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The Tethered Economy

Aaron K. Perzanowski
Case Western University School of Law, akp73@case.edu

Chris Jay Hoofnagle

Aniket Kesari

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Chris Jay Hoofnagle, Aniket Kesari** & Aaron Perzanowski****

Abstract

Imagine a future in which every purchase decision is as complex as choosing a mobile phone. What will ongoing service cost? Is it compatible with other devices you use? Can you move data and applications across devices? Can you switch providers? These are just some of the questions one must consider when a product is "tethered" or persistently linked to the seller. The Internet of Things, but more broadly, consumer products with embedded software, are already tethered.

While tethered products bring the benefits of connection, they also carry its pathologies. As sellers blend hardware and software—as well as product and service—tethers yoke the consumer to a continuous post-transaction relationship with the seller. The consequences of that dynamic will be felt both at the level of individual consumer harms and on the scale of broader, economy-wide effects. These consumer and market-level harms, while distinct, reinforce and amplify one another in troubling ways.

Seller contracts have long sought to shape consumers' legal rights. But in a tethered environment, these rights may become nonexistent as legal processes are replaced with automated technological enforcement. In such an environment, the consumer-seller relationship becomes extractive, more akin to consumers captive in an amusement park than to a competitive marketplace in which many sellers strive to offer the best product for the lowest price.

At the highest level, consumer protection law is concerned with promoting functioning free markets and insulating consumers from harms stemming from information asymmetries. We conclude by exploring legal options to reduce the pathologies of the tethered economy.

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* Adjunct Full Professor of Information and of Law, University of California, Berkeley.

** J.D. Candidate, Yale University; Ph.D. Candidate, Jurisprudence & Social Policy, University of California, Berkeley.

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INTRODUCTION

Voice assistants like Google Home and Amazon Alexa, smart kitchen appliances, new cars, and a range of Internet of Things ("IoT") devices share a central trait: they are "tethered."[1] We define "tethering" as the strategy of maintaining an ongoing connection between a consumer good and its seller that often renders that good in some way dependent on the seller for its ordinary operation. Such products present as physical goods but often function as vessels for the delivery of services.

Consumers want tethered goods because of their obvious potential advantages: automation, remote control, new functionality, and the other benefits of interconnection and data collection.[2] These devices are trending towards ubiquity. Yet, their design and economic rationale have consequences. Consumers are likely to acquire multiple generations of incompatible tethered goods, from providers that may come and go.[3] In a worst-case scenario, tethering could produce an environment similar to Terry Gilliam's *Brazil*—a world of homes filled with technology that, for reasons of both complexity and of law, is

1 *See* JONATHAN ZITTRAIN, THE FUTURE OF THE INTERNET AND HOW TO STOP IT 106 (2008) ("Tethered appliances belong to a new class of technology. They are *appliances* in that they are easy to use, while not easy to tinker with. They are *tethered* because it is easy for their vendors to change them from afar, long after the devices have left warehouses and showrooms."). We are indebted to Zittrain's early spade work in defining tethered appliances and use his terminology. This Article leans on Zittrain's framing, but elucidates a series of concerns that have arisen since his 2008 book.

2 *See* Chuck Martin, *83% See a Benefit of Smart Home Voice Assistants*, MEDIAPOST (Apr. 5, 2017), https://www.mediapost.com/publications/article/298589/83-see-a-benefit-of-smart-home-voice-assistants.html [https://perma.cc/NKD4-K6MY].

3 *See* Kyle Wiens, *Apple's Diabolical Plan to Screw Your iPhone*, IFIXIT (Jan. 20, 2011), https://www.ifixit.com/blog/2011/01/20/apples-diabolical-plan-to-screw-your-iphone/ [https://perma.cc/EMT2-B6MJ].

outside of individual consumer control.[4] A best-case scenario, on the other hand, could result in a consumer utopia, with tethered goods constantly improving, adapting, and surprising us with new, personalized utility. At present, the former seems considerably more likely than the latter.

The fate of the social robot Jibo, for example, could have sprung straight from Gilliam's imagination. Jibo was a foot-tall plastic robot with an emotive face and touch sensors that responded when petted.[5] Jibo sold for $900 and could dance, talk, and play games with its owners.[6] As the company that built Jibo failed and the servers that powered it slowly shut down, Jibo suffered from "digital dementia"—the robots went "entirely limp, displaying a slightly lit, entirely black screen [and] a head and torso that twist[ed] freely, like a lifeless body."[7] In a cruel twist, Jibo was forced to deliver a final parting message to its owners: "While it's not great news, the servers out there that let me do what I do are going to be turned off soon. I want to say I've really enjoyed our time together. Thank you very, very much for having me around. Maybe someday, when robots are way more advanced than today, and everyone has them in their homes, you can tell yours that I said hello."[8]

While business purchasers often have acquisition procedures that bring some expertise to bear on the nature and quality of tethering relationships,[9] those considerations have largely escaped the attention of the ordinary consumer.[10] This project is, in part, an effort to make the nature and quality of tethered relationships more salient.[11] This Article hopes to surface not only the discrete harms tethered products

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4 BRAZIL (Embassy International Pictures 1985); *see also* Evan Narcisse, *31 Years Later,* Brazil *Is Still a Horrifying Vision of the Ever-Encroaching Future*, GIZMODO (Nov. 29, 2016), https://io9.gizmodo.com/31-years-later-brazil-is-still-a-horrifying-vision-of-1789481174 [https://perma.cc/2RAW-JTPB].

5 *See* Jeffrey Van Camp, *My Jibo Is Dying and It's Breaking My Heart*, WIRED (Mar. 8, 2019), https://www.wired.com/story/jibo-is-dying-eulogy/ [https://perma.cc/RH3S-ZK6L].

6 *Id.*

7 *Id.*

8 *Id.*

9 *See infra* Section I.A.

10 *See infra* Part III.

11 In this effort, the authors are inspired by the framing of Callon et al., who conceive of such discussions as opening the window of discourse on what qualities could or should be present in a product or service. *See generally* Michel Callon, Cécile Méadel & Vololona Rabeharisoa, *The Economy of Qualities*, 31 ECON. & SOC'Y 194 (2002). They explain,

> Talking of quality means raising the question of the controversial processes of qualification, processes through which qualities are attributed, stabilized, objectified and arranged. It therefore consists of giving oneself the means to go, with no solu-

create, but also the tradeoffs, tensions, and feedback loops between them. To take one example, while Apple is often lauded for its efforts to maintain consumer privacy and device security, the company's aggressive stance against independent repair stands as a natural, if not entirely unavoidable, corollary.[12]

At the micro level, tethering enables sellers to impose costs on consumers, to deny them benefits, and even to compel their behavior. But tethering also has broader macro-level effects. As tethers become stronger, switching costs will increase, sellers will more easily impose higher prices, and new entrants will have to compete with established platforms. These two sets of harms are deeply intertwined. In many ways, these broader, economy-wide harms are natural outgrowths of the harms tethering imposes on individual consumers. And the consumer harms are exacerbated by the erosion of meaningful competition. Indeed, these two sets of harms mutually enable and reinforce one another.

This Article begins in Part I by describing how tethering occurs. Through the combination of technology and law, tethering creates and maintains a post-sale link between buyer and seller. Part II turns to the potential advantages of tethers, which could result in a consumer-friendly revolution in product design if incentives are properly aligned. As Part III catalogs, however, tethering has created a series of predictable harms for individual consumers. And, as Part IV demonstrates, those same features of the tethered economy result in a set of market-wide pathologies. In Part V, the Article concludes with a series of high-level objectives for capturing the benefits of tethers while avoiding their pathologies and a corresponding set of private and public legal mechanisms to meet those objectives.

I. Tools for Tethering

Attempts by device makers and service providers to shape consumer behavior are nothing new.[13] Thomas Edison designed his phonograph records to prevent playback on competing systems made by Columbia and Victor phonographs.[14] The Bell monopoly leveraged its

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> tion of continuity, from the good to the product, from the result to the process and its organization.

Id. at 199.

12 *See infra* Section III.A.5.

13 Economists call this "systems competition." *See* Michael L. Katz and Carl Shapiro, *Systems Competition and Network Effects*, 8 J. Econ. Perspectives 93, 93–115 (1994).

14 *See* Randall E. Stross, The Wizard of Menlo Park 219–20 (2007).

control over the telephone network to block competing handsets and other foreign attachments to its platform.[15]

Today, companies like Apple deploy proprietary screws in laptops and phones to thwart independent repair efforts.[16] And, electronics makers insist that product warranties are void if a consumer uses third-party components or breaks the warranty seal, despite clear legal guidance to the contrary.[17] These efforts to assert authority over consumer behavior are often ineffectual, poorly enforced, and of dubious legal merit. But, as this Part discusses, firms today avail themselves of a considerably more powerful and effective set of tools to achieve new levels of control over consumers.

That control is gained through tethers. The combination of embedded software, persistent network connections, and new transactional forms have fundamentally altered the relationships between firms providing goods and services and consumers relying on them. Equally importantly, developments in the law have been largely supportive of this transfer of power.

A. Tethering Through Design

As computing technology became smaller and cheaper, and as wireless network connectivity grew more pervasive, the popularity of so-called "smart products" exploded.[18] By embedding cheap sensors and chips in everyday devices—hair brushes,[19] salt shakers,[20] dental

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15 *See* David F. Weiman & Richard C. Levin, *Preying for Monopoly? The Case of Southern Bell Telephone Company, 1894–1912*, 102 J. POL. ECON. 103, 115–20 (1994) (describing the consolidation strategy and investments in lines to preempt development by rival companies). *But c.f.* Hush-A-Phone Corp. v. United States, 238 F.2d 266, 269 (D.C. Cir. 1956) (holding that a tariff prohibiting interconnecting devices, such as Hush-A-Phone, was unreasonable); Use of the Carterfone Device in Message Toll Telephone Service, 13 F.C.C.2d 420, 423–24 (1968) (applying principles of *Hush-A-Phone* decision).

16 *See* Wiens, *supra* note 3.

17 *See FTC Staff Warns Companies that It Is Illegal to Condition Warranty Coverage on the Use of Specified Parts or Services*, FTC (Apr. 10, 2018), https://www.ftc.gov/news-events/press-releases/2018/04/ftc-staff-warns-companies-it-illegal-condition-warranty-coverage [https://perma.cc/FH3K-ZJ36].

18 *See* Michael E. Porter & James E. Heppelmann, *How Smart, Connected Products Are Transforming Competition*, HARV. BUS. REV. (Nov. 2014), https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition [https://perma.cc/9J5K-83UT]. For example, by 2020, the global Internet of Things market is projected to grow to $8.9 trillion, reflecting a growth rate of nearly 20% since 2014. *See* Louis Columbus, *2017 Roundup of Internet of Things Forecasts*, FORBES (Dec. 10, 2017), https://www.forbes.com/sites/louiscolumbus/2017/12/10/2017-roundup-of-internet-of-things-forecasts/#3b21818d1480 [https://perma.cc/D74L-SPCX].

19 *See* Matt Burgess, *We've Reached Peak IoT. There's Now a Smart Hairbrush*, WIRED (Jan. 4, 2017), https://www.wired.co.uk/article/smart-hair-brush-loreal-withings [https://perma.cc/2XYK-MML2].

floss,[21] wine bottles,[22] candles,[23] and trash cans,[24] to name just a few—device makers can offer new functionality, generate data, and more effectively influence consumer behavior.[25] It would be all too easy to dismiss the flood of smart devices as a short-lived trend destined to join the pantheon of Beanie Babies,[26] oxygen bars,[27] and the cronut.[28] But, these products represent widely-adopted design trends with potentially broad and long-lasting implications.[29] They will be incorporated into home appliances, vehicles, and even implantable medical devices.

Three primary design features define the functionality of tethered devices. First, their operation is determined largely by software code. Device makers frequently tout the new capabilities software enables.

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20 *See* Thuy Ong, *This Smart Salt Shaker Has Voice Controls but Can't Grind Salt*, VERGE (Aug. 3, 2017), https://www.theverge.com/circuitbreaker/2017/8/3/16088526/smalt-smart-salt-shaker-app-alexa-smartphone [https://perma.cc/9D5K-4757].

21 *See* Sean Hollister, *Flosstime May Be the Simplest "Smart" Gadget You've Seen*, CNET (Mar. 10, 2017), https://www.cnet.com/products/flosstime-automatic-floss-dispenser/preview/ [https://perma.cc/F5YM-JV7Q].

22 *See* Jacob Kastrenakes, *Kuvée Is Trying to Reinvent Wine with a Ridiculous Wi-Fi Bottle*, VERGE (Mar. 28, 2016), https://www.theverge.com/2016/3/28/11317518/kuvee-bottle-keep-wine-fresh-smart-wi-fi [https://perma.cc/TQ92-AEU2].

23 *See* David Priest, *This Smart Candle Lets You Light Its Wick with an App*, CNET (Sept. 20, 2016), https://www.cnet.com/products/ludela-smart-candle/preview/ [https://perma.cc/Q43M-JMAN].

24 *See* Colin Campbell, *Notice New "Smart" Trash Cans in South Baltimore? They're Part of a Citywide Upgrade*, BALT. SUN (Sept. 18, 2018), https://www.baltimoresun.com/news/maryland/baltimore-city/bs-md-ci-smart-trash-cans-20180918-story.html [https://perma.cc/A54T-G639].

25 The ubiquity of code has reverberations throughout the legal system. Administrative agencies, for example, have faced new challenges as they have confronted the challenges of regulating code. *See* Paul Ohm & Blake Reid, *Regulating Software When Everything Has Software*, 84 GEO. WASH. L. REV. 1672, 1696–98 (2016) (noting that the ubiquity of software code has forced agencies like the Environmental Protection Agency, Food and Drug Administration, and Federal Aviation Administration to shift from regulating hardware to regulating code).

26 *See* Mark Joseph Stern, *Plush Life: Why Did People Lose Their Minds over Beanie Babies?*, SLATE (Feb. 3, 2015), http://www.slate.com/articles/health_and_science/science/2015/02/beanie_babies_bubble_economics_and_psychology_of_a_plush_toy_investment.html [https://perma.cc/4D2T-PJBD].

27 *See* Nora Zamichow & Mark Saylor, *Room to Breathe: Oxygen Bars Would Serve Customers a Shot of Clean Air*, L.A. TIMES (May 17, 1997), http://articles.latimes.com/1997-05-17/news/mn-59768_1_oxygen-bar [https://perma.cc/WZ58-ZLMT].

28 *See* Alexander Abad-Santos, *Cronuts: A Hater's Guide*, THE ATLANTIC (June 3, 2013), https://www.theatlantic.com/entertainment/archive/2013/06/cronuts/314647/ [https://perma.cc/7JNP-U52S].

29 For a lucid, compelling account of what an "onlife" world might entail, see MIREILLE HILDEBRANDT, SMART TECHNOLOGIES AND THE END(S) OF LAW: NOVEL ENTANGLEMENTS OF LAW AND TECHNOLOGY 1–7 (2015).

A smart hair brush, for example, can detect dryness, tangling, and other signs of suboptimal locks.[30] But, just as often, code constrains the capacities of a device.[31]

Code, in short, is a powerful regulator of behavior.[32] It is both more flexible and, in many respects, more powerful than traditional techniques for exercising control through physical design choices.[33] When the functionality of a product or service is dictated by software, a developer can decide not only who uses it, but when, how, and where they do so with remarkable precision. Consider school buses. Older buses feature governors that regulate speed by physically limiting the supply of fuel to the engine.[34] This results in a rather imprecise cap on speed.[35] Buses may exceed the designated speed limit while coasting downhill but struggle to keep up with the flow of traffic going uphill.[36] Some modern buses feature far more precise electronic speed controls.[37] Other vehicles even rely on cameras and software to spot speed limit signs and regulate speed accordingly.[38] They can be equipped with biometric locks and ignitions to limit access to approved drivers.[39] And, monitoring software can track if they travel

30 Ross Rubin, *The Smart Hairbrush is Not as Dumb as It Sounds*, ZDNET (Jan. 10, 2017), https://www.zdnet.com/article/the-smart-hairbrush-is-not-as-dumb-as-it-sounds/ [https://perma.cc/P3YQ-GY6B].

31 Code can, for example, artificially shorten a product's lifespan or limit its functionality. *See, e.g.*, Chaim Gartenberg, *Apple and Samsung Are Both Under Investigation by the Italian Government over Planned Obsolescence*, VERGE (Jan. 18, 2018), https://www.theverge.com/2018/1/18/16906658/apple-samsung-investigation-italian-antitrust-planned-obsolescence-software-slowdown [https://perma.cc/PXA3-K9MW]. Similarly, tethering allows lenders to remotely disable vehicles after drivers miss payments. *See* Michael Corkery & Jessica Silver-Greenberg, *Miss a Payment? Good Luck Moving That Car*, N.Y. TIMES (Sept. 24, 2014), https://dealbook.nytimes.com/2014/09/24/miss-a-payment-good-luck-moving-that-car [https://perma.cc/7WTK-PENJ].

32 *See* LAWRENCE LESSIG, CODE 120–25 (Version 2.0 ed. 2006), http://codev2.cc/download+remix/Lessig-Codev2.pdf [https://perma.cc/BE2F-KKSE]; Joel R. Reidenberg, *Lex Informatica: The Formulation of Information Policy Rules Through Technology*, 76 TEX. L. REV. 553, 572–76 (1998).

33 *See* LESSIG, *supra* note 32, at 122–25 (using cigarette smoking as an example).

34 *See* AUSTIN RUEL MEADOWS, SAFETY AND ECONOMY IN SCHOOL BUS TRANSPORTATION 26 (1940).

35 *See id.*

36 *See id.*

37 *See* Andrew J. Hawkins, *The Obama Administration Wants to Require Electronic Speed-Limiting Devices in Big Trucks and Buses*, VERGE (Aug. 26, 2016), https://www.theverge.com/2016/8/26/12660496/dot-truck-bus-speed-limit-device-obama-announced [https://perma.cc/V9MQ-3JY5].

38 *See, e.g.*, James R. Healey, *Ford Europe System Reads Speed Signs, Slows Car*, USA TODAY (Mar. 25, 2015), https://www.usatoday.com/story/money/cars/2015/03/25/ford-european-speed-limit-signs-system-camera/70424362 [https://perma.cc/4CWX-GLEH].

39 *See* Alison DeNisco Rayome, *Eye and Fingerprint Scanners in Cars Will Double by*

outside of a specified geographical zone or are operated outside of approved hours.[40]

Unlike law or social norms, the rules defined by code are self-executing. There is no need to file a lawsuit or appeal to the community. Software not only determines which behaviors are permissible, it also prevents violations from occurring in the first place.[41] Moreover, the rules enshrined in code are not the result of a legislative process or community consensus.[42] They are privately crafted.[43] And, without careful forethought, code can eliminate the options needed for exceptional or emergency circumstances.

Second, tethered devices and services typically include various sensors that gather information about consumer behavior. Amazon Echo records household conversations through a microphone.[44] Cameras record the groceries inside Samsung smart refrigerators.[45] Modern vehicles track speed and location with GPS.[46] And, smart vibrators record the frequency and intensity of their use.[47] Sometimes that information is necessary to provide improved functionality.[48] Other times, it is required to enforce the software-based restrictions described above. And, other times, it is harvested to amass huge quantities of data for machine learning or other business interests of developers or third parties.[49] Almost invariably, such reuse creates

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2021, Report Says, TechRepublic (Dec. 1, 2016), https://www.techrepublic.com/article/eye-scanners-and-fingerprints-in-cars-will-double-by-2021-report-says [https://perma.cc/R565-EPTQ].

40 *See* J. D. Biersdorfer, *Apps to Provide Peace of Mind with a Teenager Behind the Wheel*, N.Y. Times (Aug. 31, 2017), https://www.nytimes.com/2017/08/31/technology/personaltech/apps-teenager-driver.html [https://perma.cc/87LK-H437] (discussing various monitoring apps).

41 *See* Lessig, *supra* note 32, at 110.

42 *See id.* at 4–5; Hildebrandt, *supra* note 29, at 12.

43 *See* Lessig, *supra* note 32, at 121.

44 Niraj Chokshi, *Is Alexa Listening? Amazon Echo Sent Out Recording of Couple's Conversation*, N.Y. Times (May 25, 2018), https://www.nytimes.com/2018/05/25/business/amazon-alexa-conversation-shared-echo.html [https://perma.cc/7FSW-LRME].

45 Ry Crist, *Here's What's Next for Samsung's Family Hub Smart Fridge*, CNET (Jan. 7, 2018), https://www.cnet.com/news/heres-whats-next-for-samsung-family-hub-smart-fridge-ces-2018 [https://perma.cc/5K6Q-F4XF].

46 *See* Jim Edwards, *Ford Exec: "We Know Everyone Who Breaks the Law" Thanks to Our GPS in Your Car*, Bus. Insider (Jan. 8, 2014), https://www.businessinsider.com/ford-exec-gps-2014-1#ixzz2puo4Oq5f [https://perma.cc/B2Z9-95TL].

47 *See* Camila Domonoske, *Vibrator Maker to Pay Millions Over Claims It Secretly Tracked Use*, NPR (Mar. 14, 2017), https://www.npr.org/sections/thetwo-way/2017/03/14/520123490/vibrator-maker-to-pay-millions-over-claims-it-secretly-tracked-use [https://perma.cc/YUN9-EPG2].

48 *See* Adam C. Uzialko, *How Businesses Are Collecting Data (and What They're Doing with It)*, Bus. News Daily (Aug. 3, 2018), https://www.businessnewsdaily.com/10625-businesses-collecting-data.html [https://perma.cc/QV47-VUSU].

49 *See* Sapna Maheshwari, *Hey, Alexa, What Can You Hear? And What Will You Do with*

both opportunities for guile and for routine insider misuse of data.[50] Regardless of its intended or ultimate use, the raft of data that tethered devices gather about consumer behavior sets them apart from their "dumb" predecessors. Your 1998 Frigidaire didn't record what brand of beer you preferred. Your 1998 Toyota Tercel didn't monitor where you drove on Friday night. And, your 1998 sex toy didn't track how often you used it.

Third, tethered devices often feature persistent network connections. Sometimes network connectivity may be necessary to enable new features. A consumer who—for whatever reason—needs to brew tea or light a candle on their way home from the office can use a networked device to do so. But, some devices require network communication when it is neither technically necessary nor desirable. That strategy both enables more granular control over how a device is used and facilitates the acquisition of data related to consumer behavior.

Beyond hardware and software, other design choices shape the relationship between consumers and the products they use. In particular, firms have begun, in subtle and obvious ways, to rethink the basic nature of consumer transactions. Recent years have witnessed a shift from models premised on the sale of goods to models built around monthly subscriptions or short-term access to resources.[51] The poorly-named sharing economy reflects this trend: consumers opt for short-term, on-demand access to a fleet of cars[52] or bicycles[53] rather than buying one, or they choose to "Rent the Runway"[54] rather than purchasing an expensive dress.[55]

It?, N.Y. TIMES (Mar. 31, 2018), https://www.nytimes.com/2018/03/31/business/media/amazon-google-privacy-digital-assistants.html [https://perma.cc/3QR2-L94C] (describing patent applications filed by Amazon and Google that outline the ways in which recordings can be used for advertising); Chris Matyszczyk, *Samsung's Warning: Our Smart TVs Record Your Living Room Chatter*, CNET (Feb. 8, 2015), https://www.cnet.com/news/samsungs-warning-our-smart-tvs-record-your-living-room-chatter/ [https://perma.cc/YN2W-DH6K] (reporting that Samsung smart televisions record conversations and share them with third parties).

50 *See* Sam Biddle, *For Owners of Amazon's Ring Security Cameras, Strangers May Have Been Watching Too*, THE INTERCEPT (Jan. 10, 2019), https://theintercept.com/2019/01/10/amazon-ring-security-camera/ [https://perma.cc/JRH8-VQEJ].

51 Louis Columbus, *The State of the Subscription Economy, 2018*, FORBES (Mar. 4, 2018), https://www.forbes.com/sites/louiscolumbus/2018/03/04/the-state-of-the-subscription-economy-2018/#731e383253ef [https://perma.cc/DZ38-D677].

52 *See, e.g.*, ZIPCAR, https://www.zipcar.com/ [https://perma.cc/Q6D3-MFXF].

