senators-warren-graham-kick-off-bipartisan-anti-big-tech-push-2023-07- 27/ [https://perma.cc/WGE8-S79W] (Aug. 1, 2023, 4:57AM).

151. 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/LB2X-6CCP].

152. Lessig, *supra* note 2.

153. *Lawrence Lessig*, HARV. L. SCH., https://hls.harvard.edu/faculty/lawrence-lessig/ [https://perma.cc/U5UX-CAWV] (last visited Mar. 3, 2024).

is indirect influence, which the market and norms effect. The chief impact of indirect influence is to shape the modalities themselves. Thus, digital governance is less akin to a weighted sum and more accurately characterized as a function with multiple inputs.

### *B. Modalities Interact to Shape Each Other*

Lessig began his theory from the presumption that the balancing act of his modalities was a form of regulation.[154] The code-as-law calculus does not seem to imply that all modalities are equally weighted, but it does presume they all operate together.[155] Under this theory, governance is the sum of all four modalities, and the modalities are fungible: in the absence of law, any of the other modalities can essentially "pick up the slack."[156] However, Lessig's theory fails to account for the unique characteristics of each of the modalities and the way each distinctly shapes governance structures as a whole.

To step back and look at the workings of the entire system, this Article asserts that there are two types of modalities. First, there are modalities such as code and law, which bear directly on governance. Second, there are modalities like markets and norms, which have a more indirect bearing. A key function of indirect influence is that each of the modalities interacts with one another, creating opportunities for users and citizens to shape the system.

This fundamental insight, that all modalities work together while playing distinct roles, is critical to understanding what one ought to learn from and how is best to update Lessig's framework today. Perhaps the clearest way to expose this dynamic is to examine what happens when one of the four modalities fails, exposing the public to harms. Such failure results in public calls for accountability and oftentimes for redress from the aggrieved community. In response, political or regulatory institutions propose concrete legal rules to address present harms or mitigate future risks.

### *C. Norms Are Key to Digital Governance Systems*

If one expands the project of digital governance to better understand how Lessig's modalities influence and shape each other, society will be better positioned to apply deliberate pressure to change systemic outcomes. This Article will demonstrate that knowledge of the

154. Lessig, *supra* note 2, at 508.

155. *Id.* at 509.

156. *See id.* at 511–12.

modalities' interaction will be instrumental in using governance to achieve more diverse representative results.

Central to understanding this system are norms, as they are the foundation upon which code, law, and the market rest. Indirect mechanisms like norms or market forces push on code and law, often resulting changes to these direct governance mechanisms. The interrelationship among the modalities makes the shaping power of norms quite apparent. Despite their prominence, norms have not been examined as a foundational driver of digital governance in code-as-law analysis. Lessig's theory was primarily descriptive; he did not address normative questions including, most importantly, what might happen if a modality fails.[157] This Article defines the failure of a modality as occurring when users or government authorities find that the modality is unable to generate effective governance. Practical examples of modality failure include bias in code, nontransferability of social and behavioral norms in new digital spaces, passing or enforcing laws in bad faith, and fomenting ambiguity or confusion about how to apply preexisting law.

The next section delves into specific examples where early harms, which communities and regulators addressed with varying levels of success during the early days of the internet, are resurfacing in XR. They are the following: bias that impacts minority users' sense of belonging, ineffective content moderation policies impacting youth, market forces privileging commercial spaces, and new forms of harassment. Each harm pertains to a specific modality, and this Article's discussion of each outlines how that modality addressed the challenges that developed. Each example will also lay the groundwork for understanding how the modalities interrelate.

This factor-focused analysis elucidates how imbalances of digital governance and these failures' reemergence in spatial computing demonstrate a tipping point where users may question if self-governance is an effective option. Concerned parties asking institutions like courts, Congress, law enforcement, or administrative agencies to directly intervene is indicative of an imbalance across the modalities.

## VII. MODALITIES IN XR

Failures highlight the specific dynamics that have tested the code-as-law framework. Just as Lessig used cyberspace to reveal insights about digital governance,[158] XR can help create a

157. *See id.*
158. *See id.*

comprehensive portrait of digital governance, its functioning, and its shortfalls. Overall, if the quality and content of digital information in spatial computing, as well as its impact on users, differs from the traditional internet, then it may be logical to explore different governance for spatial computing. The increased complexity of XR and the benefit of hindsight from the last two decades offer important lessons about how Lessig's theory of code-as-law should adapt.

However, applying Lessig's four modalities results in two specific challenges. First, the architecture of XR has not settled in its final form, as categories like hardware and software were more distinct for the early web. The 1990s saw a general understanding of processor versus program, or core hardware versus accessories. Currently, the spatial web is still forming for XR. While the hardware floor has not solidified, it seems to be centering on HMDs for virtual reality. However, the nature of XR experiences and the types of content or sensory input to which it exposes its users is still fundamentally evolving. For example, new appendages to XR headsets engage more of their users' senses, like shirts or gloves that simulate touch.[159] Wrist-bound wearables, stemming from the lineage of Apple Watches and fitness trackers, can convey essential movement-based information and biometric data that fuel fundamental features of the headset.[160] These wearables have streamlined the gathering of body-based data in the same way watch interfaces have siphoned some of the functionality of cell phones to peripheral devices.[161]

The XR industry is unique in that it is still sufficiently nascent for the design of fundamental architecture, data flows, and internal logic of XR worlds to be flexible.[162] Lessig designated both hardware and software parts of code: "the software and hardware that constitute

159. *See* Jeremy Hsu, *Real 'Westworld' Haptic Vests Better Than Fiction,* DISCOVER MAG., https://www.discovermagazine.com/technology/real-westworld-haptic-vests-better-than-fiction [https://perma.cc/QZ8C-HVX4] (Nov. 20, 2019, 1:10 AM); Adi Robertson, *Teslasuit's New VR Gloves Let You Feel Virtual Objects and Track Your Pulse*, VERGE (Dec. 26, 2019, 12:32 PM), https://www.theverge.com/2019/12/26/21037855/teslasuit-glove-vr-haptic-feedback-glove-announce-pricing-release-date-ces-2020 [https://perma.cc/H7M4-X2EW]; *see* Heller, *Watching Androids*, *supra* note 60, at 25–26; Heller, *supra* note 97, at 10, 18.

160. *See* Daniel Berrick & Jameson Spivack, *Understanding Extended Reality Technology & Data Flows: XR Functions*, FUTURE OF PRIV. F. (Oct. 31, 2022), https://fpf.org/blog/understanding-extended-reality-technology-data-flows-xr-functions/ [https://perma.cc/J9RC-HXVN]; Jad Meouchy, *Wearables in Mixed Reality: Oculus Quest + Samsung Watch*, MEDIUM (Oct. 19, 2021), https://medium.com/badvr/wearables-in-mixed-reality-oculus-quest-samsung-watch-b7f4489d588c [https://perma.cc/FTN5-T6Y9].

161. Sujeong Lim, *Wearable Innovations Stand Out at MWC Barcelona 2023*, COUNTERPOINT (Apr. 10, 2023), https://www.counterpointresearch.com/wearable-innovations-stand-mwc-barcelona-2023/ [https://perma.cc/9RV6-NKZG].

162. Alsop, *supra* note 98.

cyberspace as it is – or, more accurately, the rules and instructions embedded in the software and hardware that together constitute cyberspaces as it is."[163] Here, the code, and what is included as part of that code in XR, is volatile.

Second, law has not yet deeply grappled with XR. Practically no cases have dealt with the social role and impact of XR, save one holding on the applicability of administrative law statutes relating to the Americans with Disabilities Act.[164] Courts have yet to opine on the general applicability of criminal law, civil law, tort law, or privacy law regimes.[165] Echoes of Easterbrook surface in academic debate over whether preexisting statutes will cover some online harms as they show up in XR spaces.[166] These debates are mostly based on whether laws in their current form will cover how data collection, retention, and sharing operates, how new hardware will evolve and how existing hardware maps upon current laws, and how courts will determine fundamentals like jurisdiction and venue in a virtual world.[167] Not only is XR a legal frontier, but the state of XR and the law parallels the early web.[168]

As part of this dialogue, discussions about norms are just as dispositive as code, especially when concerning norms around inclusivity in terms of access to XR spaces.

### *A. Norms in Action: Embedded Biases in XR Hardware*

The norms of an environment are built into the code that implements that environment. If norms carry embedded biases—for example, expecting most XR users will be of a particular race and gender—those biases will be reflected in the architecture of the

163. Lessig, *supra* note 2, at 506 n.15.

164. Panarra v. HTC Corp., 598 F. Supp. 3d 73 (W.D.N.Y. 2022). Other cases may involve trademark, copyright or IP, but they are more concerned with property-related inquires and out of the scope of this Article.

165. *See* Joseph Jerome, *Establishing Privacy Controls for Virtual Reality and Immersive Technology*, INT'L ASS'N. OF PRIV. PROS. (Sept. 9, 2020), https://iapp.org/news/a/establishing-privacy-controls-for-virtual-reality-and-immersive-technology/ [https://perma.cc/C3BC-SRBM].

166. *See* Heller, *Watching Androids*, *supra* note 60, at 42–43; Suchismita Pahi & Calli Schroeder, *Extended Privacy for Extended Reality: XR Technology Has 99 Problems and Privacy Is Several of Them*, 4 NOTRE DAME J. EMERGING TECHS. 1 (2022).

167. *See* Pahi & Schroeder, *supra* note 166. Advocacy groups like the Future on Privacy Forum disagree with this analysis, arguing that state-based privacy laws would like cover cases and controversies in XR. *But see* AWE, *Reality Check - A Deep Dive into Your Privacy in XR with Daniel Berrick & Brittan Heller*, YOUTUBE (June 6, 2023), https://www.youtube.com/watch?v=a6j6PLDOA4Y [https://perma.cc/4TMQ-VMHQ].

168. *See* Brittan Heller, *VR Is Failing the Very People It Could Benefit Most*, THE INFO. (May 19, 2022, 9:00 AM), https://www.theinformation.com/articles/vr-is-failing-the-very-people-it-could-benefit-most [https://perma.cc/N5K6-6SGC]. *See generally* Lessig, *supra* note 2.

environments the userbase creates. This happened in the 1990s, and a similar phenomenon is presently occurring with XR.[169] To address this, companies should ensure inclusive norms on the part of the developers designing the hardware and software code for new systems. Otherwise, the same failures marking the 1990s will persist.

Advocates and journalists have pointed to specific instances where problems characterizing the early web are recurring in a different format.[170] In 2016, a journalist described being groped almost immediately upon entering an archery game,[171] drawing comparisons to the 1993 article "A Rape in Cyberspace."[172] In December 2021, Nina Jane Patel, vice president of an XR education company, wrote a Medium piece about being "gang raped" in the metaverse.[173] Because of the psychological characteristic of embodiment, the virtual mobbing and groping felt like it was really happening to her.[174] Both victims described a strong sense of powerlessness, as there is a lack of recourse available to targets of abuse unless a moderator or someone else steps in.[175]

After this story went viral,[176] similar accounts of women who were targeted in XR spaces emerged, prompting public debate about online safety in virtual worlds.[177] Harmful norms like those have emerged in some web-based online spaces, where hostile environments target women in XR.[178] Research has shown that the impact of unfriendly environments created barriers for women to both enter and feel comfortable using XR spaces.[179]

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169. Heller, *supra* note 168.

170. *See* Jordan Belamire, *My First Virtual Reality Groping*, MEDIUM (Oct. 20, 2016), https://medium.com/athena-talks/my-first- virtual-reality-sexual-assault-2330410b62ee [https://perma.cc/AGN7-F2RS]; Samantha Berlin, *Mother Alleges She Was Virtually Groped in Attack Inside Facebook's Metaverse*, NEWSWEEK, https://www.newsweek.com/mother-alleged-she-was-virtually-groped-attack-inside-facebooks-metaverse-1674718 [https://perma.cc/FG73-K2QS] (Feb. 1, 2022, 9:39 AM); Rhodri Marsden, *Will Women Ever Be Safe in the Metaverse?*, NAT'L (Feb. 13, 2022), https://www.thenationalnews.com/arts-culture/2022/02/13/will-women-ever-be-safe-in-the-metaverse/ [https://perma.cc/88CZ-PE4B].

171. Belamire, *supra* note 170.

172. *See* Dibbell, *supra* note 94.

173. Berlin, *supra* note 170.

174. *Id*.

175. *See* Belamire, *supra* note 170; Berlin, *supra* note 170. As will later be discussed, the state of content moderation in XR means that even if moderators step in, they must often make novel decisions about what to do in the face of a lack of clear evidence, minimal rules, and intense community pressure. *See infra* Section VII.C.

176. *See* Berlin, *supra* note 170.

177. Marsden, *supra* note 170.

178. Dibbell, *supra* note 94; *see also* Danielle Keats Citron, *Cyber Civil Rights*, 89 B.U.L. REV. 61, 66 (2009).

179. Jessica Outlaw, *Virtual Harassment: The Social Experience of 600+ Regular Virtual Reality (VR) Users*, THE EXTENDED MIND (Apr. 4, 2018), https://www.extendedmind.io/the-extended-

Code also influences norms about who feels welcome and who can participate in XR spaces, particularly in the form of challenges with hardware accessibility.[180] These usage barriers have negatively impacted women, religious minorities, and ethnic minorities.[181] For example, an important measurement to calibrate XR headsets is the distance between a user's pupils.[182] Interpupillary distance (IPD) is a standard calibration to fit a person in any pair of eyeglasses.[183] In early headsets, the IPD was fixed, and the default measurement was that of an average-sized man, whose head was larger than the average woman's head size.[184] As a result, early versions of XR glasses were prone to cause simulation sickness for people whose head measurements did not comport with the standard IPD.[185] Theories abounded that it was women's hormones or their lack of experience with video games that caused the nausea, dizziness, and disorientation.[186] But this in actuality reflected bias in the hardware design—or the code, as Lessig would say.[187]

Sometimes situations make this assertion very stark. In a similar fashion, poor hardware fit in XR headsets has created problems for multiple minority groups.[188] In January 2020, Arwa Michelle Mboya, a researcher from MIT Media Lab, went to Kenya to conduct fieldwork with the Oculus Go headset.[189] Nearly half the times she tried to put one on a subject, the strap failed.[190] She described the experience: "The texture, size, and styling of Black hair was not suitable for the device, and the strap attachment piece kept pulling out at the joints

mind-blog/2018/04/04/2018-4-4-virtual-harassment-the-social-experience-of-600-regular-virtual-reality-vrusers [https://perma.cc/52US-2HRL].