53 *See, e.g.*, Larry Bleiberg, *10Best: Bike-Share Programs to Tour Great Cities*, USA TODAY (Feb. 27, 2015), https://www.usatoday.com/story/travel/destinations/10greatplaces/2015/02/27/bike-sharing-programs/24063027/ [https://perma.cc/SDC9-SLUY].

54 RENT THE RUNWAY, https://www.renttherunway.com/ [https://perma.cc/WG8V-6TF7].

55 *See generally* Kellen Zale, *Sharing Property*, 87 U. COLO. L. REV. 501 (2016).

Similarly, consumers pay monthly fees to access the Netflix and Spotify content libraries rather than buying Blu-ray discs, CDs, or digital downloads.[56] In each of these examples, the consumer faces a reasonably clear choice between the purchase of a product and the provision of a service.[57]

In other instances, the line separating product and service is much harder to identify and perhaps to maintain. When a consumer brings home a $3000 Samsung smart refrigerator or a set of Sonos networked speakers, they understandably believe they have purchased a product. They paid the lump sum asking price, with no ongoing obligation to pay a monthly subscription fee, in exchange for a device that they can keep in their home and use as long as they choose.[58] But, these products, as described above, rely on an ongoing relationship with the device maker. If Samsung cuts you off from its servers, your fridge will no longer remind you to buy milk or offer recipe recommendations based on the odd collection of expiring vegetables and condiments it contains.[59] And, if Sonos decides to withhold software updates until you agree to its updated privacy policy, your speakers may stop working.[60] In these instances, the line between product and service is considerably blurred.

Of course, consumers have long encountered transactions that combine the sale of a product with the provision of a service. A new car might include a warranty, routine maintenance, and roadside assistance, for example.[61] But, typically, the basic functionality of the product could be easily unbundled from the ancillary services.[62] For

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56 What it means, precisely, to buy a digital good is a contested question. *See* Aaron Perzanowski & Chris Jay Hoofnagle, *What We Buy When We Buy Now*, 165 U. PA. L. REV. 315, 325–26 (2017).

57 There may be, however, several non-obvious costs and tradeoffs implicated in that choice. *See, e.g.*, AARON PERZANOWSKI & JASON SCHULTZ, THE END OF OWNERSHIP 74–81 (2016) (discussing price discrimination and determining whether a user actually owns something).

58 *See* Crist, *supra* note 45 (Samsung smart refrigerator); *Sonos Products*, SONOS, https://www.sonos.com/en-us/shop [https://perma.cc/FE84-6LAE].

59 *See* Crist, *supra* note 45.

60 Consumerist, *Sonos Holds Software Updates Hostage If You Don't Sign New Privacy Agreement*, CONSUMER REP. (Aug. 23, 2017), https://www.consumerreports.org/consumerist/sonos-holds-software-updates-hostage-if-you-dont-sign-new-privacy-agreement/ [https://perma.cc/6U3B-WPQB].

61 *See ToyotaCare: No Cost Service & Roadside*, TOYOTA, https://www.toyota.com/owners/parts-service/toyota-care [https://perma.cc/7WGJ-JQGD].

62 *See, e.g.*, John Hagel et al., *Unbundle Products and Services*, DELOITTE (Jan. 11, 2016), https://www2.deloitte.com/insights/us/en/focus/disruptive-strategy-patterns-case-studies/disruptive-strategy-unbundling-strategy-stand-alone-products.html [https://perma.cc/YBL6-GS7M].

devices that rely on constant network connectivity or frequent software updates, however, the product and service are deeply intertwined.[63]

Nor is this new transactional hybrid the equivalent of leased equipment. It is common, for example, for businesses to lease photocopiers.[64] Rather than purchasing paper-jam-prone hardware and paying for an endless series of repair calls, many firms prefer to pay a monthly fee that combines the use of the machines and the necessary maintenance.[65] But, the structure of these transactions clearly signals their status as service contracts.[66] Furthermore, they are bargained for by sophisticated entities, complete with service level agreements.[67]

Perhaps the closest analog to chimeric smart device transactions is the software license. Software licensing has blended elements of the sale of goods and the provision of services for decades.[68] Software, whether distributed in some tangible medium or through downloads, is often offered in exchange for a one-time payment.[69] But, it also frequently entails software updates and other sorts of ongoing, network-medicated connectivity.[70] Moreover, software licenses almost always impose restrictions and limitations that purport to modify the basic entitlements of personal property and copyright law.[71]

This complex relationship has led some to describe the license itself as the product.[72] That is to say, the set of mutual ongoing obliga-

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63 *See, e.g.*, Stacy-Ann Elvy, *Hybrid Transactions and the Internet of Things: Goods, Services, or Software?*, 74 WASH. & LEE L. REV. 77, 82–86 (2017) (discussing the difficulty of applying the Uniform Commercial Code to Internet of Things because the hardware and software service are interdependent).

64 *See* Joanna Furlong, *Office Printers: The Facts About Leasing vs. Buying*, BUS. NEWS DAILY (Feb. 8, 2019), https://www.businessnewsdaily.com/10805-office-printers-leasing-vs-buying.html [https://perma.cc/8ST6-ZMN9].

65 *Id.*

66 *Id.*

67 *See, e.g.*, *Xerox Service Agreements*, XEROX, https://www.xerox.com/en-us/about/account-management/service-agreements [https://perma.cc/VB5M-CQDP].

68 The observation that software blurs the distinction between goods and services is hardly a new one. *See* Stephen Breyer, *The Uneasy Case for Copyright: A Study of Copyright in Books, Photocopies, and Computer Programs*, 84 HARV. L. REV. 281, 345 (1970) ("[A] computer user is often buying services and expertise as much as he is buying a particular computer program.").

69 *See* Christian H. Nadan, S*oftware Licensing in the 21st Century: Are Software "Licenses" Really Sales, and How Will the Software Industry Respond?*, 32 AIPLA Q.J. 555, 589 (2004).

70 *See* Elvy, *supra* note 63.

71 *See* Raymond T. Nimmer, *Licensing in the Contemporary Information Economy*, 8 WASH U. J.L. & POL'Y 99, 128 (2002).

72 Robert W. Gomulkiewicz, *The License Is the Product*, 13 BERKELEY TECH. L.J. 891, 896 (1998) ("For most software products, the license *is* the product . . . .").

tions and entitlements, often subject to modification by the developer, is the "thing" sold to consumers. But, they straddle accepted legal categories and courts struggle to conceptualize these transactions.[73] So, similarities between tethered device transactions and software licensing may serve more as a warning sign than a guidepost.

B. Tethering Through Law

Design decisions are the mechanics by which tethering occurs. Legal rules both enable and reinforce those decisions. When courts and legislators treat license terms as enforceable agreements, prevent modification of software code, and prohibit efforts to bypass digital locks, they imbue tethers with the force of law.

1. Contract

Over the last 20 years, courts have embraced a trend towards notice-based contracting. Rather than insisting that agreements reflect the mutual understanding and assent of the contracting parties, courts bind consumers to license provisions, terms of use, and privacy policies on the basis of constructive notice.[74] So long as consumers are on notice that some contractual restrictions have been proposed, courts are generally willing to enforce those terms.[75] Rather than overt manifestations of assent, contracting today is premised on proxies.[76] And, while this trend first took hold in cases dealing with software,[77] it has profoundly influenced the way courts approach contract formation for all manner of goods and services.

Beyond the formal standards of contract formation, most standard form contracts are long and complex.[78] And, they frequently incorporate other terms and policies through reference, creating a

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73 *Compare* Vernor v. Autodesk, Inc., 621 F.3d 1102, 1111–12 (9th Cir. 2010) (holding that a software user is a licensee rather than an owner of a software program where the copyright owner reserves title and imposes significant transfer and use restriction), *with* Krause v. Titleserv, Inc., 402 F.3d 119, 123–24 (2d Cir. 2005) (finding that the presence or absence of formal title is not dispositive of whether a software user is an owner of a software program and lack of title may be outweighed by evidence that the user has exercised sufficient ownership). For an overview of European decisions, see NATALI HELBERGER ET AL., DIGITAL CONSUMERS AND THE LAW: TOWARDS A COHESIVE EUROPEAN FRAMEWORK 21–40 (2013) (discussing classifying digital content as a good, service, or something else).

74 *See* NANCY S. KIM, WRAP CONTRACTS 128 (2013).

75 *Id.*

76 Courts have deemed clicking "I agree," opening a package, using a product or service, or even visiting a website sufficient to form a contract. *See id.* at 2–3.

77 *See id.* at 140.

78 Many licenses require a postgraduate education to fully understand. *See* DOUGLAS E. PHILLIPS, THE SOFTWARE LICENSE UNVEILED 77–79 (2009).

Russian nesting doll of legalese.[79] Not surprisingly, most consumers do not read them.[80]

By convincing courts to treat their terms as enforceable agreements while dissuading consumers from reading them, firms can contractually restrain otherwise lawful behaviors. Form contracts can prohibit the resale and transfer of products.[81] They can limit repair and modification, ban reverse engineering, forbid the use of competing products or services,[82] and until recently, prohibit negative reviews.[83] They can also permit various forms of monitoring and data collection by sellers.[84] They can force consumers to arbitrate disputes and waive their right to class actions.[85] These contracts can even allow their drafters to unilaterally change their own terms.[86] These restrictions are justified, at least in part, on the basis of their ability to facilitate price discrimination that lowers prices and increases access for some consumers by allowing sellers to fine tune their offerings contractually.[87]

While some courts have started to push back on this approach,[88] the trend in recent decades is to allow firms to create private legislation through license terms and other documents. Combined with technological tools that can prevent efficient breach and drastically reduce enforcement costs, current contract law creates incentives for tethering.

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79 *See* KIM, *supra* note 74, at 67–68.

80 *See* Florencia Marotta-Wurgler, *Will Increased Disclosure Help? Evaluating the Recommendations of the ALI's "Principles of the Law of Software Contracts*," 78 U. CHI. L. REV. 165, 179–82 (2011) (reporting empirical data supporting the conclusion that license terms "are almost always ignored"); *see also* Yannis Bakos et al., *Does Anyone Read the Fine Print? Consumer Attention to Standard Form Contracts* 22 (N.Y.U. L. & Econ. Working Papers, Paper 195, 2014) (finding that license agreements for software retailers were accessed by users only 0.05% of the time).

81 *See, e.g.*, Vernor v. Autodesk, Inc., 621 F.3d 1102, 1103 (9th Cir. 2010).

82 *See, e.g.*, Davidson & Assocs. v. Jung, 422 F.3d 630, 634–35 (8th Cir. 2005).

83 *See* Consumer Review Fairness Act of 2016 § 2(b)(1), 15 U.S.C. § 45b(b) (2012).

84 *See* Irina D. Manta & David S. Olson, *Hello Barbie: First They Will Monitor You, Then They Will Discriminate Against You. Perfectly.*, 67 ALA. L. REV. 135, 171–72 (2015).

85 *See* Am. Express Co. v. Italian Colors Rest. 133 S. Ct. 2304, 2308 (2013); AT&T Mobility LLC v. Concepcion, 563 U.S. 333, 344–47 (2011).

86 KIM, *supra* note 74, at 65.

87 *See* Manta & Olson, *supra* note 84, at 136.

88 *See, e.g.*, Nicosia v. Amazon.com, Inc., 834 F.3d 220, 236 (2d Cir. 2016) (questioning whether notice was sufficient where consumer was presented with a "Review your order" page including the sentence "By placing your order, you agree to Amazon.com's privacy notice and conditions of use").

2. *Copyright*

For most users, limitations encoded into software are effectively laws of nature. The average consumer can no more make a smart doorbell work with an incompatible voice assistant than they can defy the speed of light. But, for consumers with a sufficiently sophisticated understanding of software code, reprogramming a device to work how they want is a trivial task.[89] For those users, the primary hurdles are legal, not technical.

Copyright holders enjoy the exclusive right to prepare derivative works.[90] Although the scope of the derivative right is not entirely clear,[91] courts generally treat new works that incorporate protectable elements of an existing work as infringing derivatives.[92] So, for example, a consumer who modifies the firmware that controls her Tesla to optimize the vehicle's performance has likely created a derivative work based on the original firmware.[93]

But, given the deeply functional nature of software and the varying needs of consumers, Congress created a significant carve out that permits users to create derivative works based on copies of software that they own. Section 117 of the Copyright Act, reflecting the long-standing principle of copyright exhaustion,[94] grants consumers who buy or otherwise own copies of software programs the right to make or authorize the making of adaptations of that software.[95] And, ac-

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89 Given the ease of distributing code over the internet, they can easily share these modifications with other users.

90 17 U.S.C § 106(2) (2012); *see also* 17 U.S.C. § 101 ("A 'derivative work' is a work based upon one or more preexisting works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgment, condensation, or any other form in which a work may be recast, transformed, or adapted.").

91 *See* Pamela Samuelson, *The Quest for a Sound Conception of Copyright's Derivative Work Right*, 101 GEO. L.J. 1505, 1510 (2013) ("Mysteries abound about the proper scope of the derivative work right.").

92 *See* Perfect 10, Inc. v. Amazon.com, Inc., 508 F.3d 1146, 1161 (9th Cir. 2007) ("[A] copyright holder's right to create derivative works is not infringed unless the alleged derivative work 'incorporate[s] a protected work in some concrete or permanent "form."'" (quoting Lewis Galoob Toys, Inc. v. Nintendo of Am., Inc., 964 F.2d 965, 967 (9th Cir. 1992))).

93 *See* Pamela Samuelson, *Modifying Copyrighted Software: Adjusting Copyright Doctrine to Accommodate a Technology*, 28 JURIMETRICS J. 179, 185–86 (1988). If the consumer instead independently wrote new firmware that interoperated with the vehicle or created a distinct add-on program to achieve the same result, the derivative right would not be implicated. *See* Samuelson, *supra* note 91, at 1544. But, significant practical hurdles make these solutions less attractive.

94 *See generally* Aaron Perzanowski & Jason Schultz, *Copyright Exhaustion and the Personal Use Dilemma*, 96 MINN. L. REV. 2067 (2012); Guy A. Rub, *Rebalancing Copyright Exhaustion*, 64 EMORY L.J. 741 (2015).

95 17 U.S.C. § 117 (2012). Section 117 also provides for the creation of backup copies, copies essential to the use of a program copies, and right to transfer such copies. *Id.*

cording to the Commission on New Technological Uses of Copyrighted Works ("CONTU"), the expert body that drafted the language of § 117, the adaptation right permits users "to add features to the program that were not present at the time of rightful acquisition."[96]

Crucially, however, rights under § 117 are limited to owners of copies of software programs.[97] And, software developers have generally succeeded in persuading courts, pursuant to the terms of software license agreements, that the copies they provide consumers are licensed rather than sold.[98] Consumers may possess those copies, but according to this line of reasoning, they do not own them.[99] As a result, consumers are not entitled under § 117 to make adaptations. Makers of devices that rely on embedded software code for their functionality have adopted this same argument. Even when consumers clearly purchase a device, sellers insist that the copies of software it contains are merely licensed.[100] John Deere argued to the Copyright Office that tractor owners are mere licensees of the software that controls their equipment.[101] And General Motors has maintained the same position when it comes to the software in its vehicles.[102] If that is true, a consumer who tweaks the code in her own car or tractor to escape tethering may be liable for copyright infringement.

3. Anticircumvention

Federal law can prohibit tinkering with software both when it is on a device in the possession of the user and when the software is cloud-based.

Section 1201 of the Digital Millennium Copyright Act ("DMCA") reinforces tethering by prohibiting the circumvention of technological protection measures.[103] If a device maker implements

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96 NAT'L COMM'N ON NEW TECH. USES OF COPYRIGHTED WORKS, FINAL REPORT ON THE NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS (1978), *reprinted in* 3 J. MARSHALL J. INFO. TECH. & PRIVACY L. 53, 62–63 (1981). No independent legislative history of § 117 exists.

97 17 U.S.C. § 117(a) ("[I]t is not an infringement for the owner of a copy of a computer program . . . .").

98 *See, e.g.*, Vernor v. Autodesk, Inc., 621 F.3d 1102, 1111 (9th Cir. 2010) (holding that "a software user is a licensee rather than an owner of a copy").

99 *Id.*

100 *See* Lily Hay Newman, *Who Owns the Software in the Car You Bought?*, SLATE (May 22, 2015), http://www.slate.com/blogs/future_tense/2015/05/22/gm_and_john_deere_say_they_still_own_the_software_in_cars_customers_buy.html [https://perma.cc/LR68-Y6MN].

101 *Id.*

102 *Id.*

103 17 U.S.C. § 1201(a) (2012).

encryption or some other form of digital lock to restrict access to software code, as they commonly do, removing, disabling, or bypassing that lock constitutes a distinct violation of federal law.[104]

Section 1201 was designed to encourage copyright holders to make music, books, and movies available in digital formats by providing them with a new legal tool to guard against widespread infringement online.[105] If they could use digital rights management (DRM) technology to restrict access to authorized users, rights holders would be more inclined to embrace digital distribution of their works.[106]

As anticipated, early § 1201 cases focused on music, movies, and other traditional entertainment content.[107] But, the anticircumvention rules quickly emerged as a tool to enforce tethering of software-enabled consumer goods like garage door openers and printers, the predecessors of today's smart devices. In *Chamberlain Group, Inc. v. Skylink Technologies, Inc.*,[108] a maker of garage door openers sued its competitor for making an inexpensive universal remote that mimicked the "rolling code" DRM Chamberlain used in its openers.[109]

The Federal Circuit rejected Chamberlain's DMCA claim, reasoning that the circumvention of DRM bore no plausible connection to any act of copyright infringement, since owners of garage door openers "have the inherent legal right to use" the software they contain.[110] Other courts, however, have declined to follow *Chamberlain*'s lead.[111] Printer manufacturer Lexmark unsuccessfully asserted § 1201

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104 *Id.*

105 *See* Brian T. Yeh, Cong. Research Serv., RL33887, The Digital Millennium Copyright Act: Exemptions to the Prohibition on Circumvention 1 (2008).

106 *See The Pros, Cons, and Future of DRM*, CBC News (Aug. 7, 2009), https://www.cbc.ca/news/technology/the-pros-cons-and-future-of-drm-1.785237 ("[W]ithout digital locking restrictions, content makers would have little incentive to make or let people play music, movies or other materials on their computers.").

107 *See, e.g.*, 321 Studios v. Metro Goldwyn Mayer Studios, Inc., 307 F. Supp. 2d 1085, 1088 (N.D. Cal. 2004); Universal City Studios, Inc. v. Reimerdes, 111 F. Supp. 2d 294, 303 (S.D.N.Y. 2000), *aff'd sub nom.* Universal City Studios, Inc. v. Corley, 273 F.3d 429 (2d Cir. 2001); RealNetworks, Inc. v. Streambox, Inc., No. 2:99CV02070, 2000 WL 127311, at *3 (W.D. Wash. Jan. 18, 2000). Even in these early entertainment cases, § 1201 was largely a tool for enforcing tethering. It was used to prevent consumers from watching DVDs on unlicensed players, for example. *See Universal City Studios*, 111 F. Supp. 2d at 303.

108 381 F.3d 1178 (Fed. Cir. 2004).

109 *Id.* at 1183.

110 *Id.* at 1202.

111 *See, e.g.*, MDY Indus., LLC v. Blizzard Entm't, Inc., 629 F.3d 928, 950 (9th Cir. 2010), *amended and superseded on denial of reh'g*, No. 09-15932, 09-16044, 2011 WL 538748 (9th Cir. Feb. 17, 2011) ("While we appreciate the policy considerations expressed by the Federal Circuit in *Chamberlain*, we are unable to follow its approach because it is contrary to the plain language of the statute.").

after Static Control Components sold inexpensive printer cartridges that mimicked the lockout mechanism Lexmark used to force customers to buy its own higher-priced cartridges.[112] But there, the Sixth Circuit found that no circumvention was necessary to read the code that controlled access to the printer, rejecting Lexmark's claim on narrow factual grounds.[113]

Although those early efforts were ultimately unsuccessful, they did not close the door on leveraging § 1201 as a tool for tethering consumer devices. Since then, phone makers have succeeded in using the DMCA to prevent the unlocking of mobile handsets,[114] argued that the DMCA allows it to prevent access to software necessary for the repair of its tractors,[115] and Keurig has used DRM to control which brands of coffee can be brewed in its coffee makers.[116] While the Copyright Office has addressed some of the worst abuses of the DMCA through its triennial rulemaking, those exemptions are hard won, temporary, and focus largely on past harms rather than future ones.[117] Moreover, the mere credible threat of DMCA liability is often sufficient to prevent consumers from attempting to break the digital locks that tether their devices.[118]

The DMCA's protections were motivated by concerns that copyrighted content could be easily copied once it resided on the con-

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112 Lexmark Int'l, Inc. v. Static Control Components, Inc., 387 F.3d 522, 529 (6th Cir. 2004).

113 *Id.* at 551 (Merritt, J., concurring) (writing "separately to emphasize that our holding should not be limited to the narrow facts" of this case).

114 *See* TracFone Wireless, Inc. v. Bitcell Corp., No. 07-22249-CIV, 2008 WL 7278921, at *5 (S.D. Fla. May 27, 2008) (entering consent judgment and permanent injunction); TracFone Wireless, Inc. v. GSM Grp., Inc., 555 F. Supp. 2d 1331, 1336–37 (S.D. Fla. 2008) (denying dismissal of DMCA circumvention and trafficking claims as not exempt behaviors under section 1201); TracFone Wireless, Inc. v. Dixon, 475 F. Supp. 2d 1236, 1237–38 (M.D. Fla. 2007) (granting unopposed permanent injunction on the basis of both circumvention and trafficking claims); TracFone Wireless, Inc. v. Sol Wireless Grp., Inc., No. 05-23279, at *2–3 (S.D. Fla. Feb. 27, 2006) (entering stipulated final judgment enjoining unlocking).

115 *See* Darin Bartholomew, Long Comment Regarding a Proposed Exemption Under 17 U.S.C. 1201, at 22 (2014), https://copyright.gov/1201/2015/comments-032715/class%2021/John_Deere_Class21_1201_2014.pdf [https://perma.cc/CUK6-W53T].

116 *See* Jack Linshi, *How Your Coffee Is Now Like Your Music*, TIME (Dec. 5, 2014), http://time.com/3620027/keurig-coffee-drm/ [https://perma.cc/RBA3-ACFG].

117 *See generally* Aaron Perzanowski, *The Limits of Copyright Office Expertise*, 33 BERKELEY TECH. L.J. 733 (2018).

118 *See e.g.*, Comments of Consumers Union, Proposed Exemption to Prohibition on Circumvention Under 47 U.S.C. § 1201, at 3–4 (Feb. 6, 2015), https://consumersunion.org/wp-content/uploads/2015/02/DMCAExemptionUnlockingAll-PurposeTabletComments.pdf [https://perma.cc/XBT7-6CEJ].

sumer's device.[119] But, changes in internet architecture and business models have shifted resources to remote servers.[120]

Sellers can also limit tinkering by hosting software in the cloud, where a tethered device sends queries and interacts with servers controlled by the seller. In situations in which the software is not in the possession of the user, but rather a remote server, the Computer Fraud and Abuse Act (CFAA) provides a broad set of protections against testing and tinkering.[121] The CFAA prohibits unauthorized access to computers, and thus the user who tinkers with a tethered device such that it accesses a cloud service without authorization risks committing a felony.[122]

4. Patents

For more than 20 years, patent law facilitated tethering through the enforcement of post-sale restrictions. During that period, the Federal Circuit maintained that patentees could sell a product to members of the public while restricting how that product could be used or transferred by its owner.[123] Violations of those post-sale restrictions were treated as infringements of the patent.[124]

That rule was solidified in *Mallinckrodt v. Medipart*.[125] Mallinckrodt sold patented aerosol diagnostic devices to hospitals labelled for "single use only."[126] When some hospitals sent the depleted devices to Medipart for reconditioning and eventual reuse, Mallinckrodt sued.[127] The Federal Circuit held that Mallinckrodt's single-use requirement was an enforceable post-sale restriction under patent law.[128] Although Mallinckrodt's aerosol devices lacked the central features of today's smart devices, the case demonstrates how patent law enabled a form of legal tethering that allowed device makers to dictate how their products were used even after they were sold.

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119 *See* S. REP. NO. 105-190, at 8 (1998).

120 *See, e.g.*, Michael Goodenough, *Cloud Computing: Effectively Changing the Business Operation Model*, FORBES (May 16, 2013), https://www.forbes.com/sites/centurylink/2013/05/16/cloud-computing-effectively-changing-the-business-operation-model/#11f4e0da20e2 [https://perma.cc/W2F5-85GQ] (discussing business model changes due to cloud computing).