180. Heller, *supra* note 168.

181. *Id.*

182. *Id.*

183. *Id.*

184. *Id.*

185. *Id.* Women make up just under 50 percent of the global population. *World Bank Open Data*, THE WORLD BANK, https://data.worldbank.org [https://perma.cc/33DK-F5UK] (last visited Mar. 3, 2024).

186. Heller, *supra* note 168.

187. Aaron Santiago & Winston Nguyen, *A Survey About VR Sickness and Gender*, VENTUREBEAT (July 5, 2020, 6:16 AM), https://venturebeat.com/games/a-survey-about-vr-sickness-and-gender/ [https://perma.cc/JL6D-C3RX]. Note this survey was an informal survey, conducted on Reddit, without scientific rigor. *Id.*

188. Heller, *supra* note 168.

189. Arwa Michelle Mboya, *The Oculus Go Wasn't Designed for Black Hair*, DEBUGGER (Nov. 5, 2020), https://debugger.medium.com/the-oculus-go-a-hard-ware-problem-for-black-women-225d9b48d098 [https://perma.cc/6W7T-MJ6S].

190. *Id.*

from extensive stretching."[191] Mboya responded by designing a new adjustable strap herself, which was outside the scope of her thesis research project.[192] People who wear turbans and hijabs have reported similar problems.[193] One long-time British developer who is Sikh stated in an interview that his fixed-strap HMD with built-in audio, which he used for work, would not fit over his turban.[194] This meant that unless he took off his religious headgear, he had to decide whether he would be able to see or to hear while working.[195]

Research has shown that people with disabilities tend to be early adopters of new technology, yet they are often some of the last groups that developers consider in product design.[196] For example, early versions of the Oculus Quest VR headset did not have a vantage point that could be shifted for people who were seated rather than standing.[197] It was not until mid-2021, in version 30 of the Oculus updates, that users were able to change their vantage points.[198] Scientific American ironically found that a rock-climbing game was one of the only VR games that a user with muscular dystrophy could use, and only after a user created their own modified solution with a video game controller.[199]

From its launch, code is self-executing. This means that failures can become literally and figuratively baked into the operating system. Public examination of norms is how user harms become known, negotiated, and either addressed or ignored. As such, norms push against laws, code, and market forces; in that dynamic, they become a crucible for change. Since norms underlie the other modalities and

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191. *Id.*

192. *Id.*

193. Heller, *supra* note 168.

194. *Id.*

195. *Id.* Newer forms of hardware, like Apple's VisionPro headset, have recognized adaptability is a market advantage, and are looking to accessory lines that allow for greater personalization of devices. Ben Lang, *Vision Pro's Modular Design Invites Apple's Massive Third-Party Accessory Ecosystem*, ROAD TO VR, https://www.roadtovr.com/apple-vision-pro-accessories-modular/ (June 23, 2023).

196. Alice Wong & Hannah Gillis, *VR Accessibility Survey for People with Disabilities*, DISABILITY VISIBILITY PROJECT, https://www.ben-peck.com/papers/VR_Accessibility_Survey.pdf [https://perma.cc/MQ9H-67FD] (last visited Mar. 3, 2024).

197. *See* Nicholas Sutrich, *Quest v30 Update: Air Link for Quest, Microphone Fixes, Color Blind Modes,* https://www.androidcentral.com/quest-v30-june-update-finally-fixes-mic-original-quest-gets-air-link [https://perma.cc/28GE-NHQB] (June 21, 2021).

198. *Id.*

199. Kaitlin Ugolik Phillips, *Virtual Reality Has an Accessibility Problem*, SCI. AM. (Jan. 29, 2020), https://blogs.scientificamerican.com/voices/virtual-reality-has-an-accessibility-problem/ [https://perma.cc/4V9V-7WEA].

shape them, they can act as an exogenous regulator to balance modalities and avoid failure.

### *B. Market in Action: A Commercial Metaverse*

Market forces can also act as an indirect regulator, shaping other modalities. While academic communities driven by specific noncommercial goals largely built the internet, XR today comes from private businesses.[200] This suggests that the market modality will at the least function very differently for XR and bring forth unique benefits and risks alike for regulatory failure.

When Lessig was opining about what cyberlaw might teach,[201] the early internet already had its own character and architecture. The development and evolution of online spaces had very particular origins, and the embedded perspective of its creators shaped the early forms of the medium.[202] It proves important to consider how these norms inform the structural choices and implicit values of the web, including the ethos that may be most conducive to the market.

Two institutions dominated the creation of the internet. First, universities played a large role in shaping the form of early computer networks.[203] Professor J.C.R. Licklider of MIT published the first descriptions of an "intergalactic computer network," what would become online social networking in 1962.[204] Researchers at several universities from 1961–1967 simultaneously worked on key concepts to build packet switching, the technical foundation of what would become the internet.[205] In 1965, the first computer network connected universities in Massachusetts to universities in California.[206]

The military was also one of the earliest funders and participants in this line of research.[207] Licklider became the first head of the computer research program at the Defense Advanced Research

200. *See* Marcus Law, *Top 10 XR Companies Building the Future Enterprise Metaverse*, AI (May 10, 2023), https://aimagazine.com/top10/top-10-xr-companies-building-the-future-enterprise-metaverse [https://perma.cc/TVM5-S6BU].

201. Lessig, *supra* note 16.

202. *See* Leiner et al., *supra* note 46.

203. *Id.*

204. *Id.*

205. *See id.* Packet switching is "a mode of data transmission in which a message is broken into a number of parts which are sent independently, over whatever route is optimum for each packet, and reassembled at the destination." Margaret Rouse, *Packet Switching*, TECHOPEDIA, https://www.techopedia.com/definition/5603/packet-switching [https://perma.cc/ZD6S-UN2M] (Oct. 16, 2023).

206. Leiner et al., *supra* note 46.

207. *Id.*

Projects Agency (DARPA) the same year that he published his early descriptions of online social networking.[208] Computer scientist Lawrence G. Roberts went to DARPA to develop his concept of a computer network and published a plan for developing this network in 1967.[209] Other researchers from the Rand Group had written a paper on packet switching for the US Air Force in 1962 independently from academia.[210]

The institutions combined as the system developed. The precursor to the internet, the US Advanced Research Projects Agency Network (ARPANET), emerged in 1968 and selected UCLA to be the first node of the network.[211] The Stanford Research Institute (SRI) hosted a second node, followed by U.C. Santa Barbara and the University of Utah in 1969.[212] Research continued not only on how to create networked co-computers, but on how to use them.[213]

Overall, the ethos of the web embedded the foundational values of the internet. As an academic and government-centric research project, the internet's architecture prioritized spaces for education, experimentation, and open collaboration.[214] For example, Licklider's other works proposed ideas for digital libraries and [215] public television infrastructure;[216] he also was a founder of Infocom, a company which produced the earliest interactive fiction computer games.[217]

By contrast, XR hails almost exclusively from the private sector.[218] XR began as a research project to train military pilots.[219] Even as it first became commercially available in the 1990s, it was neither

208. *Id.*

209. *Id.*

210. *See id.* (citing PAUL BARAN, ON DISTRIBUTED COMMUNICATIONS NETWORKS (1962), https://www.rand.org/content/dam/rand/pubs/papers/2005/P2626.pdf [https://perma.cc/44LD-BY2H].

211. *Id.*

212. *Id.*

213. *See id.* While only two of the founders of the internet are highlighted here for brevity's sake, this is not intended to diminish the many individuals and institutions whose foundational work made the internet possible. *See id.*

214. *See id.*

215. J.C.R. LICKLIDER, LIBRARIES OF THE FUTURE 8 (1965).

216. J.C.R. Licklider, *Televistas: Looking Ahead Through Side Windows*, *in* REPORT OF THE CARNEGIE COMMISSION ON PUBLIC TELEVISION 201, 201 (1967).

217. *See Zork and Infocom – A New Kind of Fiction*, THE DOT EATERS: VIDEO GAME HISTORY 101, https://thedoteaters.com/?bitstory=computer/zork-and-infocom [https://perma.cc/BH2L-9BGP] (last visited Mar. 3, 2024).

218. *See* Law, *supra* note 200.

219. *See* Jeffrey M. Hirsch, *Future Work*, 2020 U. ILL. L. REV. 889, 903 (2020).

popularized nor affordable until very recently.[220] Starting with Meta's acquisition of Oculus in 2012, a handful of major companies have dominated the XR industry.[221] The Meta-branded metaverse is one of the main commercial entities, with the company investing billions in the hopes of creating the next generation of social networking.[222] Alternatively, Apple's vision for XR is also commercially driven, but coming from Apple's vision of enterprise or business-focused interactive environments instead of creating a new form of social media.[223]

If the medium is the message,[224] then pessimistically, the openness inherent in the early web does not appear to be a natural development in spatial computing. While both have origins in military research and academic sectors,[225] the overarching profit drive pushing XR development from private sector companies overwhelms these commonalities.

In the internet of Lessig's era, the market was one modality among many. Even as private innovation became popularized in the 1990s, the space still carried some insulation from pure market forces via laws providing protection for innovation.[226] Even so, Lessig remained leery of capitalism exerting a detrimentally strong influence on early internet spaces.[227]

But for XR, "the market" is an overwhelmingly powerful modality in comparison to the others. Today, the entire life and potential of XR innovation rests on whether a small set of companies find those innovations profitable. For example, if users care about an issue like cyberbullying in XR, companies can respond with technical solutions if they determine taking corporate action may benefit

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220. Andi Cross, *The Evolution of Virtual Reality: Exploring the Past, Present and Future*, FORBES (Nov. 9, 2023, 8:15 AM), https://www.forbes.com/sites/forbesbusinesscouncil/2023/11/09/the-evolution-of-virtual-reality-exploring-the-past-present-and-future/?sh=677d130c2b70 [https://perma.cc/A2QM-H94Q].

221. *See* Heller, *Watching Androids*, *supra* note 60, at 19.

222. *We Believe in the Future of Connection in the Metaverse*, META, https://about.meta.com/metaverse/ [https://perma.cc/8QU8-4ZH3].

223. *See* Nilay Patel, *Apple Vision Pro Review: Magic, Until It's Not*, THE VERGE (Jan. 30, 2024, 8:00 AM), https://www.theverge.com/24054862/apple-vision-pro-review-vr-ar-headset-features-price [https://perma.cc/LS8Z-DF6P].

224. "The medium is the message" is a famous statement by Marshall McLuhan, meaning a message's format, be it print, visual, digital or other, will determine how that message will be perceived. *See* MARSHALL MCLUHAN, UNDERSTANDING MEDIA: THE EXTENSIONS OF MAN 7 (1964) (positing that media, and not the content that they carry, should be the focus of study).

225. *See* Heller, *Reimagining Reality*, *supra* note 97.

226. *See Section 230*, ELEC. FRONTIER FOUND., https://www.eff.org/issues/cda230 [https://perma.cc/NW93-3ZUR].

227. *See* Lessig, *supra* note 16. Lessig warns against the consequences of an unchecked concentration of corporate power in digital spaces. *See id.*

business. It may not matter if no laws yet exist forcing companies' hands if their calculus indicates that it will be better for business if the public regards their products as a safer space for youth and diverse users. However, if major companies decide that a market perspective dissuades investing in antibullying measures, as this Article discusses below, or that this investment will not impact their bottom line, then it becomes much harder to indirectly influence the platform to change its code.

The small number of decision-makers here has potential upsides as well. Unlike the homogeneous group who developed the early internet, early creators are at a premium in XR, and, as previously noted, a diverse array of XR experiences persist in hopes of creating a broader market for XR content. With generative AI, fewer technical barriers face the creation of virtual worlds. With multimodal AI, using generative AI to create images, vidoes, and even 3D objects, today's XR companies can adapt and allow users to build much faster than the early internet-era companies, and in a much more intentional manner that accounts for creating norms in their spaces. Perhaps users can fill the need for spaces naturally dedicated to education, art, civics, and community building. However, while these worlds may be community driven and intentional, they may not satisfy the demand for return on a splashy investment.

Returning to the four modalities, XR may also place a finger on the scale for certain factors, like market forces, but one factor should not emerge as dominant if XR wishes to remain innovative and provide healthy digital spaces. Market forces asserting an indirect influence could just as easily result in ambiguous laws. Lawmakers would have to stretch preexisting laws to their limits to accommodate growth or the development of norms designed to overwhelmingly privilege commerce to the exclusion of user privacy and safety. The environment that created XR's emphasis on profitable commercial spaces may also explain what public needs will be privileged—or deemphasized—with a particular focus on financial return on XR investments. Since XR development is more mainstream than development of the early web, there may be an opportunity for broader community norm development, which could in turn impose pressure on the governance of digital spaces.

### *C. Code in Action: Content Moderation in XR*

It is not surprising that code is the modality Lessig principally examines. A core argument of his analysis is that in the internet age,

code steps in as the primary governance modality.[228] As long as society maintains the relatively hands-off approach to internet regulation that has typified the last thirty-five years, this is unlikely to change. But for governance by code to be effective, platforms need to solve the biggest governance challenges facing society through technical means. Lessig assumes this is possible in his analysis, but the lessons of the last two decades have shown that code may not serve as a sufficient check. This rings particularly true for XR and is unlikely to change in the near future, in part because the technical capabilities to deal with the detection do not exist. Because interactions in the metaverse happen in real-time, ephemerality challenges persist with regards to content moderation in XR, even with AI advances.[229] Thus, the other modalities will be particularly important where code fails to create an effective platform governance regime for content moderation in XR.

### 1. Detection

Code-as-law fails in XR not just in the hardware or experience design, but in the design of internal governance systems via content moderation.[230] Just like bias in hardware, code limits the future impact of XR content moderation.