121 *See* 18 U.S.C. § 1030 (2012).

122 *See id.*

123 *See* Mallinckrodt, Inc. v. Medipart, Inc., 976 F.2d 700, 708 (Fed. Cir. 1992), *abrogated by* Impression Prods., Inc. v. Lexmark Int'l, Inc., 137 S. Ct. 1523 (2017).

124 *See id.*

125 976 F.2d 700 (Fed. Cir. 1992).

126 *Id.* at 701–02.

127 *Id.* at 702.

128 *See id.* at 709.

In its recent decision in *Impression Products, Inc. v. Lexmark Int'l, Inc.*,[129] however, the Supreme Court rejected *Mallinckrodt* and the notion of post-sale restrictions more broadly.[130] After the Court rebuffed Lexmark's efforts to rely on the DMCA, Lexmark attempted to use its patents to restrict the resale and reuse of toner cartridges sold to consumers.[131] But, the Court held that once a patentee sells a product to a consumer, its ability to control how a consumer used or transferred the product is subject to the longstanding common law principle of exhaustion.[132] After a sale occurs, the patentees control over subsequent use and sale terminates.[133] In the patent context at least, the law has imposed some meaningful limits on tethering. But, as the above discussion makes clear, firms still enjoy a range of powerful legal tools to fashion and enforce tethers.

II. The Merits of Tethering

Tethers could enable fantastic benefits in terms of consumer welfare and dramatic innovations. In Parts III and IV, we discuss the downsides of tethering, but it is important to recognize the power these tools have to improve the lives of consumers when deployed properly.

Jonathan Zittrain made a trenchant critique of "tethered appliances" more than a decade ago. [134] Zittrain's objections were multifarious, but his core critique focused on tethered appliances' lack of "generativity." The closed nature of these devices excludes user tinkering and improvement, and thus tethered objects are unlikely to lead to surprising new innovations. Here, we respectfully diverge from Zittrain and explain why consumers might rationally trade generativity for a tether.

As a first matter, consumers simply may prefer less generativity and more centralized control for certain products. Zittrain explains this phenomenon nicely through the lens of cybersecurity, where the prevalence of user error might drive consumers and businesses alike to move users to more appliance-like computers.[135] Since Zittrain's prescient book was published, IoT devices have proliferated, enabling both sensing and software-controlled action in physical space. Outside

129 137 S. Ct. 1523 (2017).

130 See *id.* at 1538.

131 *See id.* at 1525.

132 *Id.* at 1529.

133 *See id.*

134 *See* Zittrain, *supra* note 1.

135 *See* Zittrain, *supra* note 1, at 36–65.

cybersecurity concerns, consumers may prefer less functional devices because the nature of the product itself may not be compatible with generative innovation. Consumers may opt for the simplicity of a single-purpose device, and this preference may not be consequential to innovation more broadly.

Second, tethered products may be safer. The seller can monitor how the product is actually used by consumers.[136] Sellers could notify consumers of unsafe uses, ask them to take different actions, and incorporate new designs into products to avoid harm.[137] While privacy and consumer advocates tend to see negative consequences flowing from monitoring,[138] it may also enable pro-consumer interventions.[139] If monitoring allows a firm to determine that a user is in danger, it could take steps to warn the consumer or actively mitigate the risk.[140] We may even impose a moral or legal obligation to do so.[141] For instance, in the grocery store shopper card context, sellers saw loyalty programs as convenient ways to track purchases and to link identity to purchases.[142] When purchased products were later recalled because of pathogens and other safety risks, grocers felt impelled to warn consumers through the card programs, in part because of negative news reporting and reputational risk.[143] Simply put, they could not credibly take advantage of the data collection and then ignore any responsibility to warn consumers of about the products they purchased.

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136 *See, e.g.*, Geof Wheelwright, *IoT-Linked Wearables Will Help Workers Stay Safe*, FIN. TIMES (Oct. 10, 2017), https://www.ft.com/content/944e6efe-96cb-11e7-8c5c-c8d8fa6961bb [https://perma.cc/KX5M-GARJ].

137 *See, e.g.*, *id.*; Alfred Ng, *Uber Rolls Out Safety Features, Like AI that Can Detect Crashes*, CNET (Sept. 5, 2019), https://www.cnet.com/news/uber-rolls-out-safety-features-like-ai-that-can-detect-crashes/ [https://perma.cc/LYP8-46X8] (describing how Uber notifies drivers and riders if there is an unexpected stop during the trip).

138 *See, e.g.*, David Streitfeld et al., *How Calls for Privacy May Upend Business for Facebook and Google*, N.Y. TIMES (Mar. 24, 2018), https://www.nytimes.com/2018/03/24/technology/google-facebook-data-privacy.html [https://perma.cc/Q7DK-ARFV].

139 *See, e.g.*, Edward Baig, *Apple Watch Heart Monitoring and Fall Detection: Are They Lifesavers?*, USA TODAY (Sept. 14, 2018), https://www.usatoday.com/story/tech/columnist/baig/2018/09/13/apple-watch-lifesaver/1289232002/ [https://perma.cc/34Y5-V8H7] (discussing the use of heart rate wearables in detecting health problems).

140 *See* Rebecca Crootof, *The Internet of Torts*, 69 DUKE L.J. (forthcoming 2019) (manuscript at 61–62).

141 *See id.* at 63–65.

142 *See* Donna Ferguson, *How Supermarkets Get Your Data—and What They Do with It*, GUARDIAN (June 8, 2013), https://www.theguardian.com/money/2013/jun/08/supermarkets-get-your-data [https://perma.cc/5CJS-5DQF].

143 *See* Justin Mason, *Grocery Stores Use Loyalty Cards to Alert Customers to Recalls*, DAILY GAZETTE (May 18, 2008), https://dailygazette.com/article/2008/05/18/0518_Cards [https://perma.cc/5PL5-JGZB].

When products are formally recalled, only 65% are "corrected,"[144] meaning that over one in three may still be on the market. In such recall situations, tethered products may perform better in all aspects of consumer safety goals—to mitigate harm, to communicate risks to consumers, and to get consumers to take different actions. Indeed, there will be situations where the remote disabling, known as "bricking," of tethered products is the responsible action, despite the risk of consumer complaints. For instance, Samsung used a software update to remotely disable Galaxy 7 smartphones, after several phones burst into flames aboard commercial flights.[145] We could imagine situations where tethered devices are so vulnerable to remote exploitation that their sellers disable the product.

Third, tethered devices have the potential to add new functionality over time and this functionality may even be personalized.[146] Few products age well. That is one reason why consumers may tinker with products to improve them. But, tethered products may be an exception, in that sellers can continuously update and improve them, perhaps informed by usage data gathered by the device itself.[147] Tethers may prevent user tinkering, but this restriction might be offset by gains from expert updates performed by the seller[148] These adjustments could address consumer preferences and enhance satisfaction.[149]

Some makers of tethered devices have offered significant post-sale improvements. For instance, consumers of Sonos speakers originally could only use the company's devices and software controller to play music on the speakers.[150] Subsequently, Sonos added support for

144 Carol Cave, Deputy Dir., Office of Compliance & Field Operations, Consumer Prod. Safety Comm'n, Presentation on CPSC Defect Recall Data (July 25, 2017).

145 *See Samsung Expands Recall of Galaxy Note7 Devices to Include Original and Replacement Devices*, SAMSUNG (Oct. 13, 2016), https://news.samsung.com/us/samsung-expands-recall-of-galaxy-note7-devices-to-include-original-and-replacement-devices-company-offers-refund-and-exchange-program/ [https://perma.cc/7TM9-4NH2].

146 NATALI HELBERGER, DIGITAL REVOLUTION: CHALLENGES FOR CONTRACT LAW IN PRACTICE 135, 141 (Reiner Schulze & Dirk Staudenmayer eds., 2016).

147 *See* Porter & Heppelmann, *supra* note 18; *see also* Seda Gürses & Joris van Hoboken, *Privacy After the Agile Turn*, *in* THE CAMBRIDGE HANDBOOK OF CONSUMER PRIVACY 579–601 (Evan Selinger, Jules Polonetsky & Omer Tene eds., 2018) (describing how agile development emphasizes the capture and use of user data to evaluate new features).

148 *See id.*

149 *See id.* (describing ongoing quality management, connected service, new user interfaces, and evergreen design).

150 *See* Nathan Ingraham, *AirPlay 2 Makes Sonos the Best Audio Option for Most iPhone Owners*, ENGADGET (July 11, 2018), https://www.engadget.com/2018/07/11/sonos-airplay-2-iphone-hands-on/ [https://perma.cc/BJ29-A8GT].

Apple AirPlay, Apple Music, and Amazon's and Google's voice assistants.[151] And, when Tesla learned that customers were in the path of an impending hurricane, the company used its tether to unlock additional battery capacity to help them escape danger.[152]

The post-sale advantages of tethering could transcend the creation of new features. Tethers enable detailed monitoring of users, thus providing data that could train machine learning models and ultimately lead to desirable automation or assistive technologies.[153] The most prominent example of this comes in automobiles, where "learning" cars benefit from the experiences of many other drivers.[154] Deep learning models could intuit patterns of unsafe product use or new efficiencies far beyond human perception.[155] In this way, the tether could produce knock-on services or entirely new experiences for the consumer. Tethers could thus enable ordinary products to improve in leaps and bounds, in the same way that software does when well designed.[156]

Optimization helps identify new efficiencies in both products and services, making it possible to support more people with fewer resources and reduce human impact on the environment. The promises

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151 *See id.*; Brian Heater, *Sonos Finally Gets Google Assistant Integration*, TechCrunch (May 14, 2019), https://techcrunch.com/2019/05/14/sonos-finally-gets-google-assistant-integration/ [https://perma.cc/Y2LA-ALRN]; Andrew Murphy, *Sonos Adds Alexa Support for Apple Music*, What Hi-Fi? (Apr. 18, 2019), https://www.whathifi.com/news/sonos-adds-alexa-support-for-apple-music [https://perma.cc/5NN2-UM9R].

152 *See* Dan Kopf, *Tesla Intentionally Makes Some of Its Cars Worse, and It's Good for Everybody*, Quartz (Sept. 13, 2017), https://qz.com/1074721/tesla-intentionally-makes-some-of-their-cars-worse-and-its-good-for-everybody [https://perma.cc/4DB7-AA9M].

153 *See, e.g.*, Crist, *supra* note 45 (describing smart fridges artificial intelligence-powered grocery tracking to recommend recipes); Matthew Lynley, *Nvidia Builds a Co-Pilot into Its Autonomous Drive Computer*, TechCrunch (Jan. 4, 2017), https://techcrunch.com/2017/01/04/nvidia-builds-a-co-pilot-into-its-autonomous-drive-computer/ [https://perma.cc/7L87-7YYX] (describing artificial intelligence to identify dangers when driving).

154 *See* Aviva Rutkin, *Autonomous Cars Are Learning Our Unpredictable Driving Habits*, New Scientist (Aug. 26, 2015), https://www.newscientist.com/article/mg22730362-900-autonomous-cars-are-learning-our-unpredictable-driving-habits/ [https://perma.cc/5Y5Z-8EYT] (using lane changing data from volunteer drivers to predict a driver's lane-change pattern in self-driving cars).

155 *See* Aarian Marshall, *MIT Looks at How Humans Sorta Drive in Sorta Self-Driving Cars*, Wired (Nov. 20, 2017), https://www.wired.com/story/mit-humans-semiautonomous-car-study/ [https://perma.cc/Y2Q6-MZ36] (describing collecting real-life driving scenarios to allow autonomous car designers to design machines that are better able to account for unsafe tendencies and human error).

156 *See*, *e.g.*, Adam C. Uzialko, *AI Comes to Work: How Artificial Intelligence Will Transform Business*, Bus. News Daily (Apr. 22, 2019), https://www.businessnewsdaily.com/9402-artificial-intelligence-business-trends.html [https://perma.cc/UQ9W-LDPS] (describing how artificial intelligence can act in situations not foreseen by developers to revolutionize products).

of "smart cities"[157] and of tethered medical devices depend on the assumption that by monitoring voluminous data flows, we can optimize against a range of challenges. At the macro level, these include pollution and the burden of maintaining and fixing costly infrastructure. At the micro level, optimization could account for subjective experiences that might cause an individual to have higher blood pressure. Tethering can be an important component of the continuous feedback between users and designers of these systems.

Academics have pointed to alluring possibilities enabled by monitoring, optimization, and the delegation of power to digital agents. Eric Goldman has proposed that our computers could intermediate many of our experiences, and in so doing, keenly understand our deepest desires. Goldman's proposal is articulated as a "Coasean filter," a device-based system that would target advertising to the user perfectly, based upon that user's total internet experiences.[158] Rory Van Loo anticipates transaction-cost-mitigating digital butlers.[159] Van Loo foresees the emergence of "hyperswitching," enabled by assistants that can search for and acquire good deals, freeing the consumer from noisome transaction costs in switching wireless phone or bank accounts. These kinds of services will implicate many of the risks we detail below, but perhaps could deliver on their promises with proper economic and legal incentives in place.

Fourth, tethering could make new economic models possible. A move from selling to a subscription model may provide sellers with more stable revenue over time.[160] Society is witnessing this change in software sales, where prominent technology companies such as Microsoft and Adobe have moved to subscription models, in part because critical software packages need continuous updating and care to avoid security problems.[161] Currently, some firms fail, leaving products unsupported or inoperable.[162] A move to subscription and thus regular

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157 *See generally* Andrea Zanella et al., *Internet of Things for Smart Cities*, 1 IEEE INTERNET THINGS J. 22 (Feb. 2014).

158 Eric Goldman, *A Coasean Analysis of Marketing*, 2006 WIS. L. REV. 1151, 1202.

159 Rory Van Loo, *Digital Market Perfection*, 117 MICH. L. REV. 815 (2019).

160 *See* Gürses & van Hoboken, *supra* note 147; Bob House, *How Recurring Revenue Increases Business Value*, INC.COM (Sept. 5, 2017), https://www.inc.com/bob-house/need-to-increase-business-value-recurring-revenue-.html [https://perma.cc/K9HU-4J3Y].

161 *See* David Pogue, *Adobe's Software Subscription Model Means You Can't Own Your Software*, SCI. AM. (Oct. 2013), https://www.scientificamerican.com/article/adobe-software-subscription-model-means-you-cant-own-your-software/?print=true [https://perma.cc/5CLH-2N8H].

162 *See*, *e.g.*, Rob Price, *The Smart-Home Device that Google is Deliberately Disabling Was Sold with a 'Lifetime Subscription,'* BUS. INSIDER (Apr. 5, 2016), https://www.businessin

revenue might be unpopular, but perhaps better for consumers if it keeps the company in business to continue to provide support.[163]

Subscription models may also be a better deal for some consumers.[164] For example, a user might find it convenient to use Adobe's photo-editing software just once a year, perhaps when perfecting a holiday picture. Because the tether can monitor use, the product or service can be meted out in precise ways, perhaps making it possible for someone who cannot afford the Adobe suite to temporarily get the functionality needed to complete some specific task.[165] In fact, tethering could enable widespread price discrimination that subsidizes access for those who cannot afford the full product.[166]

On a larger level, we seem to be on the cusp of a rental society, with many people, for example, deciding not to own a car because of the availability of ride services.[167] Cities are now littered with bicycles and scooters that are available for quick rental after installing a phone application.[168] Ownership has its advantages but at the same time, ownership involves rivalrous resources that go unused for most hours of the day.[169] Some consumers could reasonably conclude that ownership of certain resources is an albatross, that our things keep us from being mobile, spontaneous, even from being happy.

Of course, there are compelling arguments to be made in favor of ownership. These include increased autonomy, more reliable and durable access, alienability, protection from fluctuating prices, and greater privacy.[170] Emphasizing these benefits to consumers may convince them to embrace ownership in some contexts. But, as discussed below, tethering renders clear distinctions between goods and ser-

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sider.com/revolv-smart-home-hubs-lifetime-subscription-bricked-nest-google-alphabet-internet-of-things-2016-4 [https://perma.cc/62MV-YBZK].

163 *See* House, *supra* note 160.

164 *See*, *e.g.*, Pogue, *supra* note 161.

165 *See id.*

166 Manta & Olson, *supra* note 84, at 140. *But see* Perzanowski & Schultz, *supra* note 57, at 3–4.

167 *See* Jim Edwards, *Carpocalypse Now*, Bus. Insider (Mar. 3, 2019), https://www.businessinsider.com/carpocalypse-cars-automobile-sales-data-us-europe-2019-3 [https://perma.cc/S5ME-3SX5].

168 *See* Luz Lazo, *First the Dockless Bikes, Now Scooters.*, Wash. Post (Mar. 13, 2018), https://www.washingtonpost.com/news/dr-gridlock/wp/2018/03/13/first-the-dockless-bikes-now-you-can-hop-on-a-scooter-at-a-sidewalk-near-you/?utm_term=.b06c7c5446f3 [https://perma.cc/6NLG-YTZN].

169 *See generally* Andreas Kamilaris & Francesc X. Prenafeta-Boldú, The Rise of the Sharing Economy 97–128 (Pia A. Albinsson & B. Yasanthi Perera eds., 2018).

170 *See* Perzanowski & Schultz, *supra* note 57, at 2.

vices—and by extension, ownership and temporary access—increasingly difficult to identify and maintain.

Fifth, tethering could help sellers provide high quality features and experiences. Some consumers are happy to cede control in exchange for a well-designed user experience. Most of us, for example, prefer Microsoft or Apple to a completely unburdened operating system, such as Linux.[171] In fact, the Apple ecosystem is the best representation of this control and of its benefit.[172] Apple's services work seamlessly, often with greater security and privacy than competing offerings.[173] And, by tightly controlling the authorized repair market, Apple hopes to guarantee that fixes will be done well, assuming the consumer can afford them.[174] Of course, as discussed below, Apple has other less laudatory reasons to restrict repair.[175]

Finally, for some products, a tether cannot be avoided. Many services require a link back to some service. For instance, voice assistants as currently designed need to consult the manufacturer's cloud resources.[176] As we will see, such assistants are locked to a single seller—Google, Apple, Facebook, or Amazon—as part of a thin-wedge strategy to win market share for the operating system of the home.[177] But, there is no principled reason why a voice assistant could not incorporate services from competing sellers.

These advantages of tethering are not discrete. They are cumulative and could enable entirely new business models and knock-on services. In fact, tethers may enable moonshot advances in products. Just as today's middle class lives like the kings of earlier centuries, tethered products could enable a leap for today's average consumers into the world of the ultra-rich. Imagine products and services that are

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171 *See, e.g.*, Klint Finley, *How Apple Killed the Linux Desktop*, CNN (Aug. 28, 2012), https://www.cnn.com/2012/08/27/tech/web/apple-linux-desktop/index.html [https://perma.cc/A7QN-DWT5].

172 *See* James Grimmelmann & Paul Ohm, *Dr. Generative Or: How I Learned to Stop Worrying and Love the iPhone*, 69 MD. L. REV. 910, 918 (2010) (reviewing JONATHAN ZITTRAIN, THE FUTURE OF THE INTERNET—AND HOW TO STOP IT (2008)).

173 *See id.* at 932.

174 *See* Ryan Kailath, *How Apple's Technology Affects the Smartphone Repair Business*, MARKETPLACE (June 7, 2017), https://www.marketplace.org/2017/06/07/tech/apple-confirms-secret-technology-iphone-repairs [https://perma.cc/H69K-T8N4].

175 *See infra* Section III.A.5.

176 *See, e.g.*, Josh Strupp, *Voice Assistants in 2018: 5 Emerging Trends*, ISL (May 2, 2018), https://isl.co/2018/05/voice-assistants-in-2018-5-emerging-trends/ [https://perma.cc/8L52-XE96].

177 *See* Scott Rosenberg, *Voice Assistants Aren't so Easy to Fire*, WIRED (Oct. 11, 2017), https://www.wired.com/story/voice-assistants-arent-so-easy-to-fire/ [https://perma.cc/U3FB-8U4E] (describing that the choice of a voice assistant binds you to that seller and operating system).

today only available to the super wealthy—from the private plane, to the personalized private security service, to the yacht—being available on some terms through rental, made usable through tethered autonomous and assistive technologies. Mega-billionaire Larry Page reportedly has three flying cars.[178] In our lifetimes, perhaps, you, dear reader, might be able to rent one, and escape the drudgery of the daily commute.

Aside from moonshots, the cumulative conveniences of tethering may become transformative. The connected refrigerator may detect when you are short on milk and have it delivered automatically.[179] The connected thermostat may detect whether you are home or not, cooling the home only when needed.[180] Taken together, these small conveniences might be as transformative as a moonshot advance.

III. Consumer Harms of Tethering

Although tethered products and services promise potential benefits, they depend on an incentive-based landscape that is unlikely to exist in many markets. With strong competition, informed consumers, zero-switching costs, and accountability measures, incentives might align to create a consumer utopia.[181] Without those incentives, however, sellers, as a strategic objective, will use tethers to reduce competition and maximize profit at the expense of consumer surplus. Rational seller strategy will lead to consumer abuse by manufacturers, platform providers, and malicious third parties.

These harms implicate fundamental consumer expectations about the basic operation of the products they buy, as well as unanticipated risks to privacy and security. These pathologies are unlikely to be remedied through consumer self-help, as tethering turns search products into experience ones, thereby introducing new forms of information asymmetry. That is, the buyer of a tethered product cannot perceive the contours of the product's offering, as it could change in ways un-

178 *See* Mark Harris, *Larry Page Is Quietly Amassing a 'Flying Car' Empire*, Verge (July 19, 2018), https://www.theverge.com/2018/7/19/17586878/larry-page-flying-car-opener-kitty-hawk-cora [https://perma.cc/MAZ7-7YSB].

179 *See Out of Milk? LG's New Smart Fridge Will Let You Know*, NBC News (May 7, 2014), https://www.nbcnews.com/tech/gift-guide/out-milk-lgs-new-smart-fridge-will-let-you-know-n99531 [https://perma.cc/PLM5-3JW3].

180 Dan Seifert, *Talking to My Thermostat Feels Like the Future, but the Present Isn't Ready*, Verge (Sept. 25, 2017), https://www.theverge.com/2017/9/25/16349860/ecobee4-thermostat-alexa-smarthome-review [https://perma.cc/JQR3-2JZ3].

181 *See supra* Part II.

foreseeable even to the seller.[182] More broadly, tethering jeopardizes autonomy by constraining consumers' freedom of speech and action in troubling ways. This Part outlines the direct harms of tethering to consumers, drawing from a raft of recent real-world examples.

The prevalence of embedded software, persistent network connections, and a legal framework solicitous of the whims of device makers mean that consumers confront these risks daily, whether they know it or not. The discussion below offers a taxonomy of harms facing consumers in the tethered economy. But, given the rapid deployment of new tethered products and attendant harms, this list is almost certainly incomplete.

A. Functionality and Durability

The clock in Salisbury Cathedral has been keeping time since 1386.[183] The world's oldest operating automobile, La Marquise, was built in 1884.[184] And, a fire station in Livermore, California houses the Centennial Light, an incandescent bulb that has been burning since 1901.[185] These examples of extreme longevity aside, consumers do not expect the products they buy to last forever. Over time, they wear out and break down; that's their natural fate.

Just like cogs, gears, and springs, software can fail, like when a software glitch drained the batteries of Nest thermostats, shutting off the devices and leaving customers with frigid homes.[186] Tethered locks have faced similar issues, shutting their owners out of their homes.[187]

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182 Zittrain warns, "[a] shift to smarter appliances, ones that can be updated by—and only by—their makers, is fundamentally changing the way in which we experience our technologies. Appliances become contingent: rented instead of owned, even if one pays up front for them, since they are subject to instantaneous revision." ZITTRAIN, *supra* note 1, at 107.

183 Parmy Olson, *The World's Oldest Working Clock*, FORBES (Feb. 29, 2008), https://www.forbes.com/2008/02/28/oldest-work-clock-oped-time08-cx_po_0229salisbury.html#1e46493731f3 [https://perma.cc/4RJH-Y32A].

184 Peter Valdes-Dapena, *World's Oldest Car Sells for $4.6 Million*, CNN (Oct. 10, 2011), http://money.cnn.com/2011/10/10/autos/worlds_oldest_car [https://perma.cc/WDM7-BULN].