Content moderation in social XR spaces diverges in certain ways from its 2D counterparts. Feed-based architectures, like Facebook or Twitter, would need to fundamentally shift to models that can govern spatial computing. Content moderation on the traditional internet and social media focuses on two components: user content and user conduct.[231] For example, a social media company might analyze a user's posted content to determine if it constitutes hate speech, self-harm, or pornography. Separately, that same company might need to analyze social media users' conduct to determine if they are harassing a user through constant messaging or abusing a platform reporting system by repeatedly making false reports.

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228. *Id.*

229. Games for Change, *Reality Check - Content Moderation, Safety, and Privacy in XR – Brittan Heller* (Sept. 25, 2023), https://www.youtube.com/watch?v=TS_wrVHRwz8 [https://perma.cc/Q3KW-5VJ6].

230. *See* Lessig, *supra* note 16. Arguably this could be considered a failure of norms as well, since most companies presume that the norms of XR spaces will be an extension of social media. *See id.*

231. *See* Nafia Chowdhury, *Automated Content Moderation: A Primer*, STAN. CYBER POL'Y CTR. (Mar. 19, 2022), https://cyber.fsi.stanford.edu/news/automated-content-moderation-primer [https://perma.cc/YV7P-NLTF]. For a full primer of how content moderation works in traditional flat screen media, *see id.*

By contrast, XR content moderation must work in three dimensions. Like traditional flat screen social media, it must consider conduct and content, but it must also address the environment in which the content or conduct occurs in a way traditional social media does not.[232] While design certainly matters in 2D environments, the impact of environment is exponentially more important in a 3D world where users experience their environment as real. Critically, in this early stage of XR, users are empowered to develop architectural spaces, which, as this Article addresses above, are the virtual worlds and the digital objects that populate these places. Users do not usually build interfaces for the flat-screen social media sites with which they engage, but XR users are encouraged to world build. A user could hypothetically design a strip club and seek to embed it in a social VR space frequented by children. Or an XR user could create overlays of Nazi symbols on real buildings in AR. All three factors—content, conduct, and environment—must work together to create effective content moderation in 3D spaces. If the Nazi symbols are created for a historical tour of Berlin, the import may be different than, for example, if malicious actors imposed the symbol on a courthouse in present-day Atlanta.

Grappling with the environmental dimension has already resulted in significant consequences for the development and deployment of virtual worlds.[233] For example, Lego Universe was a greatly anticipated massive multiplayer online game, like Roblox or Minecraft, that the company ended up shuttering.[234] The company planned the experience to allow users to build their own environments, but given that parents "utterly trusted" the LEGO brand, the company was committed to robust content moderation that would, among other things, prevent users from publishing environments with adult content.[235] Ultimately, they found they could not find an automated, scalable, and economic method of preventing users from creating erotic content in their builds.[236] The demand on moderators to review content

232. *See* Cortese & Zeller, *supra* note 130. For detailed considerations in designing content moderation for social VR, *see id.*

233. Games for Change, *supra* note 229.

234. *See* Heller & Bar-Zeev, *supra* note 70. Many definitions of the metaverse will include virtual worlds like Second Life, Roblox, and Minecraft as part of immersive worlds. *See id.* Since most users will first experience XR through a web-based portal, and since many companies are investing in multimodal XR interfaces, this Article chose to include the incident with Lego Universe as its example. *See* Kyle Lautenbach, *Cancelled Lego MMO's Biggest Problem Was a Penis Filter*, IGN (June 1, 2015, 3:15 PM), https://za.ign.com/lego-universe/91181/news/cancelled-lego-mmos-biggest-problem-was-a-penis-filter [https://perma.cc/K8WH-YNQF].

235. Lautenbach, *supra* note 234.

236. *Id.*

before posting ultimately presented a wide-scale problem and proved a major factor in the project's downfall.[237]

Platforms are struggling to address trust and safety in XR due to technical constraints. Today, most social media content is moderated via automated filters, in an ex ante fashion, through classifiers.[238] These classifiers are algorithms that automatically sort or categorize data into one or more classes.[239] For example, Facebook proactively catches 97 percent of hate speech using artificial intelligence before it features on other users' feeds.[240] It is only because of automation that content moderation is able to scale for billions of Facebook users.

However, in the XR context, classifiers are problematic. As of early 2024, no methods exist for creating classifiers to govern 3D environments.[241] Gargantuan data sets for spatial media would be required to train algorithms, which do not exist outside of certain large companies. Algorithms trained on text do not effectively process behaviors or objects, even as programmers try to apply computer vision to identify simple objects and simple gestures.[242]

Some platforms try work-arounds like translating audio to text and running the resulting information through traditional flat-screen social media moderation systems.[243] This tactic is highly resource intensive and ultimately only a partial solution, as it is not able to moderate in real time. Often, the audio is confusing and lacks full context of social transactions.[244] Furthermore, this tactic may not account for gestures or other cultural cues, like impeding someone else's gameplay or invading their personal space, unless a user vocalized the norm violation. Newer moderation tools claim to use cues like volume to anticipate when an altercation might occur, but since it focuses on limited behavioral cues, it does not provide a comprehensive moderation solution.[245]

Realistically, AI-based moderation solutions are several years away from sufficient sophistication—presently, even prerequisites for moderation, like sufficient data sets for adequate training and ample computing power to work in XR contexts, are lacking. Even Meta, with its substantial investment in the metaverse, has admitted this

237. *Id.*
238. *See* Chowdhury, *supra* note 231.
239. *Id.*
240. *Id.*
241. Games for Change, *supra* note 229.
242. *Id.*
243. *Id.*
244. *Id.*
245. *Id.*

technical challenge.[246] Until the code changes, companies will struggle to automate moderation for spatial computing environments like they do for social media. These technical limitations have resulted in burden shifting of moderation from platforms to volunteer guides, community moderators, and users reporting violations of community standards.[247]

### 2. Ephemerality

Even as new technology emerges capable of grappling with the environmental aspect of XR, content moderation may stumble on a different challenge: ephemerality. The form factor for social media-based content moderation is predominantly, but not exclusively, a user's post. This is a single, contained piece of content that moderators can analyze and act upon in isolation. Indeed, some of the hardest content moderation challenges in social media are cases where analysts must look beyond a single piece of content as a course of conduct.[248] But XR content does not have a feed; it is more akin to gaming environments or public gatherings where users interact in real time and communicate through behavior, voice, and gestures.

These environments are fundamentally ephemeral; the situation, verbal commentary, bodily movements, user-object interactions, and avatar positioning all change moment by moment. This creates novel challenges for platforms that must determine the appropriate method to capture and review user interactions, how long to maintain a record, how it should be retained and disposed of, and who should have the discretion to decide the behavior violates platform policies. All of this must be done while balancing other factors, like user and bystander privacy.

It also poses substantial technical challenges. Currently, when a user reports a violation in Meta's "Horizon Worlds," one of the top platforms, they take a short recording that is sent to the platform to determine if an interaction violates the community standards or terms of service.[249] Apart from this recording, Meta does not retain the social and behavioral transactions in XR. This places the burden of reporting and recording upon the targets or bystanders witnessing abuse. Storing

246. *See* Adi Robertson, *Meta CTO Thinks Bad Metaverse Moderation Could Pose an 'Existential Threat*,*'* THE VERGE (Nov. 12, 2021, 5:14 PM), https://www.theverge.com/2021/11/12/22779006/meta-facebook-cto-andrew-bosworth-memo-metaverse-disney-safety-content-moderation-scale [https://perma.cc/XKX7-QDQ5].