185 *See* Irene Lechowitzky, *Often Overlooked, the Wine-Country Getaway Town of Livermore, Calif., Has Concerts and Fine Dining at Hand*, L.A. TIMES (June 28, 2018), http://www.latimes.com/travel/la-tr-escape-livermore-20180701-story.html [https://perma.cc/RGL3-MP4T]; Lisa Wade, *114 Years Young: Light Bulbs Before Planned Obsolescence*, PAC. STANDARD (June 14, 2017), https://psmag.com/environment/114-years-young-light-bulbs-before-planned-obsolescence [https://perma.cc/7YFA-QTGC].

186 *See* Nick Bilton, *Nest Thermostat Glitch Leaves Users in the Cold*, N.Y. TIMES (Jan. 13, 2016), https://www.nytimes.com/2016/01/14/fashion/nest-thermostat-glitch-battery-dies-software-freeze.html [https://perma.cc/CC7W-WFNR].

187 *See* Joel Hruska, *Airbnb "Smart Locks" Bricked by Bad Firmware Update*, EXTREME TECH (Aug. 15, 2017), https://www.extremetech.com/computing/254177-internet-things-smart-locks-bricked-bad-firmware-update [https://perma.cc/46MK-AXYX] (Lockstate sent a firmware

And, Nike's self-lacing smart shoes were rendered inoperable by a faulty firmware update.[188] Smart devices may add unnecessary complexity to everyday devices, making such failures more likely, but software bugs are not entirely dissimilar to more familiar mechanical failures.[189]

Tethering, however, introduces new dynamics that present consumers with unique risks and harms. It allows manufacturers to decide precisely how long a product will last and what feature set it will offer. And, it often means that when a company fails, the products it sold no longer work. Contrast the Centennial Light with the LED bulbs built into the IlluMask light therapy device. Although rated for over 30,000 hours of use, embedded software limits IlluMask bulbs to a mere 15 minutes a day for 30 days.[190] Or consider Emberlight, a company that created network-connected light sockets.[191] After the company shut down, the devices were useless since every request to turn a light off or on had to be processed through the firm's now shuttered cloud service.[192] For tethered products, it is not the wear and tear of physical components, but the business decisions of the seller that often dictate whether a product continues to operate.[193]

1. Bricking

No example illustrates the problem of "bricking," the post-sale, remote disabling of a device,[194] as clearly as Nest's decision to kill the Revolv home automation hub. Nest, a tethered device maker owned

update that disabled earlier version of the smart locks and made them inoperable); Stewart Wolpin, *How Kevo Locked Me and My Wife Out of Our Home*, GEAR BRAIN (Sept. 28, 2016), https://www.gearbrain.com/kwikset-kevo-bluetooth-smart-locks-locked-out-2013817788.html [https://perma.cc/HRN9-CP5T] (failure to configure Kevo app to new phone locked couple out of home).

188 Ashley Carman, *Nike's Smart Sneakers Are Breaking When Used with an Android Phone*, VERGE (Feb. 20, 2019), https://www.theverge.com/circuitbreaker/2019/2/20/18233157/nike-adapt-bb-android-app-update-software-break [https://perma.cc/7KP3-XDFT].

189 One crucial difference is that when tethered devices fail, it is often in unison. *See, e.g.*, Kieren McCarthy, *Not OK Google: Massive Outage Turns Smart Home Kit Utterly Dumb*, THE REGISTER (June 27, 2018), https://www.theregister.co.uk/2018/06/27/google_home_outage (Google Home outage affected all cloud-connected devices) [https://perma.cc/55HG-HB6J].

190 *See* Tim Cushing, *DRM; Or How to Make 30,000-Hour LED Bulbs "Last" Only One Month*, TECHDIRT (Mar. 18, 2015), https://www.techdirt.com/articles/20150317/08091030343/drm-how-to-make-30000-hour-led-bulbs.shtml [https://perma.cc/DWX7-EA5C].

191 *See* Dave Gershgorn, *An Internet of Things Flop Means Some Connected Lights Won't Work Anymore*, QUARTZ (Nov. 18, 2017), https://qz.com/1132657/an-internet-of-things-flop-means-some-connected-lights-wont-work-anymore/ [https://perma.cc/ZLA5-RNDG].

192 *Id.*

193 *See* Corkery & Silver-Greenberg, *supra* note 31.

194 See generally Natasha Tusikov, *Regulation Through "Bricking": Private Ordering in the*

by Google's parent company Alphabet, sold the $300 Revolv, which allowed consumers to connect various devices and control them through a single interface.[195] Nest stopped selling the Revolv shortly after acquiring the company in 2014. In March of 2016—despite the company's promise of a "lifetime subscription" for Revolv owners[196]—Nest announced it would push an involuntary software update to the devices that would render them entirely inoperable.[197] As the company explained, after May 15, "The Revolv app won't open and the hub won't work."[198] In short, Nest bricked every Revolv it ever sold.[199]

Logitech, the maker of remote controls and other peripherals, adopted the same tactic just a year later.[200] The company sent out an email announcing that after a date certain the Harmony Link, a device that allowed smartphones to act as universal remote controls, would "no longer function."[201] But, Logitech offered its customers no explanation for breaking their devices.[202]

Not surprisingly, neither of these decisions was well-received. They attracted considerable attention in the technology press, and consumers expressed frustration through social media.[203] Nest's bricking of the Revolv even triggered a Federal Trade Commission

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"Internet of Things," 8 INTERNET POL'Y REV., no. 2, (June 18, 2019) (explaining bricking as a form of technology regulation).

195 *See* Klint Finley, *Nest's Hub Shutdown Proves You're Crazy to Buy into the Internet of Things*, WIRED (Apr. 5, 2016), https://www.wired.com/2016/04/nests-hub-shutdown-proves-youre-crazy-buy-internet-things [https://perma.cc/XT9L-88R9].

196 Rob Price, *The Smart-Home Device that Google is Deliberately Disabling was Sold with a "Lifetime Subscription"*, BUS. INSIDER (Apr. 5, 2016), https://www.businessinsider.com/revolv-smart-home-hubs-lifetime-subscription-bricked-nest-google-alphabet-internet-of-things-2016-4 [https://perma.cc/79U4-6EWJ].

197 *See id.*

198 Arlo Gilbert, *The Time That Tony Fadell Sold Me a Container of Hummus*, MEDIUM (Apr. 3, 2016), https://medium.com/@arlogilbert/the-time-that-tony-fadell-sold-me-a-container-of-hummus-cb0941c762c1#.nhl96qogu [https://perma.cc/J5ML-2WAB].

199 *See Brick*, MERRIAM-WEBSTER, https://www.merriam-webster.com/dictionary/brick [https://perma.cc/YM8Q-76SA] (defining as "to render (an electronic device, such as a smartphone) nonfunctional (as by accidental damage, malicious hacking, or software changes)").

200 *See* Tom Allen, *Logitech Will Deliberately Brick Harmony Link Devices Next Year*, THE INQUIRER (Nov. 8, 2017), https://www.theinquirer.net/inquirer/news/3020612/logitech-will-deliberately-brick-harmony-link-devices-next-year [https://perma.cc/UX7R-AWWT].

201 Chris Welch, *Logitech Will Brick Its Harmony Link Hub for All Owners in March*, VERGE (Nov. 8, 2017), https://www.theverge.com/circuitbreaker/2017/11/8/16623076/logitech-harmony-link-discontinued-bricked [https://perma.cc/MM6B-59DK].

202 *See id.*

203 *See* Price, *supra* note 196; Brian Barrett, *After Backlash, Logitech Will Upgrade All Harmony Link Owners for Free*, WIRED (Nov. 9, 2017), https://www.wired.com/story/logitech-giving-harmony-link-owners-a-free-harmony-hub/ [https://perma.cc/ZY4N-U5Y7].

("FTC") investigation, which was closed after the company provided full refunds to customers.[204] And, Logitech responded to the overwhelmingly negative reaction by providing free upgrades to the Link's replacement, the Harmony Hub.[205]

Short of not having their devices bricked in the first place, a full refund or a replacement device would strike most consumers as a reasonable resolution, although it does not contemplate the transaction costs borne by consumers, or their investment in tailoring these devices.[206] In particular, with home automation, some purchasers of the Revolv had created intricate home-controlling mechanisms.[207] Still, it would be overly optimistic to be heartened by these two examples. They provide striking demonstrations of the degree of control tethering enables device makers to exert over consumer products. While the FTC may occasionally intervene in high profile cases, its authority and, more importantly, its enforcement authority, is limited; the FTC is also short on resources.[208] And, as Logitech's cribbing from the Nest playbook suggests, even an FTC enforcement effort is not enough to deter expedient bricking of tethered devices.

Aside from bricking, the basic notion of a product's "lifetime" is ambiguous for tethered products. Product lifetime is dictated not only by the quality of its hardware, but also how long its manufacturer supports it. And, there is no standard definition for what constitutes a product "lifetime" for a software-enabled device.[209] To illustrate, consider that TomTom GPS devices are sold with "lifetime" support.[210]

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204 Letter from Mary K. Engle, Assoc. Dir., Div. for Advert. Practices, FTC, to Richard J. Lutton, Jr., Head of Legal & Regulatory Affairs, Nest Labs, Inc. (July 7, 2016), https://www.ftc.gov/system/files/documents/closing_letters/nid/160707nestrevolvletter.pdf [https://perma.cc/CU35-RA6T].

205 *See* Barrett, *supra* note 203.

206 *See* Gilbert, *supra* note 198. This risk is also present with non-tethered products. But tethered products are unique in at least two ways. First, non-patented replacement parts are generally available in a way that replacement services are not. Second, consumers assume the risk of natural wear and tear, but do not anticipate the risk of bricking.

207 *See* Nick Statt, *Nest Is Permanently Disabling the Revolv Smart Home Hub*, VERGE (Apr. 4, 2016), https://www.theverge.com/2016/4/4/11362928/google-nest-revolv-shutdown-smart-home-products [https://perma.cc/NX84-VH53].

208 *See* Chris Jay Hoofnagle, *Assessing the Federal Trade Commission's Privacy Assessments*, 14 IEEE SECURITY & PRIVACY, no. 2, 58, 58–64 (Mar.–Apr. 2016).

209 *See, e.g.*, Terrell McSweeny, *Consumer Protection in the Age of Connected Everything*, 62 N.Y.L. SCH. L. REV. 203, 213 (2017) (suggesting that "[m]anufacturers must either make clear to consumers how long to expect their devices will be supported or conform to reasonable consumer expectations").

210 *What Are Lifetime Services?*, TOMTOM, http://uk.support.tomtom.com/app/content/name/Lifetime/page/1 [https://perma.cc/6UCQ-64GG].

While the language might imply something resembling "in perpetuity," the company defines this as "the period of time that TomTom continues to support your device with software updates, services, content or accessories. A device will have reached the end of its life when none of these are available any more [sic]."[211] In other words, a product reaches the end of its lifetime when the firms decide to stop supporting it.

2. *Feature Reduction*

Other functional degradations are more subtle. Rather than killing a device in one fell swoop, complete with a press release announcing the execution date, tethering offers the option of incrementally removing features or degrading performance over time. In one recent example, smart speaker maker Sonos announced a new privacy policy that would allow it not only to gather additional usage information but to record users' voices.[212] According to Sonos, "if a customer chooses not to acknowledge the privacy statement, the customer will not be able to update the software on their Sonos system, and over time the functionality of the product will decrease . . . [and] may cease to function."[213] A device that connects with dozens of online music services quickly loses its value without software updates.[214] Other device makers have been more brazen. After touting the PlayStation 3's ability to run Linux operating systems, Sony disabled the "other OS" feature enabling this ability, prompting a class action lawsuit.[215] And, Nintendo prevented all attempts to access games until Wii U owners clicked "Agree" to the new license terms.[216]

More subtly, Apple faced criticism after the company admitted to throttling the processors of older iPhones, effectively slowing the devices down as they aged.[217] The admission came after independent re-

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211 *Id.*

212 *See* Zach Whittaker, *Sonos Says Users Must Accept New Privacy Policy or Devices May 'Cease to Function'*, ZDNET (Aug. 21, 2017), https://www.zdnet.com/article/sonos-accept-new-privacy-policy-speakers-cease-to-function/ [https://perma.cc/XT5N-UH97].

213 *Id.*

214 *See id.*; *Streaming Music*, SONOS, https://www.sonos.com/en-us/streaming-music [https://perma.cc/VL6S-BLTM].

215 *See* Billy Steele, *Original PS3 Owners Can File Claims in the 'Other OS' Lawsuit*, ENGADGET (Oct. 13, 2016), https://www.engadget.com/2016/10/13/sony-ps3-other-os-linux-lawsuit-claims/ [https://perma.cc/SR3R-W77U].

216 *See* Kit Walsh, *Nintendo Updates Take Wii U Hostage Until You "Agree" to New Legal Terms*, EFF (Oct. 13, 2014), https://www.eff.org/deeplinks/2014/10/nintendo-updates-take-wii-u-hostage-until-you-agree-new-legal-terms [https://perma.cc/24R4-P5FD].

217 *See* Geoffrey A. Fowler, *Apple Admits to Slowing Your iPhone as the Battery Ages*, CHI.

searchers identified the link between slow processors and older batteries.[218] Many characterized the move as a ploy to hasten the purchase of new devices, but Apple defended the practice, arguing that slowing processors avoids spikes in energy consumption that can cause older devices to shut down.[219] Taking that explanation at face value, one might still question Apple's choice to bury this feature deep within its operating system rather than give users an option or at least clear notice of the limits imposed on their devices.[220] Apple's longstanding resistance to battery replacement and repair generally only reinforces consumers' suspicions.[221]

3. Changing the Terms of the Bargain

Tethering also enables sellers to fundamentally alter the nature of a deal after the fact. Transactions that look like product sales can transform into service relationships. In 2012, for example, children's book publisher Scholastic launched its Storia eBook store.[222] Two years later, the company shifted to a subscription streaming model.[223] Purchased eBooks disappeared, and the subscription service that replaced them required an active internet connection to read.[224]

Sometimes the terms of the bargain change in ways out of control of even the seller. For instance, in December 2017, Google blocked

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TRIB. (Dec. 21, 2017), http://www.chicagotribune.com/bluesky/technology/ct-apple-slows-iphones-20171221-story.html [https://perma.cc/6BNK-NV99].

218 *See* Jen Kirby, *Apple Admitted It's Slowing Down Certain iPhones*, VOX (Dec. 28, 2017), https://www.vox.com/2017/12/22/16807056/apple-slow-iphone-batteries [https://perma.cc/M4N6-E7PB].

219 *See* Fowler, *supra* note 217.

220 In the wake of this revelation, Apple has introduced a setting to disable throttling. *See* Sam Byford, *How to Turn Off iPhone Throttling in iOS 11.3*, VERGE (Mar. 29, 2018), https://www.theverge.com/2018/2/7/16984234/how-to-iphone-throttling-ios-11-3 [https://perma.cc/9ML7-D3DW].

221 *See* Fowler, *supra* note 217; Jason Koebler, *Apple Is Lobbying Against Your Right to Repair iPhones, New York State Records Confirm*, MOTHERBOARD (May 18, 2017), https://motherboard.vice.com/en_us/article/nz85y7/apple-is-lobbying-against-your-right-to-repair-iphones-new-york-state-records-confirm [https://perma.cc/Q8FG-GKTA]. Apple is facing over 50 separate lawsuits regarding its alleged practice of slowing the performance of old iPhones to encourage people to purchase newer models. *See* Tripp Mickle & Kirsten Grind, *Apple Faces Multiple Lawsuits Over Slowed-Down iPhones; Complaints Could Prolong Attention on Company's Controversial Battery Strategy*, WALL ST. J. (Mar. 28, 2018), https://www.wsj.com/articles/apple-faces-multiple-lawsuits-over-throttled-iphones-1522229400 [https://perma.cc/VJ75-CSEV]. The merits of these suits, however, remain unclear. *See id.*

222 Nate Hoffelder, *Scholastic to Close Storia eBookstore*, DIGITAL READER (July 27, 2014), http://the-digital-reader.com/2014/07/27/scholastic-close-storia-ebookstore-customers-will-lose-access-ebook-purchases/#.U_fFdvSE-a5 [https://perma.cc/42U6-T9L9].

223 *Id.*

224 *See id.*

Amazon Fire users from accessing YouTube, in order to put competitive pressure on Amazon to sell its products.[225] When Amazon provided its consumers technical workarounds, Google blocked those, too.[226] This means that consumers lost device functionality—namely, access to YouTube, an unparalleled source of video content—because of a competitive tussle far removed from the consumer's control.[227] The tether thus creates uncertainty.[228]

4. Firm Failure

As Emberlight suggests, devices that rely on connections to remote servers for basic functionality can leave consumers with worthless devices in the event the firm fails.[229] Juicero is among the most maligned examples of the excesses of the smart device trend. The firm raised $120 million in funding on the promise of its $700 eponymous internet-connected juicer.[230] The Juicero was designed to work only

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225 *See* Janko Roettgers, *Google Starts Blocking YouTube on Amazon's Fire TV, Echo Show*, VARIETY (Dec. 5, 2017), https://variety.com/2017/digital/news/google-blocks-youtube-fire-tv-echo-show-1202631248/ [https://perma.cc/X6KU-ZRJB].

226 *See id.*

227 *See id.*; Bree Brouwer, *YouTube Now Gets Over 400 Hours of Content Uploaded Every Minute*, TUBEFILTER (July 26, 2015), https://www.tubefilter.com/2015/07/26/youtube-400-hours-content-every-minute/ [https://perma.cc/D6EP-E97T].

228 Services can also force users to act under the threat of cancellation. In 2018, an anonymous user of Google Cloud complained that the company threatened to permanently turn off his service—which ran power-generating infrastructure in eight countries—unless he provided a copy of his identification and a credit card within three business days. Punch a Server, *Why You Should Not Use Google Cloud*, MEDIUM (June 29, 2018), https://medium.com/@serverpunch/why-you-should-not-use-google-cloud-75ea2aec00de [https://perma.cc/6FE6-9SCM]; *see also* Greg Sandoval, *A Customer Complaint About Google Cloud Went Viral Last Week, and Now Google Is Doing Damage Control to "Ensure This Does Not Happen Again,"* BUS. INSIDER (July 6, 2018), https://www.businessinsider.com/google-cloud-responds-viral-customer-complaint-2018-7 [https://perma.cc/S942-U2F2]. The user complained, "[c]ustomer service chat is off. There's no phone to call," yet the closure of service would have severe consequences for the enterprise. Punch a Server, *supra*. While the cloud is a pure service, any sophisticated company would take months to move its cloud services. There are significant switching costs involved, and no enterprise could be expected to even weigh all the competitive options in the time Google provided. *See, e.g.*, Steve Ranger, *Cloud Computing Migration: More Expensive and Complicated Than You Thought*, ZDNET (Sept. 22, 2017), https://www.zdnet.com/article/cloud-computing-migration-more-expensive-and-complicated-than-you-thought/ [https://perma.cc/T8U7-GXM3]. The controversy forced Google to revisit their policies, but the underlying opportunity for imposing new policy still exists—Google has incentives to skimp on customer service while at the same time making new requirements, long after the buyer is locked into the service. This power to compel is present in all service relationships but can become perverse in situations where transaction costs make switching impractical.

229 *See supra* note 191 and accompanying text.

230 David Gelles, *Juicero, Start-Up With a $700 Juicer and Top Investors, Shuts Down*, N.Y. TIMES (Sept. 1, 2017), https://www.nytimes.com/2017/09/01/technology/juicero-start-up-shuts-

with premade packets of chopped fruits and vegetables.[231] Each packet featured a QR code that the juicer scanned, according to the company, to ensure its freshness.[232] If the code was missing, the packet was expired, or your internet connection went down, no juice for you.[233] More likely, Juicero's design was intended to prevent other companies from selling competing fruit and vegetable packets, much like Keurig's coffee pod DRM.[234] But, Juicero's plans began to unravel when reports surfaced that its packets could be easily squeezed by hand, obviating the need for a $700 WiFi-enabled device.[235] Not long after that, the company and its vegetable-authenticating servers shut down, leaving customers with an overpriced monument to smart device enthusiasm.[236] The loss of a juicer may seem comical or even deserved, but these same problems are likely to present themselves in other, more dire contexts, including next-generation medical devices.[237]

5. Repair

Makers of tethered devices have strong incentives to prevent consumers from repairing their products. As discussed in more detail be-

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down.html [https://perma.cc/9MYT-WU4Z]; Ellen Huet & Olivia Zaleski, *Silicon Valley's $400 Juicer May Be Feeling the Squeeze*, BLOOMBERG (Apr. 19, 2017), https://www.bloomberg.com/news/features/2017-04-19/silicon-valley-s-400-juicer-may-be-feeling-the-squeeze [https://perma.cc/HY2K-E4P7].

231 Huet & Zaleski, *supra* note 230.

232 Gelles, *supra* note 230.

233 Jacob Kastrenakes, *Who Comes up with a $700 Wi-Fi-Connected Juicer?*, VERGE (May 23, 2016), https://www.theverge.com/2016/5/23/11745326/juicero-wifi-juicer-doug-evans-interview [https://perma.cc/QJN6-P5QE].

234 Alyson Shontell, *We Tried Juicero, the $700 Mess-Free Juicer that Silicon Valley Investors and Celebrities Are Crazy About—Here's What It's Like*, BUS. INSIDER (Apr. 16, 2016), http://www.businessinsider.com/juicer-juicer-product-review-2016-4 [https://perma.cc/T4BH-ZRUU].

235 Huet & Zaleski, *supra* note 230.

236 Jason Del Rey, *Juicero, The $700 Juicer Startup, Is Looking for a Buyer—and Shutting Down in the Meantime*, VOX (Sept. 1, 2017), https://www.vox.com/2017/9/1/16243452/juicero-shutting-down-expensive-juicer-for-sale-doug-evans [https://perma.cc/9YPM-W5AZ]. When news broke of the ability to hand-squeeze Juicero packets, the company offered a refund to dissatisfied customers. *See, e.g.*, Jacob Kastrenakes, *Juicero Offering Refunds to All Customers After People Realize $400 Juicer is Totally Unnecessary*, VERGE (Apr. 20, 2017), https://www.theverge.com/2017/4/20/15375940/juicero-full-refund-customers-ceo-jeff-dunn [https://perma.cc/9QU5-G85X]. When it closed its doors months later, it extended that refund offer for 90 days. *See, e.g.*, Maya Kosoff, *Juicero Investors Blame Populism for $400 Juicer's Demise*, VANITY FAIR (Sept. 8, 2017), https://www.vanityfair.com/news/2017/09/juicero-investors-blame-populism-for-400-dollar-juicers-demise [https://perma.cc/CU8P-H25H].

237 *See* Andrea Matwyshyn, *The Internet of Bodies*, 61 WM. & MARY L. REV. (forthcoming 2019).

low, reducing home and third-party repair allows device makers to control the potentially lucrative market for repair services.[238] And, companies that enjoy healthy profit margins on hardware would much rather a consumer buy a new smartphone, for example, than repair an existing one. As Apple CEO Tim Cook recently told investors, "significantly reduced pricing for iPhone battery replacements" were at least partly responsible for the company's flagging revenue figures.[239] An uptick in repairs cost Apple as much as $11 billion.[240] But, another way of looking at it is that Earth's landfills didn't have to absorb millions of still-valuable phones, and consumers saved billions by holding onto serviceable devices.

Device makers like Apple employ a host of tactics to discourage repair.[241] They charge exorbitant prices.[242] They limit the availability of replacement parts.[243] They design products to frustrate repair.[244] They encourage recyclers to destroy used devices.[245] They threaten consumers with legally dubious warranty stickers.[246] They strike deals

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238 *See infra* Part IV.

239 Jason Koebler, *Tim Cook to Investors: People Bought Fewer New iPhones Because They Repaired Their Old Ones*, MOTHERBOARD (Jan. 2, 2019), https://motherboard.vice.com/en_us/article/zmd9a5/tim-cook-to-investors-people-bought-fewer-new-iphones-because-they-repaired-their-old-ones [https://perma.cc/PDU2-YJVQ].

240 Apple expected only one or two million consumers to replace their batteries, but the availability of repair at a low cost changed consumer behavior. *See* Matthew Humphries, *11M iPhone Owners Bought Apple's $29 Battery*, PCMAG (Jan. 15, 2019), https://www.pcmag.com/news/365986/11m-iphone-owners-bought-apples-29-battery [https://perma.cc/MBN7-NQZZ]. But, Apple estimates that 11 million consumers replaced a battery, many of whom decided to hold on to an older device rather than spend upwards of $1,000 on a new mobile phone. *Id.*

241 *See* Jason Koebler, *Apple: iPhones Are Too 'Complex' to Let You Fix Them*, MOTHERBOARD (Sept. 22, 2017), https://motherboard.vice.com/en_us/article/xwgg8z/apple-iphones-are-too-complex-to-allow-unauthorized-repair [https://perma.cc/6RSK-BWK2].

242 *See* Gordon Gottsegen, *Apple Just Made Your iPhone More Expensive to Fix*, CNET (Sept. 14, 2017), https://www.cnet.com/news/apple-iphone-repair-service-price-hike/ [https://perma.cc/7FJR-MF8U] (discussing Apple increasing prices for repairs).

243 *See* Jason Koebler, *DHS Seizes Aftermarket iPhone Screens from Prominent Right-to-Repair Advocate*, MOTHERBOARD (May 11, 2018), https://motherboard.vice.com/en_us/article/evk4wk/dhs-seizes-iphone-screens-jessa-jones [https://perma.cc/FPZ4-YLHN] (discussing Apple limiting purchase of replacement parts to only registered repair services).

244 Adrian Kingsley-Hughes, *How Apple Makes Products Difficult and Expensive to Repair*, ZDNET (Nov. 2, 2012), https://www.zdnet.com/pictures/how-apple-makes-products-difficult-and-expensive-to-repair/2/ [https://perma.cc/7RTE-SGQ7].

245 *See* Jason Koebler, *Apple Forces Recyclers to Shred All iPhones and MacBooks*, MOTHERBOARD (Apr. 20, 2017), https://motherboard.vice.com/en_us/article/yp73jw/apple-recycling-iphones-macbooks [https://perma.cc/LBA5-EWPD].

246 *See FTC Staff Warns Companies that It Is Illegal to Condition Warranty Coverage on the Use of Specified Parts or Services*, FTC (Apr. 10, 2018), https://www.ftc.gov/news-events/press-releases/2018/04/ftc-staff-warns-companies-it-illegal-condition-warranty-coverage [https://perma.cc/6UVV-T7CH]; Matthew Gault, *FTC Gives Sony, Microsoft, and Nintendo 30 Days to*

with marketplaces to exclude refurbished goods.[247] And, they oppose legislation designed to facilitate repair.[248] Aside from imposing significant environmental harm, these practices impose considerable costs on consumers and reduce the life of their devices.[249] The primary arguments for preventing consumer repair are security and quality—in some cases, third party or consumer repair could reduce the integrity of the product.[250]

Tethering exacerbates the problem by offering manufacturers powerful new tools for impeding repair. In 2016, iPhone owners who patronized independent repair shops found their devices inoperable.[251] Their phones would not start up, and the contacts, photos, and other data they stored were inaccessible.[252] Error 53, as the problem came to be known, occurred when third party repair shops replaced a connector between the device's home button and its Touch ID sensor.[253] Phones that were working normally for weeks or months were suddenly bricked after the installation of a software update.[254] When that new code detected a replacement connector, the phone stopped working altogether.[255] Apple justified the move as a security measure,

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Get Rid of Illegal Warranty-Void-if-Removed Stickers, MOTHERBOARD (May 1, 2018), https://motherboard.vice.com/en_us/article/xw7b3z/warranty-void-if-removed-stickers-sony-microsoft-nintendo-ftc-letters [https://perma.cc/RV3A-YDQC].

247 *See* Jason Koebler, *Amazon Is Kicking All Unauthorized Apple Refurbishers Off Amazon Marketplace*, MOTHERBOARD (Nov. 9, 2018), https://motherboard.vice.com/en_us/article/bjexb5/amazon-is-kicking-all-unauthorized-apple-refurbishers-off-the-site [https://perma.cc/TU9V-3EBH].

248 Damon Beres & Andy Campbell, *Apple Is Fighting a Secret War to Keep You from Repairing Your Phone*, HUFFINGTON POST (June 9, 2016), https://www.huffingtonpost.com/entry/apple-right-to-repair_us_5755a6b4e4b0ed593f14fdea [https://perma.cc/7RZY-MEHW].

249 *See* Nick Statt, *Why Apple and Other Tech Companies Are Fighting to Keep Devices Hard to Repair*, VERGE (Aug. 3, 2017), https://www.theverge.com/2017/8/3/16087628/apple-e-waste-environmental-standards-ieee-right-to-repair [https://perma.cc/5P6Q-ZEVG].

250 Researchers have demonstrated that malicious hardware could be included during a mobile phone screen repair. *See* Dan Goodin, *Secret Chips in Replacement Parts Can Completely Hijack Your Phone's Security*, ARS TECHNICA (Aug. 18, 2017), https://arstechnica.com/information-technology/2017/08/a-repair-shop-could-completely-hack-your-phone-and-you-wouldnt-know-it/ [https://perma.cc/6JL3-M5NV].

251 Matthew Panzarino, *Apple Apologizes and Updates iOS to Restore iPhones Disabled by Error 53*, TECHCRUNCH (Feb. 18, 2016), https://techcrunch.com/2016/02/18/apple-apologizes-and-updates-ios-to-restore-iphones-disabled-by-error-53/ [https://perma.cc/REE8-YE47].

252 *See* Miles Brignall, *'Error 53' Fury Mounts as Apple Software Update Threatens to Kill Your iPhone 6*, GUARDIAN (Feb. 5, 2016), https://www.theguardian.com/money/2016/feb/05/error-53-apple-iphone-software-update-handset-worthless-third-party-repair [https://perma.cc/7GSH-BAWP].

253 Panzarino, *supra* note 251.

254 *See* Brignall, *supra* note 252.

255 *See id.*

but quickly issued a software update in the face of public backlash.[256] But, even after the fact, Apple refused requests from some consumers for repair of their bricked devices.[257]

Efforts to limit repair have extended to some unlikely corners of the market. Farmers have repaired their own equipment for centuries. But, as tethering spreads, they have been forced to contend with the tethered economy. Modern John Deere tractors, which can cost more than $500,000,[258] depend on multiple electronic control units (ECUs)—embedded computers that control everything from the engine to the power seat.[259] By controlling access to the software code that runs these ECUs, John Deere prevented independent diagnosis and repair of the equipment it sold to farmers.[260] From John Deere's perspective, farmers didn't own their tractors; they merely enjoyed "an implied license for the life of the vehicle to operate the vehicle."[261] Eventually, farmers and repair advocates were able to obtain a temporary exemption from § 1201 of the DMCA,[262] but that provision is just one of many legal and practical hurdles to repairing tethered products. A similar fight has played out between car companies and independent repair shops. After Massachusetts passed a Right to Repair bill, the industry agreed to provide aftermarket repair shops with access to diagnostic data.[263] Similar bills have been introduced in a number of states but have not yet gained traction.[264]

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256 *See id.*

257 Jennifer Bisset, *Apple Fined $6.6M in Australia After Error 53 Controversy*, CNET (June 18, 2018), https://www.cnet.com/news/apple-bricked-our-phones-with-error-53-now-it-owes-6-8-million-in-australia/ [https://perma.cc/ZG25-SYUK].

258 *See* Justin Law, *John Deere Reveals Prices on Its 9RX and Hits High Water Mark*, WEEKLY TIMES (Aug. 28, 2015), https://www.weeklytimesnow.com.au/machine/john-deere-reveals-prices-on-its-9rx-and-hits-high-water-mark/news-story/f634498894817078b5c1bfa77bf2b573 [https://perma.cc/F4TU-SFJU].

259 *See* PERZANOWSKI & SCHULTZ, *supra* note 57, at 146.

260 *Id.*

261 Bartholomew, *supra* note 115, at 6; *see also* PERZANOWSKI & SCHULTZ, *supra* note 57, at 146 (discussing liability under the DMCA).

262 *See* U.S. COPYRIGHT OFFICE, SECTION 1201 RULEMAKING: SIXTH TRIENNIAL PROCEEDING TO DETERMINE EXEMPTIONS TO THE PROHIBITION ON CIRCUMVENTION 218 (2015), https://www.copyright.gov/1201/2015/registers-recommendation.pdf [https://perma.cc/4ZNZ-YVWH].

263 *See* Billy Baker, *The Backyard Mechanic Who is Taking Over Tesla*, BOS. GLOBE (Mar. 4, 2019), https://www.bostonglobe.com/metro/2019/03/04/the-backyard-mechanic-who-taking-tesla/Sv1l8q2sxpQvTFMp13VFwM/story.html [https://perma.cc/GYV2-227N]; Jason Torchinsky, *Carmakers Want to Use Copyright Law to Make Working on Your Car Illegal*, JALOPNIK (Apr. 21, 2015), http://jalopnik.com/carmakers-want-to-make-working-on-your-car-illegal-beca-1699132210 [https://perma.cc/HV6G-MEUW].

264 *See* Chaim Gartenberg, *California Becomes the 18th State to Introduce Right to Repair Bill*, VERGE (Mar. 8, 2018), https://www.theverge.com/2018/3/8/17097256/california-right-to-re-

6. *Physical Harm*

When a device maker bricks a device, renders it temporarily inoperable, or removes features, it can cause physical harms to people and property. As Rebecca Crootof has powerfully argued, the physicality of tethered devices "alters and magnifies" their potential harms.[265] Consider a tethered vehicle. If your carmaker disables your vehicle for missing a lease payment—or exceeding your allotted miles or tweeting angrily at the company's CEO—you may find yourself "unable to take [your] children to the emergency room, . . . marooned in dangerous neighborhoods, [or] idling in an intersection."[266] As Crootof explains, the harms here are not measured merely in terms of the lost value of chattels, but in physical harm to individuals. Tethered security systems, fire alarms, baby monitors, and thermostats could all lead to significant physical harm, including loss of life.[267]

In the tethered economy, device makers can dictate whether and to what extent products consumers use every day—phones, cars, lightbulbs, and locks—will function. But, tethering introduces risks that go well beyond lost functionality.

B. Information Risks

Because tethered devices, almost by definition, collect information about consumer behavior and integrate with other networked devices and services, they create potential harms that are qualitatively different from their analog predecessors. Although consumers are beginning to understand these risks, most wouldn't anticipate that their cars could be witnesses against them in a criminal trial or that their pacemakers could be hacked by a foreign government.[268]

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pair-bill-apple-microsoft-service-replace-parts [https://perma.cc/46E5-GGT7]. For a thorough analysis of the intellectual property implications of the right to repair movement, see Leah Chan Grinvald & Ofer Tur-Sinai, *Intellectual Property Law and the Right to Repair*, 88 FORDHAM L. REV. (forthcoming 2019).

265 Crootof, *supra* note 140, at 23.

266 *Id.* at 3.

267 *Id.* at 6, 24.

268 Marina Medvin, *Your Vehicle Black Box: A 'Witness' Against You in Court*, FORBES (Jan. 8, 2019), https://www.forbes.com/sites/marinamedvin/2019/01/08/your-vehicle-black-box-a-witness-against-you-in-court-2/#236844c831c5 [https://perma.cc/BF3W-H8WC]; *see* Micah Zenko, *6 Things Washington Doesn't Get About Hackers*, FOREIGN POL'Y (Aug. 19, 2015), https://foreignpolicy.com/2015/08/19/6-things-washington-doesnt-get-about-hackers/ [https://perma.cc/5JQE-XR9L].

1. Privacy

A device that tracks your location in real time—like a modern GPS-enabled vehicle—can reveal a great deal about your behavior.[269] As a Ford executive unwisely proclaimed, "[w]e know everyone who breaks the law, we know when you're doing it. We have GPS in your car, so we know what you're doing."[270] Technology can be used to enforce compliance with the law. Ford's Intelligent Speed Limiter, for example, scans the road for speed limit signs and then prevents drivers from exceeding posted limits.[271]

Technology can be used as evidence against users as well. An Ohio man was charged with arson, partly on the basis of data stored in his pacemaker that revealed his heart rate was not elevated at the time he allegedly discovered the blaze.[272] A court later ruled that the pacemaker data could be introduced at trial.[273] In recent years, investigators and prosecutors have relied on evidence from Fitbits,[274] Apple Watches,[275] Amazon Alexas,[276] and smart alarms.[277]

Beyond law enforcement, tethered devices offer greater opportunity for private actors to gather information about consumer behavior. Device makers and service providers have attempted to exploit the value of that information, often opaquely. Samsung sold televisions that eavesdropped on consumers by default and uploaded recorded audio to the cloud,[278] and Vizio developed technology to detect all

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269 *See* Carpenter v. United States, 138 S. Ct. 2206 (2018).

270 Edwards, *supra* note 46.

271 *See* Healey, *supra* note 38.

272 *See* Deanna Paul, *Your Own Pacemaker Can Now Testify Against You in Court*, WIRED (July 29, 2017), https://www.wired.com/story/your-own-pacemaker-can-now-testify-against-you-in-court/ [https://perma.cc/R5UP-T4YW].

273 *See id.*

274 *See* Alejandro Alba, *Police, Attorneys Are Using Fitness Trackers as Court Evidence*, N.Y. DAILY NEWS (Apr. 19, 2016), http://www.nydailynews.com/news/national/police-attorneys-fitness-trackers-court-evidence-article-1.2607432 [https://perma.cc/YFN4-7AL9].

275 *See* Marguerite Reardon, *Your Alexa and Fitbit Can Testify Against You in Court*, CNET (Apr. 5, 2018), https://www.cnet.com/news/alexa-fitbit-apple-watch-pacemaker-can-testify-against-you-in-court/ [https://perma.cc/E5MZ-HJKN].

276 *See id.*; Gerald Sauer, *A Murder Case Tests Alexa's Devotion to Your Privacy*, WIRED (Feb. 28, 2017), https://www.wired.com/2017/02/murder-case-tests-alexas-devotion-privacy/ [https://perma.cc/GP2B-P3RA].

277 *See* Justin Jouvenal, *Commit a Crime? Your Fitbit, Key Fob or Pacemaker Could Snitch on You*, WASH. POST (Oct. 9, 2017), https://www.washingtonpost.com/local/public-safety/commit-a-crime-your-fitbit-key-fob-or-pacemaker-could-snitch-on-you/2017/10/09/f35a4f30-8f50-11e7-8df5-c2e5cf46c1e2_story.html [https://perma.cc/DPW8-63PU].

278 *See* Matyszczyk, *supra* note 49.

programming displayed on its televisions in order to customize advertising.[279]

Not to be outdone, Uber tracked and displayed the real-time whereabouts of well-known riders as a literal party trick.[280] More recently, users of the Nest Secure home security system were alarmed to find out that the devices contained a secret microphone that Google planned to activate more than a year after the product's release.[281] And Alexa users were shocked to discover that Amazon employs thousands of workers to listen to and annotate recordings of users to improve its speech recognition and natural language processing.[282]

Nor are these harms distributed equally. Consumers who buy less expensive devices, which often feature implicit subsidies for the sharing of information, face greater privacy risks. This fact has led some to worry that privacy is emerging as a luxury good, available only to those able to pay a premium for devices from companies like Apple that have adopted comparatively privacy-protective business models.[283]

Compounding these problems, poor information security practices have exposed personal information to malicious third parties. VTech's smart devices collected personal information, including photos and text messages, from hundreds of thousands of children without adequate parental consent.[284] The company's poorly-secured

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279 *See* Jacob Kastrenakes, *Most Smart TVs Are Tracking You—Vizio Just Got Caught*, VERGE (Feb. 7, 2017), https://www.theverge.com/2017/2/7/14527360/vizio-smart-tv-tracking-settlement-disable-settings [https://perma.cc/7APB-5UMA].

280 *See* Brian Fung, *Uber Settles with FTC over "God View" and Some Other Privacy Issues*, L.A. TIMES (Aug. 15, 2017), http://www.latimes.com/business/technology/la-fi-tn-uber-ftc-20170815-story.html [https://perma.cc/V5S5-SJN7]; Kashmir Hill, *"God View": Uber Allegedly Stalked Users for Party-Goers' Viewing Pleasure*, FORBES (Oct. 3, 2014), https://www.forbes.com/sites/kashmirhill/2014/10/03/god-view-uber-allegedly-stalked-users-for-party-goers-viewing-pleasure/ [https://perma.cc/QWR9-TUNG].

281 Sidney Fussell, *The Microphones That May Be Hidden in Your Home*, THE ATLANTIC (Feb. 23, 2019), https://www.theatlantic.com/technology/archive/2019/02/googles-home-security-devices-had-hidden-microphones/583387/ [https://perma.cc/6V8L-EDRS].

282 *See* Kate O'Flaherty, *Amazon Staff Are Listening to Alexa Conversations—Here's What to Do*, FORBES (Apr. 12, 2019), https://www.forbes.com/sites/kateoflahertyuk/2019/04/12/amazon-staff-are-listening-to-alexa-conversations-heres-what-to-do [https://perma.cc/CQJ7-R22L].

283 *See* Jacob Kastrenakes, *Apple Exec Dismisses Google CEO's Criticism Over Turning Privacy into a 'Luxury Good'*, VERGE (May 27, 2019), https://www.theverge.com/2019/5/27/18641372/apple-craig-federighi-privacy-criticism-google-luxury-good [https://perma.cc/C3UM-XDN2].

284 *See Electronic Toy Maker VTech Settles FTC Allegations That it Violated Children's Privacy Law and the FTC Act*, FTC (Jan. 8, 2018), https://www.ftc.gov/news-events/press-releases/2018/01/electronic-toy-maker-vtech-settles-ftc-allegations-it-violated [https://perma.cc/E87Z-E6KJ].

servers were subsequently hacked.[285] CloudPets, a line of cloud-enabled stuffed animals, recorded and uploaded millions of voice recordings of children; the company's database was hacked and held for ransom.[286] This phenomenon isn't limited to children's toys. WeVibe's internet-connected sex toys not only reported on the frequency, duration, and intensity of their use, but they linked that usage data to individual consumers using their email addresses.[287] In short, tethering exposes the most intimate details of our lives to government, to private surveillance, and as the next Section explains, to the ongoing risk of data spills.

2. Security

Perhaps the most widespread challenge tethered devices introduce is their insecurity. Many so-called smart devices are easily hacked, leaving both individual users and the broader network infrastructure exposed to a variety of attacks.[288] Because they are connected, the most mundane product decisions will implicate cyber-physical systems security.[289]

Tethered appliances collect data in contexts where individuals have high expectations of privacy and that affect our physical environment.[290] These devices will thus raise all the issues known in the "CIA" triad of cyber security—confidentiality, integrity, and availability—in unforeseen ways.[291] The threat models are also diverse, and do not require hostile or ill intent. Mere coding errors (cyber *accidents*) can have security consequences as deep as the most deliberate cyber-attacks.[292] Insiders at service providers and third parties can use ser-

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285 *See id.*

286 *See* Alex Hern, *CloudPets Stuffed Toys Leak Details of Half a Million Users*, GUARDIAN (Feb. 28, 2017), https://www.theguardian.com/technology/2017/feb/28/cloudpets-data-breach-leaks-details-of-500000-children-and-adults [https://perma.cc/RDV2-WNTB].

287 *See* Adam Boult, *"Smart-Vibrator" Firm Tracked Users' Sexual Activity Without Their Knowledge*, TELEGRAPH (Mar. 17, 2017), https://www.telegraph.co.uk/technology/2017/03/14/smart-vibrator-firm-tracked-users-sexual-activity-without-knowledge/ [https://perma.cc/98FL-BMM5].

288 *See* Laura DeNardis & Mark Raymond, *The Internet of Things as a Global Policy Frontier*, 51 U.C. DAVIS L. REV. 475, 476–78 (2017).

289 *See id.*

290 *See id.* at 482–83.

291 *See* Jeff Kosseff, *Defining Cybersecurity Law*, 103 IOWA L. REV. 985, 997–98 (2018) (discussing and defining the CIA triad).

292 *See, e.g.*, Fred Donovan, *ERS Online Coding Error Exposes 1.25M Users to Health Data Breach*, HEALTH IT SECURITY (Oct. 25, 2018), https://healthitsecurity.com/news/ers-online-coding-error-exposes-1.25m-users-to-health-data-breach [https://perma.cc/7BE7-QPBQ] ("[A] coding error on its password-protected ERS Online portal allowed certain members who logged

vice data to embarrass the user, possibly even to stop them from seeking remedies for wrongdoing.[293]

Nearly half a million pacemakers sold by St. Jude Medical, now Abbott, were susceptible to remote attacks that could rapidly and fatally drain their batteries or alter the heart rhythm of patients.[294] Yet the patch for this vulnerability created new problems, including a risk of device malfunction.[295] The cost-benefit analysis led some doctors to tell patients to assume the risk of hacking lest the pacemaker malfunction during the upgrade process.[296]

Hackers took remote control of the steering and braking systems of a Jeep as it was on the road.[297] A smart refrigerator exposed the Gmail credentials of its users.[298] A team of researchers successfully took control of an entire building's Philips Hue smart lightbulbs from over 400 yards away using a drone,[299] enabling them to induce epilep-

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in . . . to view other members' . . . first and last names, Social Security numbers, and ERS member identification numbers."); Danny Palmer, *Coding Error Blamed for NHS Data Sharing Mistake Affecting 150,000 Patients*, ZDNET (July 3, 2018), https://www.zdnet.com/article/coding-error-blamed-for-nhs-data-sharing-mistake-affecting-150000-patients/ [https://perma.cc/TJ43-ZJRJ] ("A coding error in software used by doctors has led to confidential data of around 150,000 NHS patients being shared without their permission.").

293 *See* Kashmir Hill, *Seamstress Discovers Downside of Suing Facebook*, FORBES (Feb. 15, 2012), https://www.forbes.com/sites/kashmirhill/2012/02/15/facebook-lawyers-successfully-scare-off-seamstress-suing-over-sponsored-stories/ [https://perma.cc/GLQ8-GRZE] ("When it came time to do depositions, Facebook lawyers, from Cooley LLP, allegedly used plaintiffs' Facebook pasts to 'attack them.' (Unsurprisingly.)"); Dave Simpson, *"Public Figure" Says Gay Porn Site Extorts with IP Claims*, LAW360 (Aug. 15, 2017), https://www.law360.com/cybersecurity-privacy/articles/954706 [https://perma.cc/EC3A-DP65] (plaintiff alleged that a gay pornography site extorted him/her by threatening to file a lawsuit with pages of pornographic exhibits and by filing a press release to give publicity to the plaintiff's membership).

294 *See Firmware Update to Address Cybersecurity Vulnerabilities Identified in Abbott's (formerly St. Jude Medical's) Implantable Cardiac Pacemakers: FDA Safety Communication*, FDA (Aug. 29, 2017), https://www.fda.gov/medicaldevices/safety/alertsandnotices/ucm573669.htm [https://perma.cc/ERL9-AW4D].

295 *See* Peter Loftus, *Hacking Is a Risk for Pacemakers. So Is the Fix*, WALL ST. J. (Oct. 20, 2017), https://www.wsj.com/articles/hacking-is-a-risk-for-pacemakers-so-is-the-fix-1508491802 [https://perma.cc/W4CZ-23BK].

296 *See id.*

297 *See* Andy Greenberg, *After Jeep Hack, Chrysler Recalls 1.4M Vehicles for Bug Fix*, WIRED, (July 24, 2015), http://www.wired.com/2015/07/jeep-hack-chrysler-recalls-1-4m-vehicles-bug-fix [https://perma.cc/6S3J-S62G] [hereinafter Greenberg, *After Jeep Hack*]; Andy Greenberg, *Hackers Remotely Kill a Jeep on the Highway—With Me in It*, WIRED, (July 21, 2015), https://www.wired.com/2015/07/hackers-remotely-kill-jeep-highway [https://perma.cc/Z3X2-CTEV] [hereinafter Greenberg, *Hackers Remotely Kill a Jeep*].

298 *See* Colin Neagle, *Smart Refrigerator Hack Exposes Gmail Login Credentials*, NETWORK WORLD (Aug. 26, 2015), https://www.networkworld.com/article/2976270/internet-of-things/smart-refrigerator-hack-exposes-gmail-login-credentials.html [https://perma.cc/T8JJ-JQWU].