247. Games for Change, *supra* note 229.

248. *See* Franks, *supra* note 119.

249. *Report Someone in Meta Horizon Worlds*, META, https://www.meta.com/help/quest/articles/horizon/safety-and-privacy-in-horizon-worlds/report-someone-horizon-worlds/ [https://perma.cc/5GPG-DBVY] (Mar. 2, 2024).

longer videos is also an inadequate strategy. Even if a platform decided to disregard the safety and privacy implications of long-term storage,[250] implementing this storage would be a monumental feat requiring an exponential amount of data storage. Moving user data into the cloud is a possibility, and even a likelihood, based on the amounts of data spatial computing requires, but it risks increased privacy and security violations.

The limitations of code in XR and the resulting impact from tradeoffs between privacy, safety, and technical feasibility are fundamental to understanding the competing values that content moderation must address—and why XR is not simply a new form of social media.

### *D. Law in Action: Nonconsensual Intimate Imagery and Cyberharassment Laws*

One key lesson of the last two decades is that code alone cannot contain all the harms and risks online environments create. An example is the gaps where code fails on its own in instances where law exists in a novel or uncertain environment, like cyberharassment and nonconsensual intimate imagery (NCII), sexual content distributed without the consent of the individuals depicted.[251]

Recall that Easterbrook posited that specific laws would not be needed to address cyberspace, and Lessig asserted that governance would be a negotiation of regulatory forces, including law.[252] Forms of harm that are endemic to networked activity have since emerged, and neither prediction has materialized in full. Consider cyberharassment, a historied harm from internet activity that state law most often governs.[253] Early attempts to address the harm entailed a type of piecemeal enforcement calculus with anti-cyberharassment laws, which were not standardized across jurisdictions.[254] Law enforcement stumbled as legislators presumed that on-the-books anti-harassment prohibitions would suffice.[255] Often, this presumption resulted in

250. *See Social Media Privacy*, EPIC.ORG, https://epic.org/issues/consumer-privacy/social-media-privacy/ [https://perma.cc/N6W9-P5MJ] (last visited Mar. 3, 2024).

251. David Thiel & Lisa Einstein, *Online Consent Moderation*, STAN. INTERNET OBSERVATORY CYBER POL'Y CTR. (Dec. 18, 2020), https://cyber.fsi.stanford.edu/io/news/ncii-legislation-limitations [https://perma.cc/Z3S2-WMEE].

252. *See supra* notes 1–2 and accompanying text.

253. *State Laws & Online Harassment*, ONLINE HARASSMENT FIELD MANUAL, https://onlineharassmentfieldmanual.pen.org/state-laws-online-harassment/ [https://perma.cc/J854-Z59L] (last visited Mar. 3, 2024).

254. *See id.*

255. *See id.*

perverse consequences, like when laws intended to protect against stalking or harassment still required physical contact as an element of the offense when applied to digital spaces.[256]

A particularly virulent type of harassment, NCII, provides an example of the pace of legal change. Advocates pointed out that this type of harm was dependent upon online networks and did not have precedent or coverage in other preexisting laws.[257] After vigorous work in which groups like the Cyber Civil Rights Initiative engaged, laws prohibiting NCII reached forty-eight states and two US territories in 2023.[258]

Online safety advocates considered NCII prohibitions a success,[259] but the victory was not without cost. Considering three decades elapsed before cyberlaw addressed specific harms that did not fit into preexisting legal structures, it became clear that the cost of doing nothing was not particularly high for companies or regulators.[260] Existing law is structured so companies do not have a duty of care to users, and companies may not want to impose one on themselves based on the lack of clarity around the nature of virtual harm.[261]

Lessig's negotiation of modalities did not curtail cyberharassment and NCII. Law enforcement was reportedly ill-equipped to respond to citizen complaints about online harassment.[262] Investigations involving forms of electronic evidence were either too complex for smaller police departments or too expensive to pursue.[263] Harassers were savvy about masking their identities and obscuring their steps.[264] Oftentimes, those who reported harassment found police did not take the complaints seriously or misfiled the complaints as domestic violence.[265] Looking to the challenges for law enforcement and

256. *See* ADL REPORT: CONTROL-ALT-DELETE 18 (2016), https://www.adl.org/sites/default/files/documents/assets/pdf/press-center/adl-journalism-task-force-recommendations.pdf [https://perma.cc/8Y4Y-BF3N].

257. *See* Danielle Keats Citron & Jonathan W. Penney, *When Law Frees Us to Speak*, 87 FORDHAM L. REV. 2317 (2019).

258. *Nonconsensual Distribution of Intimate Images*, CYBER CIV. RTS. INITIATIVE, https://cybercivilrights.org/nonconsensual-distribution-of-intimate-images/ [https://perma.cc/YXL5-HK3W] (last visited Mar. 3, 2024).

259. *See* Citron & Penney, *supra* note 257.

260. *See* ADL REPORT: CONTROL-ALT-DELETE, *supra* note 256.

261. *See id.*

262. Danielle Citron, *Cops Don't Take Harassment of Women Seriously—Especially Online*, TIME (Oct. 17, 2014, 12:41 PM), https://time.com/3513763/anita-sarkeesian-hate-crimes/ [https://perma.cc/J2JQ-LUPP].

263. *See* ADL REPORT: CONTROL-ALT-DELETE, *supra* note 256.

264. *See id.* at 6.

265. *See id.*

disincentives to engage around online harassment, none of those challenges have been resolved, even as computing has evolved.

As legal remedies have lagged, code-based content moderation systems place the burden on aggrieved parties to report harassment. This ex-post reporting system produces myriad undesirable norms. For example, relying on the targets of harassment or bystanders to engage in retrospective reporting leaves targets with unremedied emotional injury and exposure to risk of revictimization. Additionally, markets for adult content emerged, giving commercial value to NCII content.[266] While content moderation has improved, users and advocates remain critical of the system.[267]

Turning to XR, challenges remain involving harassment and assault at this early stage in the platform's development. Scholars have written about the types of harm that could befall users in XR if and when their images are used to create immersive pornography.[268] As previously mentioned, users who have been mobbed and groped describe the experience as akin to sexual assault.[269] This provides a cautionary tale for users and advocates if they turn to regulation alone.

## VIII. THE UNBALANCING OF MODALITIES

### *A. Law Is Not Self-Executing Like Code*

Given these examples of individual modalities, tipping points suggest failure is possible and may lead to calls for more hard law. As discussed above, Lessig's assertion that his modalities balanced[270] was apparently descriptive rather than normative. Consequently, he did not consider what would constitute a failure in governance. The code-as-law system breaks down when users or government authorities determine that a modality is unwilling or unable to contribute to effective governance. In turn, society may respond with calls for more direct, hard law-based regulation.

Looking to the examples of modalities in action, the type of circumstances that can lead to failure share the common threat of

266. *See* Kate Samuelson, *Reddit Nudes Marketplace a 'New Evolution of Revenge Porn,'*, WEEK (Aug. 22, 2022), https://theweek.com/news/society/957714/reddit-nudes-marketplace-a-new-evolution-of-revenge-porn [https://perma.cc/K5ZL-MA77].