299 *See* Lorenzo Franceschi-Bicchierai, *Afraid of the Dark? Too Bad, Your Smart Bulbs*

tic seizures or even extract data from secure networks.[300] Even discarded smart bulbs can reveal your home WiFi password to dumpster-diving hackers.[301] And, the flow of reports of insecure webcams or baby monitors seems to be never-ending.[302]

In some cases, hackers can not only access video feeds but can control the camera and speak through built-in speakers.[303] Insecure cameras are so common search engines for video feeds have emerged.[304] As cheap devices with relatively short lifecycles are connected to the network, these problems are compounded.[305]

Beyond their impact on users, tethered devices create security externalities that can cripple networks on a local, national, and poten-

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Can Be Hacked, MOTHERBOARD (Aug. 5, 2016), https://motherboard.vice.com/en_us/article/d7yxxw/hackers-could-take-control-of-your-smart-light-bulbs-and-cause-a-blackout [https://perma.cc/675Q-XUT2].

300 Eyal Ronen & Adi Shamir, *Extended Functionality Attacks on IoT Devices: The Case of Smart Lights*, 2016 IEEE EUR. SYMP. ON SECURITY & PRIVACY 3, 3.

301 Cory Doctorow, *Discarded Smart Lightbulbs Reveal Your Wifi Passwords, Stored in the Clear*, BOING BOING (Jan. 29, 2019), https://boingboing.net/2019/01/29/fiat-lux.html [https://perma.cc/8A4D-27DZ].

302 *See, e.g.*, Richard Chirgwin, *Oops! 185,000-plus Wi-Fi Cameras on the Web with Insecure Admin Panels*, REGISTER (Mar. 9, 2017), https://www.theregister.co.uk/2017/03/09/185000_wifi_cameras_naked_on_net/ [https://perma.cc/2FZ8-5M4M] ("Chinese generic wireless webcam sold under more than 1,200 brands from 354 vendors . . . ."); Thomas Fox-Brewster, *Warning: 50,000 Mi-Cam Baby Monitors Can Be Spied on with Ease*, FORBES (Feb. 21, 2018), https://www.forbes.com/sites/thomasbrewster/2018/02/21/50000-mi-cam-baby-cams-vulnerable-to-simple-spy-attacks/#65810c251c7e [https://perma.cc/K48Q-DRXZ] (Mi-Cam baby monitors); Ms. Smith, *Another Baby Monitor Camera Hacked*, CSO (June 6, 2018), https://www.csoonline.com/article/3279194/security/another-baby-monitor-camera-hacked.html (FREDI wireless baby camera monitor) [https://perma.cc/C87J-CG9U].

303 *See, e.g.*, Alana Abramson, *Tex. Couple Nervous After Baby Monitor Hacking*, YAHOO (Aug. 14, 2013), https://www.yahoo.com/gma/blogs/abc-blogs/houston-couple-nervous-baby-monitor-hacking-171424527.html [https://perma.cc/6NPJ-RTLH] (man cursing and making lewd comments from hacked baby monitor with camera); *Hacker Hijacks Baby Monitor*, FOX 19 (Apr. 24, 2014), http://www.fox19.com/story/25310628/hacked-baby-monitor [https://perma.cc/84M9-KC75] (baby monitor camera moved by hacker); Matt Ingram, *Family's Home-Monitoring Camera Hacked; Eerie Voice Speaks*, GLOBE & MAIL (May 15, 2018), https://www.theglobeandmail.com/news/national/familys-home-monitoring-camera-hacked-police-say/article25646101/ [https://perma.cc/4BFW-2HRY] (hacked baby monitor played creepy music and voice said that they were being watched); Cale Guthrie Weissman, *A Minnesota Family Just Learned How Hackable Nanny Cams Can Be. Creepy.*, BUS. INSIDER (Apr. 6, 2015), https://www.businessinsider.com/hacked-nannycam-website-2015-4 [https://perma.cc/8EL3-YZVF] (hacked baby monitor footage streaming online).

304 *See* Aamna Mohdin, *Are You Being Watched Right Now? There's a Creepy Search Engine for Unsecured Webcams*, QUARTZ (Jan. 25, 2016), https://qz.com/602218/are-you-being-watched-right-now-theres-a-creepy-search-engine-for-unsecured-webcams/ [https://perma.cc/Z8VB-QSUN].

305 *See* Woodrow Hartzog & Evan Selinger, *The Internet of Heirlooms and Disposable Things*, 17 N.C. J.L. & TECH. 581, 586–87 (2016).

tially global scale. When a university network ground to a halt, its IT staff discovered that thousands of tethered devices on campus, including internet-capable vending machines, were infected with a virus that swamped university servers with requests for seafood-related websites.[306] On a larger scale, the Mirai botnet enlisted one hundred thousand insecure tethered devices to bring down much of the Domain Name System (DNS), rendering websites like Twitter, Netflix, and Reddit inaccessible.[307]

The same tool was used to disrupt internet connectivity nationwide in Liberia.[308] Researchers estimated that the Mirai attack on a single website cost users more than $300,000 in bandwidth and electricity.[309] Tethered devices give sophisticated attackers—including hostile foreign governments[310] and relative amateurs[311]—a powerful new tool. In response to the failure of makers and users of tethered devices to take security seriously, a hacker known as The Janitor created the BrickerBot, a tool to automatically disable insecure networked devices.[312] That tool eventually bricked more than ten million devices, and the security problem continues to grow.[313]

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306 *See* Shaun Nichols, *University DDoS'd by Its Own Seafood-Curious Malware-Infected Vending Machines*, REGISTER (Feb. 13, 2017), https://www.theregister.co.uk/2017/02/13/university_ddosd_by_own_vending_machines/ [https://perma.cc/S76J-Z554].

307 *See* Nicky Woolf, *DDoS Attack that Disrupted Internet Was Largest of Its Kind in History, Experts Say*, GUARDIAN (Oct. 26, 2016), https://www.theguardian.com/technology/2016/oct/26/ddos-attack-dyn-mirai-botnet [https://perma.cc/Q528-VK9Q].

308 *See* Nicky Woolf, *Massive Cyber-Attack Grinds Liberia's Internet to a Halt*, GUARDIAN (Nov. 3, 2016), https://www.theguardian.com/technology/2016/nov/03/cyberattack-internet-liberia-ddos-hack-botnet [https://perma.cc/9H25-BYXF].

309 *See* KIM FONG ET AL., RIOT: QUANTIFYING CONSUMER COSTS OF INSECURE INTERNET OF THINGS DEVICES 9 (2018), https://groups.ischool.berkeley.edu/riot/ [https://perma.cc/YM82-J42N].

310 *See, e.g.*, James Sanders, *Chinese Government Linked to Largest DDoS Attack in GitHub History*, TECH REPUBLIC (Apr. 3, 2015), https://www.techrepublic.com/article/chinese-government-linked-to-largest-ddos-attack-in-github-history [https://perma.cc/D44T-T7DR].

311 Mirai was developed by three college students hoping to cheat at Minecraft. *See* Garrett M. Graff, *How a Dorm Room Minecraft Scam Brought Down the Internet*, WIRED (Dec. 13, 2017), https://www.wired.com/story/mirai-botnet-minecraft-scam-brought-down-the-internet [https://perma.cc/9XXH-95KY].

312 *See* Lee Mathews, *Hacker Ends Malware Mission After Bricking 10 Million Connected Devices,* FORBES (Dec. 12, 2017), https://www.forbes.com/sites/leemathews/2017/12/12/hacker-ends-malware-mission-after-bricking-10-million-connected-devices [https://perma.cc/N3BX-L7WL].

313 *Id.*

3. Harassment and Abuse

Tethered devices have given rise to another set of unexpected harms. In recent years, victims of domestic abuse have reported that their abusers used networked thermostats, locks, and other devices to remotely harass them.[314] The codes to their front door locks would change on a daily basis; speakers would turn on unbidden, blasting loud music; temperatures would fluctuate wildly.[315] Remote control over tethered devices enables abusers to monitor both the physical and digital activities of their victims.[316] Apple and Google have come under fire for distributing Absher, an app that "allows [Saudi] men to manage the women under their guardianship by giving or revoking their right to travel through airports."[317] Equally troubling, insiders at service providers and third parties with access to data can even use it to embarrass the user, possibly even to stop them from seeking remedies for wrongdoing.[318] For instance, in class action litigation against Facebook, plaintiffs' lawyers sought an injunction to protect underage litigants because Facebook lawyers were asking them, on the record, why plaintiffs liked particular postings, why they used profanity, and whether they used marijuana or other drugs.[319]

These stories underscore the ways in which tethered devices, even when they haven't been hacked, require users to cede some measure of control to individuals or firms they trust. When that relationship of trust ends, users need an easy way to regain control of their homes and data.

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314 *See* Nellie Bowles, *Thermostats, Locks and Lights: Digital Tools of Domestic Abuse*, N.Y. TIMES (June 23, 2018), https://www.nytimes.com/2018/06/23/technology/smart-home-devices-domestic-abuse.html [https://perma.cc/3ZKQ-XW5B].

315 *See id.*

316 *See* DIANA FREED ET AL., "A STALKER'S PARADISE": HOW INTIMATE PARTNER ABUSERS EXPLOIT TECHNOLOGY, 5–7 (2018). These problems are compounded by mobile applications designed to facilitate stalking and spying on former intimate partners. *See generally* Danielle Keats Citron, *Spying Inc.*, 72 WASH. & LEE L. REV. 1243 (2015).

317 Ben Hubbard, *Apple and Google Urged to Dump Saudi App That Lets Men Track Women*, N.Y. TIMES (Feb. 13, 2019), https://www.nytimes.com/2019/02/13/world/middleeast/saudi-arabia-app-women.html [https://perma.cc/Z7HM-FNVC].

318 *See, e.g.*, Hill, *supra* note 292 ("When it came time to do depositions, Facebook lawyers, from Cooley LLP, allegedly used plaintiffs' Facebook pasts to 'attack them.' (Unsurprisingly.)"); Simpson, *supra* note 292 (describing how an anonymous plaintiff alleged that a gay pornography site extorted him/her by threatening to file a lawsuit with pages of pornographic exhibits and by filing a press release to give publicity to the plaintiff's membership).

319 Fraley et al. v. Facebook et al., No. CV-11-1726-LHK (N.D. Cal. 2002) (docket item 423, at 11, 17).

C. Consumer Decision Making and Autonomy Interferences

As many of the examples above illustrate, the embrace of tethered devices constrains consumer autonomy in important ways. It denies them the ability to use and repair devices, and it cedes control over their personal information, security, and even safety to third parties. Below we detail additional harms to consumer freedom that are exacerbated by tethering.

1. Transfer

The combination of contractual terms, copyright law, and DRM give device makers unprecedented control over reselling, giving away, or otherwise transferring tethered products.[320] As the Supreme Court recently recognized, everything from our cars to our smartphones contain copyrighted software code.[321] And, to the extent device makers or copyright holders can limit the transfer of copies of that code, they can exercise effective control over the devices themselves.[322] These concerns are not merely hypothetical. The terms of use for Google Glass prohibit owners from reselling, lending, transferring, or giving away the device.[323] And, companies like Hewlett-Packard and Cisco maintain that buyers of used products cannot use them without buying new and expensive software licenses.[324]

Car makers already use contractual provisions to limit resale of some vehicles.[325] And, they use software to extract additional pay-

320 *See supra* Section I.B.

321 *See* Kirtsaeng v. John Wiley & Sons, Inc., 568 U.S. 519, 542 (2013).

322 *See* Jon Healey, *New Bill Would Protect the Market for Used High-Tech Goods*, L.A. Times (Sept. 22, 2014), http://www.latimes.com/opinion/opinion-la/la-ol-farenthold-bill-first-sale-digital-devices-iphone-20140919-story.html [https://perma.cc/9KBT-PU2E].

323 *See* David Kravets & Roberto Baldwin, *Google Is Forbidding Users from Reselling, Loaning Glass Eyewear*, Wired (Apr. 17, 2013), http://www.wired.com/2013/04/google-glass-resales [https://perma.cc/8769-QZLK].

324 Cisco claims owners of its products "[do] not own the software on the product—and therefore [have] no rights to sell it to you." *Third Party Maintenance Services*, Cisco https://www.cisco.com/c/dam/en_us/about/doing_business/legal/service_descriptions/docs/Third_Party_Maintenance_Services_FAQ.pdf [https://perma.cc/GJ6U-9YXC]; *see also* Healey, *supra* note 321 ("Hewlett-Packard . . . requires that buyers of certain used HP servers pay $400 to license the software needed to operate them.").

325 *See* Alanis King, *Ford Is Also Suing the Dealer That Bought and Apparently Resold John Cena's Ford GT*, Jalopnik (May 22, 2018), https://jalopnik.com/ford-is-also-suing-the-dealer-that-bought-and-apparentl-1826119625 [https://perma.cc/8PN8-JQGD]; Tony Markovich, *The Flip That Flopped: John Cena and Ford Settle GT Resale Lawsuit*, Car & Driver (June 19, 2018), https://www.caranddriver.com/news/the-flip-that-flopped-john-cena-and-ford-settle-gt-resale-lawsuit [https://perma.cc/EBA4-MHM9].

ments from car owners for standard hardware.[326] Although they have not yet leveraged copyright and DRM to clamp down on resale, consumer concern about resale value appears to deter them much more effectively than any legal or policy barrier.[327] While some legislative efforts to enable the transfer of software-enabled devices have been proposed, none have been enacted.[328]

2. *User Innovation*

Tethering also limits the degree to which consumers can modify and improve existing products.[329] User innovation has led to several important contributions across a wide range of inventive fields, from the first skateboard to disposable diapers.[330] User innovators often start with products they buy and make changes to suit their needs.[331] While some device and platform makers have embraced user innovation,[332] both technological and legal tethering can curtail this sort of behavior. In other instances, as with Apple's iOS App Store, firms encourage user innovation but retain significant control over whether and how the resulting innovations are shared with the public.[333]

The automotive industry offers the starkest example of the restrictions tethering can impose on user innovation. Since the earliest days of the automobile, users have tinkered with and improved upon their vehicles.[334] Beyond ordinary repair, car owners have long swapped out factory components for performance replacement parts

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326 *See* Greg Fink, *BMW to Treat Apple CarPlay as a Subscription Service and Charge Customers an Annual Fee*, CAR & DRIVER (Jan. 22, 2018), https://www.caranddriver.com/news/bmw-to-treat-apple-carplay-as-a-subscription-service-and-charge-customers-an-annual-fee [https://perma.cc/WN6N-UQKD]; Kopf, *supra* note 152.

327 *See* Healey, *supra* note 321.

328 *See* H.R. 905, 115th Cong. (1st Sess. 2017); H.R. 862, 114th Cong. (1st Sess. 2015).

329 *See* ZITTRAIN, supra note 1.

330 *See* ERIC VON HIPPEL, DEMOCRATIZING INNOVATION 1–3, 63–65, 141–42 (2005); Robert Mcg. Thomas Jr., *Marion Donovan, 81, Solver of the Damp Diaper Problem*, N.Y. TIMES (Nov. 18, 1998), https://www.nytimes.com/1998/11/18/business/marion-donovan-81-solver-of-the-damp-diaper-problem.html [https://perma.cc/FHS2-MSET]. For an in-depth discussion of users of products and services innovating for themselves, see generally VON HIPPEL, *supra*.

331 VON HIPPEL, *supra* note 330, at 2.

332 *See* Eric von Hippel, *The User Innovation Revolution*, MIT SLOAN MGMT. REV. (Sept. 21, 2011), https://sloanreview.mit.edu/article/the-user-innovation-revolution/ [https://perma.cc/3QKU-XERU].

333 *See* VON HIPPEL, *supra* note 330, at 2; Kia Kokalitcheva, *Apple's App Approval Process Just Got a Lot Faster*, FORTUNE (May 12, 2016), http://fortune.com/2016/05/12/apple-app-store-faster-approval-2 [https://perma.cc/4XK4-K7JD].

334 *See* Steve Lohr, *A Souped-Up Model T May Have Been the First Mash-Up*, N.Y. TIMES (July 27, 2008), https://www.nytimes.com/2008/07/27/weekinreview/27lohr.html?mtrref=www.google.com [https://perma.cc/7Y49-Y2BC].

or altered tuning and gearing ratios to maximize speed or fuel efficiency.[335] Some have even transformed their cars into pollution-belching affronts to humanity.[336] Taken to extremes, the resulting vehicles are sometimes barely recognizable.[337]

But, in modern vehicles, software can thwart even the most benign forms of tinkering. Switching from summer to winter tires can require access to locked-down onboard computer code just to make sure the transmission shifts properly.[338] Other components are specifically designed to exclude replacement parts. Renault, for example, sold an electric vehicle with a DRM-enabled battery that owners could not replace.[339] The auto industry's view "is that the sophisticated computers in vehicles are so intertwined that they shouldn't (for security and safety and environmental reasons) be allowed to be tinkered with,"[340] a position belied by the industry's own failures in recent years.[341] Over industry protest, consumer advocates secured temporary exemptions from the DMCA's anticircumvention provision in 2015 and again in 2018.[342] But, those exemptions do not apply to the

335 *See, e.g.*, Stephen Edelstein, *36-MPG Jaguar XJ-S: Hypermiling Owner's Great Lengths for 1984 Luxury Coupe*, GREEN CAR REP. (Oct 24, 2014), https://www.greencarreports.com/news/1095094_36-mpg-jaguar-xj-s-hypermiling-owners-great-lengths-for-1984-luxury-coupe [https://perma.cc/26ZM-RS4L] (maximizing fuel efficiency); Travis Okulski, *How Changing Your Final Drive Ratio Can Make Your Car Quicker*, ROAD & TRACK (Jan. 16, 2017), https://www.roadandtrack.com/car-culture/buying-maintenance/videos/a32293/final-drive-ratio-engineering-explained/ [https://perma.cc/7673-9VAE] (altering gearing ratios in order to maximize speed).

336 Hiroko Tabuchi, *'Rolling Coal' in Diesel Trucks, to Rebel and Provoke*, N.Y. TIMES (Sept. 4, 2016), https://www.nytimes.com/2016/09/05/business/energy-environment/rolling-coal-in-diesel-trucks-to-rebel-and-provoke.html [https://perma.cc/FSL6-WELW].

337 *See* John Redfern, *The Most Extreme Car Tuners*, MOTORING RES. (Dec. 20, 2017), https://www.motoringresearch.com/car-news/features/most-extreme-car-tuners [https://perma.cc/3BNS-WHXW].

338 CRAIG SMITH, THE CAR HACKER'S HANDBOOK 188 (2016), http://opengarages.org/handbook/ebook/#calibre_link-368 [https://perma.cc/2NSB-PQ2N].

339 *See* Cory Doctorow, *Renault Ships a Brickable Car with Battery DRM that You're Not Allowed to Own*, BOING BOING (Nov. 13, 2013), https://boingboing.net/2013/11/13/renault-ships-a-brickable-car.html [https://perma.cc/58HW-AHW8].

340 Torchinsky, *supra* note 263.

341 *See* Greenberg, *After Jeep Hack*, *supra* note 297; Greenberg, *Hackers Remotely Kill a Jeep*, *supra* note 297; *see also* Bill Chappell, *11 Million Cars Worldwide Have Emissions "Defeat Device," Volkswagen Says*, NPR (Sept. 22, 2015), https://www.npr.org/sections/thetwo-way/2015/09/22/442457697/11-million-cars-worldwide-have-emissions-problem-volkswagen-says [https://perma.cc/6CTT-F4AK].

342 Exemption to Prohibition on Circumvention of Copyright Protection Systems for Access Control Technologies, 83 Fed. Reg. 54,010 (Oct. 26, 2018) (to be codified at 37 C.F.R. pt. 201); Exemption to Prohibition on Circumvention of Copyright Protection Systems for Access Control Technologies, 80 Fed. Reg. 65,944 (Oct. 28, 2015) (to be codified at 37 C.F.R. pt. 201).

tools most consumers would need to modify their vehicles.[343] Nor does it provide protection from other sources of potential liability.[344]

3. Speech

Finally, tethering gives device makers and platform operators the ability to punish and restrain speech. Aside from its obvious implications for free expression, this power is troubling for at least three reasons. First, consumers may be surprised to learn that using a product might trigger private curtailment of speech, and they may not consider this factor in their choice of products and services.[345] Second, even sophisticated communications platforms rely on opaque and inconsistent standards for regulating speech,[346] and many tethered device makers have no meaningful experience or expertise developing or implementing such policies. Third, this power to restrict speech is reinforced through the lock-in effects described below, which considerably increase the costs consumers face in switching to more accommodating alternatives, assuming they exist.[347]

The worst examples of tethering as an antispeech measure are startling in their overreach. After a customer wrote a negative Amazon review of Softcomplex's Garadget internet-enabled garage door opener warning shoppers not to buy the device, Softcomplex owner Denis Grisak told the customer that the "review . . . demonstrate[d] [his] poor impulse control" and that he would not "tolerate any tantrums."[348] As a result, the customer's device was "denied server connection."[349] In a world of connected devices, a negative review could

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343 *See* 17 U.S.C. §§ 1201-1205 (2012).

344 Other bases for potential liability include breach of contract, violations of the Computer Fraud and Abuse Act, and copyright infringement.

345 *See, e.g.*, Editorial Board, *"Gag Clauses" Chill Consumers' Free Speech: Our View*, USA TODAY (Dec. 23, 2015), https://www.usatoday.com/story/opinion/2015/12/23/consumer-reviews-gag-first-amendment-editorials-debates/77801050/ [https://perma.cc/V6ZP-T623] (describing "gag clauses" in terms of service that can prohibit negative reviews).

346 *See* TARLETON GILLESPIE, CUSTODIANS OF THE INTERNET 6–8 (2018); Aaron Mak, *How Facebook Decides What Content to Remove*, SLATE (Apr. 24, 2018), https://slate.com/technology/2018/04/facebook-content-moderation-rules-how-company-decides-what-to-remove.html [https://perma.cc/466Y-DARK]; Louise Matsakis, *YouTube Doesn't Know Where Its Own Line Is*, WIRED (Mar. 2, 2018), https://www.wired.com/story/youtube-content-moderation-inconsistent [https://perma.cc/RN5T-DD2A].

347 *See infra* Section IV.B.

348 Karl Bode, *Garage Door Opener Company Bricks Customer Hardware After Negative Review*, TECHDIRT (Apr. 5, 2017), https://www.techdirt.com/articles/20170404/10460937082/garage-door-opener-company-bricks-customer-hardware-after-negative-review.shtml [https://perma.cc/4CSS-S6M5].

349 *Id.*

spell the end of your Ham Radio software[350] or even your electric car.[351]

The curation of app stores and other marketplaces can lead to speech concerns, as well.[352] Apple, which prevents its users from installing software from third-party sources,[353] has repeatedly wielded control over its app store to limit speech. It has refused to approve social networking applications like Gab,[354] deleted VPN apps at the request of the Chinese government,[355] and blocked software updates for the secure messaging app Telegram after the Russian government complained.[356] Apple has also refused to distribute apps and books critical of the company's business practices.[357]

Politically-relevant apps, including a clock counting down to the end of the Bush administration,[358] a collection of Pulitzer Prize-win-

350 *See* Tim Cushing, *Software Company Shows How Not to Handle Negative Review*, TECHDIRT (Dec. 22, 2016), https://www.techdirt.com/articles/20161220/12411836320/company-bricks-users-software-after-he-posts-negative-review.shtml [https://perma.cc/G9AB-VQRP].

351 *See* Alex Hern, *Elon Musk Personally Cancels Blogger's Tesla Order After 'Rude' Post*, GUARDIAN (Feb. 3, 2016), https://www.theguardian.com/technology/2016/feb/03/elon-musk-blogger-tesla-motors-model-x [https://perma.cc/GV8B-ETNL] (Elon Musk cancelled Tesla preorder after blogger wrote an open letter criticizing launch event for Model X).

352 *See, e.g.*, Joe Coscarelli, *Spotify Pulls R. Kelly and XXXTentacion from Playlists, Stirring a Debate*, N.Y. TIMES (May 10, 2018), https://www.nytimes.com/2018/05/10/arts/music/rkelly-spotify-accusations-xxxtentacion.html [https://perma.cc/8PCB-R3VC].

353 *See* Kif Leswing, *Apple Has Strong Words for Anyone Who Wants to "Jailbreak" Their iPhone to Run Unauthorized Apps*, BUS. INSIDER (June 23, 2018), https://www.businessinsider.com/apple-jailbreak-iphone-warning2018-6 [https://perma.cc/YT3M-WDFX].

354 *See* Timothy B. Lee, *Google Explains Why It Banned the App for Gab, A Right-Wing Twitter Rival*, ARS TECHNICA (Aug. 18, 2017), https://arstechnica.com/tech-policy/2017/08/gab-the-right-wing-twitter-rival-just-got-its-app-banned-by-google [https://perma.cc/D43W-7T2N] (noting that Apple rejected the Gab app twice for containing "defamatory or mean-spirited" content).

355 *See* David Z. Morris, *Apple Has Pulled Anti-Censorship Apps from China's App Store*, FORTUNE (July 29, 2017), http://fortune.com/2017/07/29/apple-censorship-apps-china [https://perma.cc/C6L2-KLLA].

356 *See* Tom Warren, *Telegram Says Apple Has Been Rejecting Its App Updates Even Outside of Russia*, VERGE (May 31, 2018), https://www.theverge.com/2018/5/31/17412396/telegram-apple-app-store-app-updates-russia [https://perma.cc/NH39-P9GU].

357 *See, e.g.*, Mark Brown, *Apple Bans Phone Story Game That Exposes Seedy Side of Smartphone Creation*, WIRED (Sept. 14, 2011), https://www.wired.com/2011/09/phone-story/ [https://perma.cc/349L-8TTM] (banning game that depicted lifecycle of Apple iPhone from "mines in the Congo, through the oppressive Foxconn factories and to planned obsolescence"); Aaron Perzanowski, *Why You Can't Buy Our Book from Apple*, END OF OWNERSHIP BLOG (Nov. 21, 2016), http://www.theendofownership.com/blog/2016/11/18/why-you-cant-buy-our-book-from-apple [https://perma.cc/D7AM-4YSM] (banning book critical of Apple's policies, including DRM and banning independent repair).

358 *See* JR Raphael, *Want in Apple's App Store? Just Win a Pulitzer Prize*, PC WORLD (Apr. 16, 2010), https://www.pcworld.com/article/194432/Want_In_Apples_App_Store_Just_Win_a_Pulitzer_Prize.html [https://perma.cc/ER8U-CZY2].

ning political cartoons,[359] a drone strike alert app,[360] and *Liyla and the Shadows of War*, a game in which players control a young Palestinian girl,[361] have all been rejected by Apple. The company has also endeavored, somewhat inconsistently, to prevent access to sexually explicit content.[362] Most recently, the microblogging platform Tumblr introduced sweeping new content rules that removed all adult content in response to Apple temporarily removing the Tumblr app from its iOS app store.[363]

D. Consumer Harms and Tradeoffs

The harms described above do not exist independently of one another. The degree to which any particular harm manifests with respect to a particular tethered product or service is the result of a set of interrelated business decisions and technological constraints. These choices inevitably involve some degree of tradeoff. That fact does not excuse the harms firms inflict, but it does help explain how various business models, corporate philosophies, and strategic choices give rise to predictable clusters of pathologies.

Apple illustrates this phenomenon well. Historically, the firm has primarily generated revenue from hardware sales.[364] Services like iCloud, Apple Music, and various software applications are ancillary revenue sources primarily intended to drive the sale of new devices.[365] As a result, Apple is the most openly hostile to repair of all major technology firms.[366] On the other hand, because Apple's business model is not premised on advertising or otherwise selling consumer data, it is generally regarded as more privacy protective than firms like

359 *See id.*

360 *See* Andrea James, *Apple Finally Allowed Drone Strike Alert App, Then Removed It Again*, BOING BOING (Mar. 30, 2017), https://boingboing.net/2017/03/30/apple-finally-allowed-drone-st.html [https://perma.cc/TCV7-NUDX].

361 *See* Nick Statt, *Apple's Rules for Video Games Are Still Causing Problems in the App Store*, VERGE (May 23, 2016), https://www.theverge.com/2016/5/23/11748180/apple-app-store-liyla-and-the-shadows-of-war-approval [https://perma.cc/N7KN-YELE].

362 *See, e.g.*, Robert Andrews, *The Sun's "Obscene" Page 3 Girls Get iPhone Newspaper App Banned by Apple*, GUARDIAN (May 6, 2009), https://www.theguardian.com/media/pda/2009/may/06/sun-newsinternational [https://perma.cc/KTP8-69X6].

363 Aja Romano, *Tumblr Is Banning Adult Content. It's About so Much More Than Porn.*, VOX (Dec. 17, 2018), https://www.vox.com/2018/12/4/18124120/tumblr-porn-adult-content-ban-user-backlash [https://perma.cc/9CHC-FBLD].

364 *See* David Bloom, *Apple's Hardware Is Fueling Its Huge Growth in Subscriptions and Services*, FORBES (Aug. 1, 2018), https://www.forbes.com/sites/dbloom/2018/08/01/apple-subscriptions-services-streaming-quarterly-earnings/#444c867f7e04 [https://perma.cc/TMQ3-F6NA].

365 *See id.*

366 *See supra* notes 251–57 and accompanying text.

Google and Facebook.[367] Whether that reputation is entirely deserved, Apple now touts that comparative advantage in its advertising.[368] Apple's longstanding focus on near-total control of the end user experience means its ecosystem skews towards closed.[369] That philosophy may have benefits for consumers in terms of usability and security, but it also tends to harm user innovation and imperils speech across the internet.[370] Apple's emphasis on hardware revenue has more direct costs to consumers as well; it generally leads to higher retail prices.[371]

For firms that monetize user data or rely on more open platforms, these tradeoffs often play out quite differently. Privacy and security may be sacrificed for lower sticker prices and "free" services.[372] But, some of those platforms have proven more receptive to user innovation and less restrictive with respect to speech.[373]

In part, these choices reveal what product attributes firms believe are salient to the market segments they serve. But, the interplay these tradeoffs represent also suggest that reforms targeting specific user

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367 *See* Chris Hoofnagle, *Facebook and Google Are the New Data Brokers*, DIGITAL LIFE INITIATIVE (Jan. 16, 2019), https://www.dli.tech.cornell.edu/blog/facebook-and-google-are-the-new-data-brokers [https://perma.cc/322P-4SJL].

368 *See* Hamza Shaban, *Apple Stars at Giant Tech Confab CES—Without Actually Being There*, WASH. POST (Jan. 7, 2019), https://www.washingtonpost.com/technology/2019/01/07/apple-burns-google-giant-billboard-touting-privacy-ces/?utm_term=.c5b4f01158d3 [https://perma.cc/X45K-V62S]; Michael Simon, *Apple's iPhone Privacy Billboard Is a Clever CES Troll, but It's Also Inaccurate*, MACWORLD (Jan. 7, 2019), https://www.macworld.com/article/3331597/apple/apple-privacy-billboard.html [https://perma.cc/EH2S-FHF3].

369 *See* Tim Worstall, *The Problem with Apple's Closed Apps Universe*, FORBES (Aug. 31, 2012), https://www.forbes.com/sites/timworstall/2012/08/31/the-problem-with-apples-closed-apps-universe/#4793d982794b [https://perma.cc/KUL9-G7GQ]; *see also* Shaun Nichols, *Apple Heading for Supreme Court Showdown Over iOS App Store "Monopoly" Gripe*, REGISTER (Nov. 27, 2018), https://www.theregister.co.uk/2018/11/27/apple_supreme_court/ [https://perma.cc/8EU6-ED23].

370 *See* Ian Sherr & Michael Totty, *Is It Better for Businesses to Adopt Open or Closed Platforms?*, WALL ST. J. (Nov. 15, 2011), https://www.wsj.com/articles/SB10001424052970204554 20457702399419474272O [https://perma.cc/NQA3-JNAX].

371 *See* Ewan Spence, *Apple Faces More Tricky Decisions Over iPhone Revenue*, FORBES (Nov. 12, 2018), https://www.forbes.com/sites/ewanspence/2018/11/12/apple-iphone-xr-sales-weak-low-danger-decision-revenue-margin/#388877091c0c [https://perma.cc/27Z3-PHXT].

372 *See* Chris Jay Hoofnagle & Jan Whittington, *Free: Accounting for the Costs of the Internet's Most Popular Price*, 61 UCLA L. REV. 606, 626–28, 642–46 (2014); Nilay Patel, *Taking the Smarts Out of Smart TVs Would Make Them More Expensive*, VERGE (Jan. 7, 2019), https://www.theverge.com/2019/1/7/18172397/airplay-2-homekit-vizio-tv-bill-baxter-interview-vergecast-ces-2019 [https://perma.cc/NJ9K-XHLF] (Vizio's CTO Bill Baxter "was also clear that TV companies are in a cutthroat business, and that companies like Vizio would have to charge higher prices for hardware if they didn't run content, advertising, and data businesses").

373 *See* Nat Ives, *Big Advertisers and Social Media Form Alliance to Fight 'Unsafe' Content Online*, WALL ST. J. (June 18, 2019), https://www.wsj.com/articles/big-advertisers-and-social-media-form-alliance-to-fight-unsafe-content-online-11560830460 [https://perma.cc/4HWZ-3CFK].

harms may have broader collateral effects. Even acknowledging that possibility, these harms to individual users, however, are only part of the story. More broadly, tethering reshapes markets in potentially profound ways, as the next Part considers.

IV. Market Harms of Tethering

Aside from its implications for individual consumers, tethering introduces and reinforces market pathologies that give sellers greater control over complementary goods and services, restrain secondary markets, and degrade the quality and clarity of information. At a high level, tethers require consumers to negotiate agreements with sellers in ways that only sophisticated businesses tend to—by thinking through the product's entire lifespan, by engaging in strategy to understand how a product fits into the ecosystem of other purchased items, by predicting what could go wrong, and contemplating nuances such as service-level guarantees when they do.

In this Part, we discuss the market-wide pathologies created by tethering. Tethering allows sellers to bundle physical and digital goods and services, reducing choice and competition in markets for content, consumables, parts, and repair services. By leveraging network effects and limiting interoperability, tethering also raises switching costs, potentially locking consumers into particular devices or platforms. Finally, tethering exacerbates information asymmetries that allow sellers to manipulate the market.

A. Tethered Products as Bundled Offerings

Tethered products emerged as a result of sellers' natural incentives to bundle digital goods and services with physical ones.[374] Economists use the concepts of rivalry and excludability to define goods.[375] Rivalry refers to the idea that if one consumer uses a good, it becomes unavailable to other consumers.[376] Excludability refers to the concept that the supplier can effectively bar consumers from consuming the good.[377] Tethering makes it possible to exclude people from nonrivalrous goods.

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374 *See, e.g.*, Tyler Hayes, *If You Want to Sell Digital Products, Bundle Them with Physical Ones*, Fast Company (Aug. 21, 2013), https://www.fastcompany.com/3016158/if-you-want-to-sell-digital-products-bundle-them-with-physical-ones [https://perma.cc/PV2A-PXC3] (suggesting that in 2013 "[w]e're not yet a society that values digital products as much as physical ones").

375 *See* Robert Cooter & Thomas Ulen, Law & Economics 40 (6th ed. 2011).

376 *See id.*

377 *See id.*

Tethered products have the features of both private goods and public goods. The physical devices themselves are private goods in that there is generally a limited supply and suppliers can exclude consumers.[378] However, economists generally categorize digital goods and services as public goods.[379] It is difficult to separate these two concepts in economic analyses of tethered products. This tension is important because the appropriate regulatory approach will differ with respect to private and public goods. In particular, public goods generally face the free-rider problem.[380] Because no one can be excluded from consumption, there is little incentive to pay for the production of the good, and therefore it will be underproduced.[381] Due to this problem, certain public goods, like national security, are provided for through means such as taxation.[382] In the case of software and knowledge goods, sellers overcome this problem by finding ways to exclude free riders through techniques like digital rights management.[383]

Tethered goods have contradictory economic features in other respects as well. While digital goods can be infinitely durable, the devices that deliver them are not.[384] Most practically for consumers today, this mismatch between physical and digital durability creates frustration about the expected lifespan of a product.[385] For instance, degraded battery life and other performance issues caused by old hardware can reduce the usefulness of smartphone applications.[386]

At the same time, software updates may be incompatible with older hardware.[387] Tethered devices have different durability, but the

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378 *See id.* at 40, 102–03.

379 *See* Shane M. Greenstein, *Digital Public Goods*, IEEE MICRO, at 62 (Sept./Oct. 2013), https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6630005 [https://perma.cc/6XYN-8Z7T]. This classification of digital goods as public goods explains why digital content piracy posed a major problem for years; content like digital music was easy to copy and distribute for free. *See* John P. Conley & Christopher S. Yoo, *Nonrivalry and Price Discrimination in Copyright Economics*, 157 U. PA. L. REV. 1801, 1806 (2009).

380 COOTER & ULEN, *supra* note 372, at 41.

381 *Id.*

382 *See id.*

383 *See, e.g.*, Bartholomew, *supra* note 115, at 1–2.

384 *See, e.g.*, Simon Parkin, *Video Games and the Curse of Retro*, NEW YORKER (Jan. 11, 2015), https://www.newyorker.com/tech/elements/video-games-curse-retro [https://perma.cc/B9MD-LV3L] (explaining that video games theoretically have infinite shelf life as code but rely on old devices being produced or maintained).

385 *See, e.g.*, *id.*

386 *See, e.g.*, Tom Warren & Nick Statt, *Apple Confirms iPhones with Older Batteries Will Take Hits in Performance*, VERGE (Dec. 20, 2017), https://www.theverge.com/2017/12/20/16800058/apple-iphone-slow-fix-battery-life-capacity [https://perma.cc/55UY-SGZ4].

387 *See, e.g.*, Hruska, *supra* note 187.

digital goods and services they deliver could at least theoretically last forever. In practice however, questions of hardware compatibility and obsolescence often limit the lifespan of digital goods and services.[388] Economic analysis may treat tethered products as having the features of the physical vessel (rivalrous, excludable, low durability, etc.) regardless of the features of digital services that they provide. Tethered products blur the lines between goods and services by incorporating elements of physical goods, digital goods, and digital services.

Two approaches to understanding the complex ways the tethered goods operate in the market are through the lenses of information and behavioral economics. The economics of tethered products is undoubtedly complex, so these approaches are not exhaustive. Nonetheless, they provide powerful tools for understanding how the particular features of tethered goods impact market behavior.

Information economics is the study of how information affects decision-making. In particular, information economics provides a key insight into why sellers find tethered products attractive. As mentioned earlier, digital goods are both non-rivalrous and non-excludable.[389] Information economics suggests that one way around this problem is for sellers to bundle their digital offerings.[390] Bundling is the practice of selling multiple products as a package, with the idea being that consumers unwilling to pay for one piece of the bundle may nonetheless have a high enough willingness to pay for some other aspects of the bundle that they will purchase the whole thing.[391] A seller will find bundling especially attractive when the additional bundled goods have low or no associated marginal costs.[392] Thus, tethered products are perhaps the most ideal form of this incentive because digital goods are easy and free to copy indefinitely and can therefore be bundled with physical devices with no constraints arising from the digital goods themselves.

Such bundling goes beyond content provision, however, and can result in digital rights management restrictions that mainly serve to frustrate consumers by making the seller a one-stop shop for all repairs and future purchases.[393] Keurig's coffee pod DRM is one famil-

388 *See, e.g.*, Parkin, *supra* note 384.

389 *See supra* note 375 and accompanying text.

390 *See* Kevin Zhu & Bryan MacQuarrie, *The Economics of Digital Bundling: The Impact of Digitization and Bundling on the Music Industry*, 46 COMM. ACM 264, 266 (2003).

391 *See id.*

392 *See* Timothy Derdenger & Vineet Kumar, *The Dynamic Effects of Bundling as a Product Strategy*, 32 MARKETING SCI. 827, 853–54 (2013).

393 *See supra* Sections III.A.4–.5.

iar example,[394] as are John Deere and Apple's efforts to limit repair.[395] Simply put, while bundling may yield some pro-consumer benefits in terms of convenience, it also enables sellers to engage in behaviors that reduce competition.

While this relationship is true of any product that runs software, it is especially instructive for tethered products because in many cases, the service is exclusive. Consider our paradigmatic examples of voice assistants, such as Amazon Echo, Google Home, and Apple HomePod. Each delivers a suite of digital applications and connectivity to other devices, but the core offering is an AI-enabled personal assistant linked to a particular seller.[396] For these products, the "bundle" constitutes the AI assistant, the physical speakers, and the range of applications (connectivity to other devices, music streaming, search, etc.). In this case, consumers presumably value the AI assistant enough to pay for the rest of the bundle.

B. Switching Costs and Lock-In

The bundling made possible by tethers increases the risk of consumer lock-in.[397] This phenomenon is already widely-recognized in the digital media space.[398] A music fan who has invested thousands of dollars in the Apple iTunes ecosystem faces significant disincentives to switch to an incompatible non-Apple device or streaming service.[399]

Indeed, the degree of control this form of tethering generated for Apple was the primary motivation for the music industry to abandon DRM for digital downloads.[400] In the markets for eBooks and movies, consumer demand has achieved some degree of inter-platform compatibility.[401] But, it remains a pressing issue in the video game and

394 *See* Linshi, *supra* note 116.

395 *See supra* Section III.A.5.

396 *See* Tripp Mickle, *Apple Unveils Smart Speaker Called HomePod*, WALL ST. J. (June 5, 2017), https://www.wsj.com/articles/apple-wwdc-event-watch-gets-upgrades-amazon-video-coming-to-apple-tv-1496684848 [https://perma.cc/6GUK-GYDY].

397 Joseph Farrell & Paul Klemperer, *Coordination and Lock-In: Competition with Switching Costs and Network Effects*, *in* 3 HANDBOOK OF INDUSTRIAL ORGANIZATION 1967 (M. Armstrong & R. Porter eds., 2007).

398 *See* Rod Schultz, *The Many Facades of DRM*, WORLDPRESS at 1–2, (https://fortunedotcom.files.wordpress.com/2014/12/2012_misc_drm.pdf. [https://perma.cc/M3KF-YHQC]).

399 *See id.* at 1–2, 13.

400 *See id.* at 1–2.

401 For example, Amazon's Kindle books are available on a wide range of devices. *See Get the Free Kindle App*, AMAZON, https://www.amazon.com/kindle-dbs/fd/kcp [https://perma.cc/PWJ8-CC2E]. And, Movies Anywhere allows consumers to access movies acquired from a range of services on various devices. *See* Iyaz Akhtar, *Movies Anywhere: Everything You Need to*

mobile app markets, among others.[402] Network effects often reinforce the lock-in problem.[403] As any Facebook user will attest, consumers face significant practical and even psychological barriers to leaving an ecosystem used by friends, relatives, and coworkers.[404]

Similarly, sellers of tethered products know the power of lock-in. The more devices in your home interact within a given platform, the less likely you are to switch.[405] To gain a foothold in the home, and ultimately grow their networks, both Google and Amazon offer inexpensive entry level devices—the Home Mini and Echo Dot.[406] That initial purchase could create path dependencies that drive subsequent purchases, each accreting switching costs.[407] Apple's smartphone market share and its commitment to a closed ecosystem yield similar results.[408] Over time, lock-in on this scale may reduce competition and innovation, as consumers feel tied to inferior legacy products and platforms.

Lock-in enables forms of opportunism, or chances to easily extract more value from consumers. For instance, as consumers are locked-in to a particular home operating system, sellers become price makers.[409] Many tethered products, particularly brands such as Apple, keep prices artificially high through minimum resale price maintenance.[410]

Know, CNET (Feb. 1, 2019), https://www.cnet.com/how-to/movies-anywhere-everything-you-need-to-know-faq [https://perma.cc/M7E4-VRGP].

402 *See, e.g.*, Trevor Ruben, *The Laws Behind 'Fortnite's' PS4, Nintendo Switch Woes*, VARIETY (June 20, 2018), https://variety.com/2018/gaming/features/fortnite-nintendo-switch-ps4-laws-1202851944 [https://perma.cc/MDT4-CPHS] (Fortnite game accounts could not be transferred to another company's gaming console).

403 CARL SHAPIRO & HAL R. VARIAN, INFORMATION RULES: A STRATEGIC GUIDE TO THE NETWORK ECONOMY 173 (1998).

404 *See* Aja Romano, *How Facebook Made It Impossible to Delete Facebook*, VOX (Dec. 20, 2018), https://www.vox.com/culture/2018/3/22/17146776/delete-facebook-difficult [https://perma.cc/98GY-K77B].

405 *See* Jared Newman, *How Smart Home Lock-In Imprisons You, And Why That Might Change*, FAST COMPANY (Mar. 20, 2018), https://www.fastcompany.com/40545455/dont-let-your-smart-home-lock-you-in [https://perma.cc/PDW5-HK5Q].

406 *See* Erika Rawes, *Google Home Mini vs. Amazon Echo Dot: Which Smart Speaker Is Better?*, DIGITAL TRENDS (Mar. 27, 2018), https://www.digitaltrends.com/home/google-home-mini-vs-amazon-echo-dot/ [https://perma.cc/HZ5U-HTPF].

407 *See* Newman, *supra* note 405.

408 *See id.*

409 *See* Chris Middleton, *Smart Speakers Market 2.5 Times Bigger Than 2017, Says Report*, INTERNET OF BUS. (July 10, 2018), https://internetofbusiness.com/smart-speaker-market-2-5-times-bigger-than-2017-says-report/ [https://perma.cc/HV6P-AYEM].

410 Marco Tabini, *How Apple Sets Its Prices*, MACWORLD (Jan. 14, 2013), https://www.macworld.com/article/2024257/how-apple-sets-its-prices.html [https://perma.cc/7Q97-ZBZN].

The personal information dynamics of tethering are subtle and not well understood by policy makers. While this Article discussed the individual privacy risks raised by tethering,[411] information collection has competitive effects as well.[412] As Jan Whittington and Chris Jay Hoofnagle have explained, personal information transactions have high "asset specificity."[413] Personal information is, after all, personal and individualized. As sellers collect it and develop deeper personalization, consumers become enmeshed in bilateral dependent trading relations with the seller.[414] In this view, in addition to traditional forms of lock-in, personal data introduces a form of monopoly power that deepens the connection between buyer and seller.[415] Switching opportunities are not "just a click away" when the competitor lacks the advantages gained from years of developing personalization and knowledge about the user.[416]

Another important shift in the relationship between providers' and consumers' transaction costs reinforces tethering. By ratcheting up transaction costs for consumers while simultaneously minimizing them for device makers, tethering shifts power from the former to the latter.[417] As they collect data, track behavior, and identify preferences, tethered devices raise switching costs for consumers.[418] Those costs are amplified by the not-entirely-open nature of many smart device ecosystems.[419] The Google Home integrates seamlessly with the company's Nest thermostat, security system, and doorbells.[420] But, consumers who have already invested in Apple or Amazon devices

411 *See supra* Section III.B.1.

412 *See* Jan Whittington & Chris Jay Hoofnagle, *Unpacking Privacy's Price*, 90 N.C. L. REV. 1327, 1346–47 (2012).

413 *Id.* at 1343.

414 *See id.* at 1349 ("[P]ersonal information is an asset specific to each consumer and, by extension, specific to transactions each consumer makes with that information. Transaction cost economics holds that asset specificity, in the presence of any reason for ex post haggling or dispute, would drive up the cost of transacting, even if the asset is only specific to one of the parties. Generally, the party that lacks alternative trading partners—in our case, the consumer—is more likely to bear these transaction costs. In online markets, these costs can take many forms that are, in our current regulatory environment, practically impossible for consumers to trace." (internal citation omitted)).

415 *See id.* at 1351 n.77 ("Bilateral monopoly will occur if both the consumer and the SNS lack alternative trading partners for the same information.").

416 *See id.* at 1341.

417 *See* Newman, *supra* note 405.

418 *See id.*

419 *See id.*

420 *See Google Home Hub*, NEST, https://nest.com/google-home-hub/ [https://perma.cc/8TBW-7Z5Q].

may find integration more challenging.[421] Consumers may experience those transactions costs on the front end by carefully researching compatibility before acquiring a device. Or they may experience it on the back end in the form of constraints on their choice of future purchases. At the same time, transaction costs for producers have plummeted. Monitoring and enforcement of contractual terms that would have been all but impossible with untethered products can be accomplished with minimal cost today.[422] That fact shapes not only whether existing rules are enforced, but the sort of rules firms bother to articulate in the first place, likely encouraging more granular and intrusive terms.