267. *See* Molly Wood, *Facebook Takes on Revenge Porn*, MARKETPLACE (Apr. 6, 2017), https://www.marketplace.org/shows/marketplace-tech/040617-facebook-takes-revenge-porn/ [https://perma.cc/3X5S-594K].

268. *See generally* Franks, *supra* note 119.

269. Berlin, *supra* note 170.

270. *See supra* Part VI.

violations of public trust at their core. Code that has enabled discriminatory outcomes has led to calls for accountability, especially in the context of social media.[271] Markets have placed users behind profits.[272] Laws have failed to adequately protect vulnerable groups, and norms have enabled serious harms to individual users. Lessig notes that law functions as a regulator in a limited fashion, as it is one of several tools that exist for "affecting constraints upon behavior."[273]

Professor Wendy Hui Kyong Chun criticized Lessig's philosophy in *Control and Freedom*.[274] In this work, she "examines 'freedom' through the rubric of the Internet, more specifically, through its emergence as a mass medium," just as Lessig examined governance through the rubric of cyberlaw.[275] She asserts that Lessig understates the significance of the constraints he describes because code is "inhumanly perfect" at enforcement.[276]

Code executes from the moment of its deployment and continues to execute until a human consciously intervenes. This means that the code will continue executing in the same way, even as the environment or culture shifts around it. Unlike Lessig, Chun does not privilege code or aggrandize its impact: "[Code is] an inhumanly perfect 'performative' uttered by no one. Unlike any other law or performative utterance, code almost always does what it says because it needs no human acknowledgement . . . Moreover, whereas a law's effectiveness depends on enforcement (self- or otherwise), code's enforcement stems from itself."[277]

Laws, however, are not self-enforcing. Humans must be involved in, and can continuously exert discretion over, their enforcement. The act of governance through law requires extensive interpretation and the application of discretion for enforcement, and these fact patterns may further evolve from the moment of law's creation.

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271. For an example of the first algorithmic discrimination case involving advertising in violation of the Fair Housing Act, *see* Press Release, U.S. Department of Justice, *Justice Department Secures Groundbreaking Settlement Agreement with Meta Platforms, Formerly Known as Facebook, to Resolve Allegations of Discriminatory Advertising*, https://www.justice.gov/opa/pr/justice-department-secures-groundbreaking-settlement-agreement-meta-platforms-formerly-known [https://perma.cc/7KWE-QPSZ] (June 21, 2022).

272. *See generally* SHOSHANA ZUBOFF, THE AGE OF SURVEILLANCE CAPITALISM: THE FIGHT FOR A HUMAN FUTURE AT THE NEW FRONTIER OF POWER (2019).

273. Lessig, *supra* note 2, at 502.

274. *See* WENDY HUI KYONG CHUN, CONTROL AND FREEDOM: POWER AND PARANOIA IN THE AGE OF FIBER OPTICS 66–71 (2006).

275. *Id.* at vii; *see* Lessig, *supra* note 2.

276. *See* Hui Kyong Chun, *supra* note 274, at 66–67.

277. *Id.*

It is in this distinction that Lessig discounts the importance of norms. But the true import of governance is not only to note how architectures can modify behaviors in both physical spaces and virtual environments, but also to see how code's structuring effect in a digital medium is not distinct from the values and philosophies of the governed: norms. Sometimes a door is not a gateway, but a means to keep others out.

### *B. Norms Are a Barometer for Access and Change*

Adam Smith described the market as having an invisible hand;[278] perhaps norms are its invisible heart. Norms can establish "the way things are" and, as a zeitgeist, serve as a barometer for change. They allow for society to normalize discrimination, especially in a vacuum of applicable laws, but they can also consist of the range of individual and social responses to such discrimination. These varied responses differ substantially from a self-executing mechanism, like code.

Norms can also amplify minority voices, enabling groups to vocalize unfair treatment. They are what allow for disenfranchised populations—like women who participate in social XR[279]—to create their own forms of self-governance. For example, when combatting the key forms of harassment in XR spaces," Jessica Outlaw, writing as an expert for the Institute of Electrical and Electronics Engineers (IEEE), explicitly stated that "[t]he primary way we recommend combatting virtual harassment is through the creation of social norms. While product developers tend to focus on technical solutions or formal moderation, establishing social norms can create environments that are moderated by the users themselves."[280] Through norms, a group's values are solidified into a culture, and this culture dictates appropriate behavior. As such, norms are arguably as strong as invisible regulators like markets or code.

Norms are an indirect shaping force, but that does not mean they are less powerful than direct governance. If the four modalities all interact in a system, then norms are the modality that systematically shapes the others. In essence, they serve as the regulator for this system

278. *See* F. Eugene Heath, *Invisible Hand*, BRITANNICA MONEY, https://www.britannica.com/money/invisible-hand [https://perma.cc/CXJ9-K4DS] (last visited Mar. 3, 2024).

279. Jessica Outlaw, *IEEE Global Initiative on Ethics in XR: Trolling, Harassment, and Online Safety in Social and Multi-User Spaces*, MEDIUM (Feb. 14, 2022), https://jessica-outlaw.medium.com/ieee-global-initiative-on-ethics-in-xr-trolling-harassment-and-online-safety-in-social-and-157d31de9921 [https://perma.cc/CM35-7UU3].

280. *Id.*

of regulation. If a developer does not build sufficient protections via code, norms will drive the government to enact more constraints. In this way, norms are similar to market forces, but public values rather than economic pressure functions as their fulcrum.

Lessig's theory did not give adequate weight to norms. Doing so changes how theorists can imagine the modalities, and shows they are not as clearly defined and distinct. While Lessig defines the modalities as sovereigns that compete with one another,[281] this Article's examples demonstrate that, in actuality, the modalities function more like a cluster of Venn diagrams. Norms influence other modalities fundamentally, like in the underlying decisions that result in embedding biases in XR, and are the force behind exercising discretion for law enforcement. They circumscribe the range of ethical business activity. They reflect user desires addressed by a virtual world's architecture.

The reason for Lessig's unequal emphasis on norms or how other modalities interact with them is evident in his assertion that net regulation of any particular policy is the sum of the regulatory effects of the four modalities together.[282] Not giving norms full consideration may result in faulty calculus, making calls for regulation untimely. It also may account for users feeling dissatisfied about the subpar enforcement power of law or of code.

### *C. The Tipping Point Results in Calls for Regulation*

The tipping point for code-as-law occurs when balancing the modalities disenfranchises participants or creates biased outcomes. Norms are necessary to shed light on these apparent or perceived injustices. A return to calls for hard law or new regulation are not part of Lessig's code-as-law modality balancing because demand for hard law is a reaction to a perceived failure and, in essence, a step away from self-governance. The tipping point results in increased calls for direct governance in the form of hard law to give the government more opportunities to exercise its discretion in enforceability.

While code may be faster to create than legislation, it may also be less responsive to shifting norms that sustain social and political environments. For example, looking to child online safety laws in 2023, at least four bills were introduced on a federal level.[283] Since those

281. Lessig, *supra* note 2, at 532.

282. *Id.* at 508.

283. Tim Bernard, *144 State Bills Aim to Secure Child Online Safety as Congress Flounders*, TECH POL'Y.PRESS (May 22, 2023), https://techpolicy.press/144-state-bills-aim-to-secure-child-online-safety-as-congress-flounders/ [https://perma.cc/783R-R9WU].

federal bills were seen as unlikely to pass, 144 state-level bills were introduced in the first half of the year.[284] To examine shifts in responsiveness more closely, public institutions have previously stepped in as social media regulators when self-governance has fallen away. For example, in XR, administrative law is an early safeguard. As previously referenced, the *Panarra* case reifies that the Americans with Disabilities Act applies to virtual worlds, bringing norms for accessibility and law guaranteeing certain public accommodations into XR.[285]

Antitrust concerns loom large for companies creating XR infrastructure and may continue to do so as companies grow and develop their spatial computing verticals. The Federal Trade Commission (FTC) has indicated it views XR as a form of technology it seeks to regulate.[286] In July 2022, the agency initiated a case against Meta for their plans to acquire an XR fitness company, Within Unlimited, that created the popular workout app Supernatural.[287] In November 2022, Chairperson Lina Khan stated at the FTC PrivacyCon:

> VR and AR are both essentially still in beta without a clear business model . . . But that hasn't stopped some of the world's biggest technology firms from investing billions. Enforcers and regulators shouldn't wait until a new sector matures before thinking about the issues it could raise . . . . [T]he FTC is already taking steps to ensure that we're fully abreast of the issues emerging in these emerging sectors before problematic business practices have time to solidify.[288]

However, it remains unclear who would be the most effective regulators of XR given the fundamental questions that remain. The FTC eventually withdrew its judicially denied request to block the acquisition of Supernatural.[289]

Bars to regulation can be both substantive and procedural. Social media saw regulators and state attorneys general applying labor law and fair housing laws.[290] But given the uncertain state of XR and

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284. *Id.*

285. *See* Panarra v. HTC Corp., 598 F. Supp. 3d 73 (W.D.N.Y. 2022).

286. *See* Cynthia Brumfield, *Feds Eye Virtual Reality as the Next Privacy and Security Battleground*, MEDIUM (Nov. 4, 2022), https://medium.com/readme/feds-eye-virtual-reality-as-the-next-privacy-and-security-battleground-fb72779a2cfb [https://perma.cc/LT5H-ZVBT].

287. Jared Schifman, *Policing Virtual Reality:* FTC v. Meta Platforms, Inc., UNIV. OF MIA. L. REV. (Apr. 9, 2023), https://lawreview.law.miami.edu/policing-virtual-reality-ftc-v-meta-platforms-inc/ [https://perma.cc/Q3YP-9Q4V].

288. Brumfield, *supra* note 286.

289. Schifman, *supra* note 287.

290. Naomi Nix & Elizabeth Dwoskin, *Justice Department and Meta Settle Landmark Housing Discrimination Case*, WASH. POST, https://www.washingtonpost.com/technology/2022/06/21/facebook-doj-discriminatory-housing-ads/ [https://perma.cc/9XCL-4RM7] (June 21, 2022, 4:26 PM).

existing law, and depending on legislators' understanding of harms in XR, new laws may be needed to clarify who or what is the proper body for enforcement—and what this particular type of digital harm implies. Jurisdiction for regulatory agencies should be clarified, as the FTC did not appeal the Supernatural decision, but instead dismissed its complaint and abandoned other proceedings related to the transaction. Finally, decisions under state privacy law may provide shaping for XR regulation. With the lack of federal privacy guidance, companies extrapolate from decisions around biometrics law from privacy-forward states like Virginia, Colorado, Illinois, Texas, and Washington.[291] In a way, these small decisions are larger oracles, as companies lack hard guidance to determine if their products and services will comply with the law.

Given this dearth of information and authority, regulators should examine the potential for bodily and psychological harms, as well as for harms specific to the affordances of XR hardware, to determine whether a new legal regime is warranted for specific legal aspects relating to emerging technologies. Legislation should be drafted for harms, and not for the hardware itself, given the still-developing forms of XR devices.

Additionally, regulators should pay attention to other emerging technologies to avoid holes in legislation. Generative AI will likely play a role in populating worlds in XR environments with objects—and even the digital architecture of the worlds themselves. As such, hype cycles declaring the decline of the metaverse are quite overblown. Lawmakers concerned with effective digital governance understand that new technologies should not be considered in a vacuum, as they will overlay one another and intersect as part of a new ecosystem.[292]

## IX. CONCLUSION

Rather than simply reapplying Lessig's analysis to new technology, this Article aims to expand upon his thesis to elucidate imperative insights about law-as-regulator in the XR space given that cyberlaw has emerged as a discipline in its own right.

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291. Jameson Spivack, Tatiana Rice & Daniel Berrick, *Old Laws & New Tech: As Courts Wrestle with Tough Questions Under US Biometric Laws, Immersive Tech Raises New Challenges*, FUTURE OF PRIV. F. (July 27, 2023), https://fpf.org/blog/old-laws-new-tech-as-courts-wrestle-with-tough-questions-under-us-biometric-laws-immersive-tech-raises-new-challenges/ [https://perma.cc/CJL5-T4WY].

292. Brittan Heller, *Don't Count the Metaverse Out*, THE INFO. (May 30, 2023, 9:00 AM), https://www.theinformation.com/articles/dont-count-the-metaverse-out [https://perma.cc/N5FK-6HU4].

Contrasting the 1990s with today, the zeitgeist has dramatically changed. Techno-exceptionalism characterized the early years of the internet, but society's collective lived experience with online harms tempered that early enthusiasm. Despite this disconnect, Lessig's ideas endured because of their shared insight that the governance of digital spaces relies at least as much on the code that defines those spaces as on the fundamental operation of law.[293]

Today, with the advent of XR, it is incumbent upon regulators to return to theories of digital governance like code-as-law and admit how these systems of governance can falter and have failed. The reluctance of companies and regulators to address norms and use them to create XR spaces that are welcoming to all users has showcased the imperative of regulatory intervention.

Lessig asserted that the architecture and functionality of hardware, software, platforms, and networks impose certain rules, constraints, and affordances that influence users' behavior and limit their actions within the digital realm. This theory has held. Lessig also envisioned how code would build the initial architecture for digital environments. The impact of code has become undeniably omnipresent. It unquestionably impacts various legal regimes.

But XR takes Lessig's observations to an unanticipated place. Virtual worlds blur the boundaries of coded environments and physical spaces. Here, XR makes architecture, or what Lessig termed "how [an environment] has already been made," less of a fixture of real space and more of a hybrid element of the digital and the physical.[294]

Furthermore, code is self-executing in a way that law is not. This facet is instructive regarding failures of governance. Norms help societies understand when digital governance is hurting those it is supposed to protect. In response, calls for increased hard law to fill the void demonstrate what XR can teach about indirect and direct forms of governance. As spatial computing evolves, regulators must think about how overreliance on law, markets, and code have failed users and impacted lives, with apologies to Lessig. But regulators can update this framework by analyzing past technology and setting new norms for regulatory structures.

293. *See* Lessig, *supra* note 2, at 532.

294. *Id.* at 507 (emphasis removed).