A recent example of how sellers can abuse network effects to their benefit comes from the interoperability debates in the video gaming community. The popular video game Fortnite is available on all major platforms offered by mobile providers (Apple, Android devices, etc.) and console makers (Sony, Microsoft, and Nintendo).[423] While users across most of these devices are able to port their information from one hardware platform to another, and in most cases, play with other users using a different platform, Sony PlayStation 4 owners were conspicuously deprived of this benefit until recently.[424] Sony argued that keeping its players on its own online platform ensured the platform's integrity, thus creating a better product overall.[425] As the market leader in the console space, Sony was able to prevent its users from using the same account on PlayStation as they use on other platforms.[426] Whereas users of Microsoft's Xbox One and Nintendo's Switch can play with one another, they could not play with Sony users until Sony recently unlocked accounts from the PlaySta-

421 *See, e.g.*, *Learn How to Control Your Nest Products with Amazon Alexa*, NEST, https://nest.com/support/article/Nest-and-Amazon-Alexa [https://perma.cc/M8LA-2BHB]; Newman, *supra* note 405.

422 *C.f.* Ben Kerschberg, *Legal Contract Management and the Modern Enterprise*, FORBES (Apr. 6, 2011), https://www.forbes.com/sites/benkerschberg/2011/04/06/legal-contract-management-and-the-modern-enterprise/#38fc89a24337 [https://perma.cc/D94Y-GTFL].

423 *See* Ruben, *supra* note 402.

424 *See id.*; Ben Kuchera, *PS4-Locked Fortnight Accounts Now Freed for Switch and Xbox One, Merged Accounts Coming*, POLYGON (Sept. 26, 2018), https://www.polygon.com/fortnite/2018/9/26/17906258/ps4-fortnite-account-nintendo-switch-unlocked [https://perma.cc/3XUN-P4UY].

425 While this may be true in some cases, the law has generally not favored these sorts of efforts at protecting system integrity, as established in cases like Sony Comput. Entm't v. Connectix Corp., 203 F.3d 596 (9th Cir. 2000) and Sega Enters. Ltd. v. Accolade, Inc., 977 F.2d 1510 (9th Cir. 1992), which found reverse engineering video game console systems to create competing games and emulators constitutes fair use.

426 *See* Ruben, *supra* note 402; *see also* Kuchera, *supra* note 424.

tion 4.[427] As Sony's change of heart demonstrates, there was no technical reason for this lack of cross-play.[428]

Sony can use its position as market leader to prevent interoperability.[429] Despite opening up cross-play for Fortnite, Sony refuses to implement a general cross-play policy and instead will make decisions on a case-by-case basis. Lack of interoperability and portability create a cost for consumers who may wish to switch to another platform later on, as they would have to sacrifice their accounts and progress across games if they ever changed hardware products.[430] Creating limited exceptions for particular products only forces consumers to confront uncertainty about whether a given software purchase will have interoperability features. Further, only granting these exceptions for exceptionally popular products disadvantages smaller developers and their consumers. Basically, Sony uses its dominant position to force a default anti-cross-play policy, despite any technical justification. Thus, consumers may be effectively locked into Sony's ecosystem.[431]

C. Platform Power, Market Manipulation, and Price Discrimination

Sellers have powerful incentives to create tethered goods because the tether allows sellers to bundle digital goods in media that have the desirable attributes of physical goods. At the same time, sellers also have a strong incentive to make each piece of a product ecosystem reliant on the others, thus making physical goods subject to the same network effects that some digital goods enjoy. These two incentives combine to create the conditions for powerful sellers who can engage in a wide range of behaviors that take advantage of their position.

Ryan Calo identified "digital market manipulation" as a key concept in contemporary consumer protection.[432] Calo extends the concept of "market manipulation,"—a seller using information asymmetries to change consumer behavior—to digital markets.[433] He details how firms use a combination of behavioral and data-driven insights to target potential consumers and compel them to purchase a product.[434] For instance, he highlights Target predicting which of its

427 *See* Ruben, *supra* note 402; *see also* Kuchera, *supra* note 424.

428 *See* Kuchera, *supra* note 424.

429 *See id.*

430 *See id.*

431 *See* Ruben, *supra* note 402; *see also* Kuchera, *supra* note 424.

432 *See generally* Ryan Calo, *Digital Market Manipulation*, 82 GEO. WASH. L. REV. 995 (2014).

433 *See id.* at 999.

434 *Id.* at 996.

customers were pregnant and targeting ads toward them.[435] Importantly, the Target inference was generated with the company's own data; Target did not have to buy information from third parties, which would be the traditional way privacy law might protect the customer.[436] Digital market manipulation, therefore, may come about without the involvement of data brokers or other third-party profiling companies.

From a consumer protection standpoint, the main issue with this sort of targeting is that it creates an imbalance between the seller and consumer. Specifically, Calo notes that the FTC has identified solicitation of consumers as potentially harmful because consumers cannot enter the marketplace with a critical frame of mind.[437] Essentially, a potential seller enjoys disproportionate benefits from the ability to locate consumers, predict what sort of ad will sway them to engage, and sell them a product. Aside from potentially violating basic notions of fairness, this type of behavior can also distort markets by allowing for activities such as price discrimination in a way that routinely takes advantage of consumer decision fatigue or other cognitive biases.[438]

Digital market manipulation is, in some sense, a tool that enhances a seller's ability to engage in perfect price discrimination and therefore capture the surplus from economic transactions with their consumers.[439] Simply put, if consumers are in a situation where the seller has extensive information about their willingness to pay ("WTP") for certain products, and more importantly, can target that consumer right when their WTP is at its apogee, the seller can extract all of the surplus from the situation.[440] While consumers with lower WTP can typically benefit by getting a product at their WTP, sellers maintain a distinct advantage by being able to utilize information about a consumer's cognitive biases. Meanwhile, because the consumer is effectively locked into the ecosystem and cannot switch without incurring considerable costs, there is no countervailing opportunity to capture surplus from the producer by taking advantage of their willingness to sell.[441]

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435 *Id.*

436 *See* Charles Duhigg, *Psst, You in Aisle 5*, N.Y. TIMES MAG., Feb. 19, 2012, at 30, 33.

437 *See* Calo, *supra* note 432, at 1004.

438 *Id.* at 1026.

439 *Id.* at 1003, 1010.

440 *See, e.g.*, *id.* at 997, 1010 (describing two separate situations in which companies have used consumer data to specifically target consumers).

441 *See supra* Section IV.B.

All of this adds up to a situation in which sellers amass an immense amount of market power. They can bundle their digital products into physical goods, stifle consumers' opportunities to make meaningful choices about which products/services to buy, and take advantage of lock-in to capture the surplus in any transaction. Given that the tether enables a continuous relationship between sellers and consumers, this interaction will repeat. Over time, platforms will develop and maintain enormous power to block new entrants into markets and prevent meaningful consumer choices in the market.

D. Quality and Quantity of Competition

Historically, competition has provided strong incentives for a healthy seller-consumer relationship. The nature of tethered products, however, endangers two important aspects of competition: its quality and quantity. Some scholars observe that digital business models degrade the quality of competition between sellers and consumers, as sellers' focus has shifted to extracting consumer surplus, sometimes in ways that the consumer does not understand. For example, Shoshana Zuboff argues that we are operating in an age of "surveillance capitalism," characterized by an "institutional logic [that] thrives on unexpected and illegible mechanisms of extraction and control that exile persons from their own behavior."[442] To put this simply, Zuboff observes that as we use services such as web search, search engine companies repurpose behavioral data collected in a way that is not part of the bargain, because there is no hope that the consumer can understand how data is ultimately used.[443] Some repurposing is pro-social or at least intended to be, such as when Google earnestly but speciously predicted flu outbreaks based on search queries.[444] But, Zuboff goes on to recount a series of user-hostile developments flowing from "behavioral surplus," such as the automation of contract enforcement and running experiments on users.[445] Tethered products are rife with op-

442 Shoshana Zuboff, *Big Other: Surveillance Capitalism and the Prospects of an Information Civilization*, 30 J. INFO. TECH. 75, 85 (2015).

443 *See id.* at 79.

444 *See* David Lazer et al., *The Parable of Google Flu: Traps in Big Data Analysis*, 343 SCI. 1203, 1203–05 (2014).

445 Behavioral surplus is essentially the notion that digital products make it possible to observe and measure user behavior, turn that behavior into data, and use that data to create products that predict future behavior. Thus, the surplus of behavioral data becomes valuable to businesses. *See* Zuboff, *supra* note 442, at 81–85; Shoshana Zuboff, *The Secrets of Surveillance Capitalism*, FRANKFURTER ALLGEMEINE (May 3, 2016), http://www.faz.net/aktuell/feuilleton/debatten/the-digital-debate/shoshana-zuboff-secrets-of-surveillance-capitalism-14103616.html [https://perma.cc/SX38-G3VX].

portunity to extract behavioral surplus in ways impossible for the user to comprehend.[446] On a high level, interventions should level the playing field for consumers so that they can understand the bargains offered in a tethered economy.

Comprehension alone will not be enough if all the choices are unhealthy for consumers.[447] In a healthy market, sellers cannot rely on lock-in and bilateral dependency to skew bargains in their favor. In healthy market conditions, sellers compete to create the best possible product and at the lowest price to meet consumer demand. Tethered products, since they are so dependent on post-transaction extraction of value, put the seller and consumer into a conflicting posture where the sellers' incentives are to extract as much as possible from the consumer. Tethered products, specifically if they achieve lock-in, also produce opportunities for zero-sum competitions between the seller and consumer that are highly artificial (e.g. "unlocking" features, bundling features, and so on).[448] These options offer little beyond opportunities for extraction masquerading as consumer choice.

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446 Zuboff intuits a troubling, complex dynamic in surveillance capitalism. *Id.* While it is often said that if you are not paying, you are the product, the reality is more complex. Companies are willing to provide services in exchange for user data because that data is necessary to implement deep learning systems. *Id.* Consumers are willing to give up data because they want free services. *Id.* These services, in turn, will develop increasingly broad artificial intelligence tools. *Id.* For example, Google outbid its competitors for the opportunity to provide free Wi-Fi to Starbucks' three billion yearly customers so that it could harvest and profit from their data. *See* Zuboff, *supra* note 442, at 79. The point is that big data is an instrument to a terminal goal, one that, if reached, might devalue you as an individual. People tend to think of their attention and their data as valuable, sought after goods, but if we take the predictions of AI seriously, our data and even our work may become economically irrelevant. *See generally* YUVAL NOAH HARARI, HOMO DEUS 341–46 (Yuval Noah Harari English trans., Harvill Secker 2016) (2015) (describing how improvements in AI technologies could lead humans to eventually turnover their decision-making authority to electronic algorithms).

447 Amartya Sen describes this idea and says that,

> One alternative is simply to count the number of elements in the set as reflecting the value of the range of choice. But this number-counting procedure leads to a rather peculiar accounting of freedom. It is odd to conclude that the freedom of a person is no less when she has to choose between three alternatives which she sees respectively as 'bad', 'awful', and 'gruesome' than when she has the choice between three alternatives which she assesses as 'good', 'excellent', and 'superb'. Further, it is always possible to add trivially to the number of options one has . . . . The assessment of the elements in a range of choice has to be linked to the evaluation of the freedom to choose among that range.

See AMARTYA SEN, DEVELOPMENT AS FREEDOM 34 (1999).

448 *See* Einer Elhauge, *Tying, Bundled Discounts, and the Death of the Single Monopoly Profit Theory*, 123 HARV. L. REV. 397, 402, 450 (2009).

Quantity of competition seems to be decreasing as well, most dramatically for those who decide to adopt any given tethered product.[449] The consumer who chooses something as inconsequential as an Amazon-owned connected doorbell has just started on a path where their next device is far more likely to be made by Amazon as well.[450]

Within the "smart home" market, there are currently four major players: Google, Apple, Facebook, and Amazon.[451] The initial purchase of any of these companies' smart speakers, for example, promises access to devices and services that are exclusive to each ecosystem, while foregoing access to other similar competing products.[452] An environment already defined by precious few players becomes even less competitive once a consumer identifies as an Apple or Amazon loyalist. Markets for a range of distinct consumer goods could collapse into a market with competition between a handful of tightly tethered ecosystems. Once consumers make a seemingly innocuous and inexpensive first purchase, they become incrementally invested in a single such ecosystem, and their freedom to customize their own product and services choices diminishes.

Moreover, each of the major tethered platform providers has shown a willingness to acquire actual and potential competitors.[453] That tendency is problematic for at least two reasons. When a company like Amazon determines there is a market for smart doorbells, it has two choices. It could develop its own product, thus increasing the

449 *See* Aaron Perzanowski, *Is This the End of Consumer Ownership?*, FORBES (Sept. 21, 2018), https://www.forbes.com/sites/insights-intelai/2018/09/21/is-this-the-end-of-consumer-ownership/#a0c46953f245 [https://perma.cc/4H7N-UH8D].

450 Amazon bought Ring in 2018. Abha Bhattarai, *Amazon is Buying Smart-Doorbell Maker Ring*, WASH. POST (Feb. 27, 2018), https://www.washingtonpost.com/news/business/wp/2018/02/27/amazon-is-buying-smart-doorbell-maker-ring [https://perma.cc/AG5L-7XMF].

451 *But see* John Koetsier, *Comcast Challenges Amazon's, Apple's, and Google's Leadership in Smart Home Tech*, FORBES (Apr. 9, 2018), https://www.forbes.com/sites/johnkoetsier/2018/04/09/comcast-now-competing-with-amazons-alexa-apples-siri-and-google-home-in-smart-home-tech/#612cda8b60b3 [https://perma.cc/URG5-Z3NP].

452 *See* Joshua Cooper Ramo, *Why 'Network Power' Is the Secret of Success for Apple, Facebook and Amazon*, FORTUNE (July 19, 2016), http://fortune.com/2016/07/19/21st-century-network-power/ [https://perma.cc/Q4PK-PK27].

453 *See, e.g.*, *Apple to Acquire Beats Music & Beats Electronics*, APPLE (May 28, 2014) https://www.apple.com/newsroom/2014/05/28Apple-to-Acquire-Beats-Music-Beats-Electronics/ [https://perma.cc/9PJN-TZ7A]; Dennis Green, *Amazon's $1 Billion Acquisition of the Doorbell-Camera Startup Ring is the Company Doing What it Does Best – and It Should Terrify Every Other Retailer*, BUS. INSIDER (Mar. 3, 2018), https://www.businessinsider.com/why-amazon-acquired-ring-2018-3 [https://perma.cc/6LF2-5ACN]; Nick Statt, *Nest Is Rejoining Google to Better Compete with Amazon and Apple*, VERGE (Feb. 7, 2018), https://www.theverge.com/2018/2/7/16987002/nest-google-alphabet-smart-home-competition-amazon-alexa-apple [https://perma.cc/L65V-ZLRE].

number of competitive offerings by one. Or it could acquire a company like Ring, a move that allows Amazon to capture some segment of the market without introducing a new product. Second, the threat of a behemoth like Amazon entering the market has its own pro-competitive affects. In order to ensure that the smart doorbell market, for example, doesn't entice Amazon to swoop in, firms are more likely to exercise some restraint in setting prices and profits.[454]

Taken together, the implications of tethering present serious risks to competition for a significant swath of the consumer goods market.

E. The Vicious Circle of Consumer and Market-Level Harms

This Article has described two distinct sets of harms in the tethered economy. The first—direct harm to consumers—includes reductions in device functionality, control over personal information, and autonomy.[455] The second—market-wide harms to competition—includes increased switching costs, lock-in, and platform power.[456] Although these injuries can operate independently, they are often interrelated. In some instances, consumer harms reinforce broader market-wide pathologies by reducing competition and entrenching established platforms. At the same time, anemic competition paves the way for abuses of consumers by denying them meaningful alternatives. Together, these dynamics create a sort of feedback loop that indulges the worst impulses of the tethered economy

Consumer harms have implications for the market as a whole. Restrictions on resale, user innovation, and critical speech directly implicate the autonomy interests of consumers. But each of these constraints can also reduce competition. Resale markets lower switching costs; user innovation can yield new competitive offerings, and critical speech provides information essential to meaningful consumer choice. By restricting individual autonomy, firms can constrain competition and reinforce lock-in.

By the same token, markets defined by high levels of concentration and lock-in are more likely to tolerate devices and services that put consumers at risk. In a market with plentiful choice and low switching costs, consumers would either not choose insecure, privacy-

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454 *See* William E. Dorigan, *The Potential Competition Doctrine: The Justice Department's Antitrust Weapon Under Section 7 of the Clayton Act*, 8 J. MARSHALL J. PRAC. & PROC. 415, 416–17 (1975) ("[C]ompetition between businesses already participating in that market will be encouraged by the threat that another large and powerful company in the same product line is 'waiting in the wings' for some inducement to enter their market.").

455 See *supra* Part III.

456 *See supra* Sections IV.B.C.

invasive products in the first instance, or they would abandon them for better alternatives. Instead, a consumer who discovers her home security device includes a secret microphone has to choose whether to accept the risk it poses or attempt to surmount the considerable switching costs a network of integrated tethered products introduces (here, a potential replacement of an entire ecosystem of sensors). Likewise, lock-in and limited consumer choice decrease the likelihood that the market will appropriately discipline firms that brick devices or reduce their functionality.

From this perspective, while the division between consumer and market harms remains a useful taxonomical distinction, the interrelated consequences of tethering render it a somewhat blurry one. This vicious circle of anemic competition giving rise to consumer abuses, which in turn further erode the competitive marketplace, is one that is likely to persist in the absence of some legal intervention.

V. Approaches to Legal Intervention

This Article details how tethering changes the nature of the relationships among sellers, buyers, and other economic actors. Tethering turns search products into experience goods. Tethering lengthens relationships among actors. Minor misalignments between sellers and buyers can deepen with time and become maladaptive. These risks seem only to increase, as sellers will thirst for platform power. The tether will present irresistible opportunities for guile, for increasing costs to consumers, and to denying consumers the ability to defect to competitors. How might law shape the tethered economy and restrain its most harmful impulses?

One possibility is to rely on private law. Contract and tort law may be able to adapt to the tether. These well-trodden fields of law also have the benefit of being organized through high-level principles that can apply across many contexts. As we detail below, several scholars have offered solutions to regulating the tether through these mechanisms precisely because of these conceptual strengths.[457] Perhaps the most attractive feature of using private law is that harmed consumers will be in the best position to advocate for themselves, rather than relying on the government to acquire information about various harms and regulate companies accordingly.[458]

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457 *See infra* Section V.B.

458 *See* Benjamin Powers, *Who is Responsible When the Internet of Things Malfunctions?*, Daily Dot (July 7, 2018), https://www.dailydot.com/layer8/internet-things-liability/ [https://perma.cc/3JZH-UFPM].

However, private law is limited in the sense that it does little to prevent the macro, economy-wide effects of tethering, such as the competitive drain caused by lock-in.[459] The primary issue pervading the tethered economy is that sellers will have an unparalleled power to impose transaction costs on consumers so that they cannot defect, enabling platform power as a result.[460] This agglomeration of market power is not easily prevented through private law alone, and instead generally requires proactive regulation through consumer and competition law. Indeed, some of the examples of opportunistic seller behavior have been targeted by the FTC.[461]

That being said, an approach that focuses on FTC consumer and antitrust activity alone would not necessarily protect all of the relevant dimensions of consumer interests. While preventing lock-in is a key priority in the tethered economy, there are also other consumer harms that stem from the tether that should be accounted for.

In this Part, we illustrate the details of various approaches to addressing the consumer problems that arise from the tether. No single approach would solve the broader issues surrounding lock-in and switchover. Indeed, one could easily imagine that mandating a company like Apple respect a right to repair might encourage it to instead sell data, thus diluting privacy protections. When policy makers are confronted with such unintended consequences, it would be prudent to remember that various legal tools should be applied to solve the high-level consumer problems we sketched out in earlier sections.

A. Private Law

1. Contract

Could contract law meaningfully constrain the harms of tethering? An initial difficulty comes from classifying tethered devices: are they products or services? Historically, the law treats these two categories differently. The Uniform Commercial Code (UCC) is the national template that governs the sale of goods.[462] At the time it was created, and in the decades since, the UCC primarily dealt with goods and explicitly excluded the rendering of services.[463] The UCC provides

459 *See infra* Section V.A.

460 *See supra* Section IV.B.

461 *See* David McLaughlin, *Tech Firms to Draw Antitrust Scrutiny as FTC Chief Takes Reins*, BLOOMBERG (June 20, 2018), https://www.bloomberg.com/news/articles/2018-06-20/tech-firms-to-draw-antitrust-scrutiny-as-ftc-chief-takes-reins [https://perma.cc/BAM2-JXNA].

462 *See* William A. Schnader, *A Short History of the Preparation and Enactment of the Uniform Commercial Code*, 22 U. MIAMI L. REV. 1, 10 (1967).

463 There are a few plausible explanations as to why goods and services were cleaved from

a now-familiar set of default, non-waivable rules for the sale of goods.[464] It imposes a general duty of good faith that, if violated, voids the contract.[465] Statements about goods generally become warranties that are difficult to disclaim.[466] On the other hand, services are subject to sectoral regulation, and these can range from strong, supervisory-level oversight, licensing, and enhanced duties of care to no special protections at all.[467]

At several junctures, policymakers and scholars considered how the UCC might adapt to digital technologies that incorporate bundled goods, services, and software. William Woodward and Amelia Boss offered a take on the product/service divide in the UCC soon after personal computing became commonplace.[468] Writing in 1988, they discuss their work on two task forces that ultimately recommended the reexamination of the UCC's exclusion of services from Article 2 and called for the American Law Institute to conduct further studies into how to classify computer services.[469] Despite these recommenda-

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each other at the time the UCC was drafted. Robert Rasmussen observed that services were in many ways qualitatively different from goods in the mid-20th century. *See* Robert K. Rasmussen, *The Uneasy Case Against the Uniform Commercial Code*, 62 La. L. Rev. 1097, 1112 (2002). At the time, the economy still had a large manufacturing component, and domestic consumption was oriented around goods. *See id.* The more compelling explanation, however, is that the interest groups pushing for the adoption of the UCC were fundamentally dissimilar from the interest groups that dealt with services. Karl Llewellyn, as one of the chief architects of the UCC, was primarily concerned that the patchwork of state laws governing the sale of goods created numerous complications that hindered interstate commerce. *See* Karl N. Llewellyn, *Why We Need the Uniform Commercial Code*, 10 U. Fla. L. Rev. 367, 371, 373–74 (1957). He was largely motivated by the fact that interstate sale of goods had grown tremendously since the late 1800s, and the variety of laws that existed confused even legal experts and were totally inscrutable to businesspeople. *See id.* at 370–72. Thus, he advocated for a standard body of law that lawyers, clerks, and businesspeople could easily interpret, thus facilitating interstate business transactions. *See id*. at 373.

464 *See, e.g.*, U.C.C. § 9-602 (Am. Law Inst. & Unif. Law Comm'n 1977) (waiver and variance of rights and duties).

465 *See id.* § 1-203 (imposing duty of good faith); *id.* at § 2-103(j) (defining "good faith" as "honesty in fact and the observance of reasonable commercial standards of fair dealing in the trade").

466 *See, e.g.*, *id.* § 2-314 (implied warranty of merchantability).

467 *Compare* Daniel Calvo et al., Financial Supervisory Architecture: What Has Changed After the Crisis? (2018) (describing the complex regulatory models of the financial industry), *with* Erin Joyce, *More Regulation for the Software Industry?*, eSecurity Planet (Feb. 17, 2005), https://www.esecurityplanet.com/trends/article.php/3483876/More-Regulation-For-The-Software-Industry.htm [https://perma.cc/5NTD-YRY2] (describing the lack of regulation for software security).

468 *See generally* Amelia H. Boss & William J. Woodward, *Scope of the Uniform Commercial Code; Survey of Computer Contracting Cases*, 43 Bus. Law. 1513 (1988).

469 *See id.* at 1517–18.

tions, the UCC did not substantially change to bring services into the fold in a meaningful way.[470]

One reason this effort failed was that the proposed Article 2B of the UCC would have given software publishers unfettered ability to dictate the terms under which their products could be used, overriding limitations demanded by copyright and other bodies of law.[471] Pam Samuelson explains that while efforts to update the UCC to anticipate the growth of a global information economy were laudable, Article 2B—which later became the Uniform Computer Information Transactions Act—would have substantially reduced consumer rights.[472] As Samuelson points out, consumers cannot be expected to parse the dense legal terms presented in software licenses.[473] And, even if they could, competition alone is unlikely to protect consumer interests, especially in concentrated markets.[474]

This expansive embrace of shrinkwrapping threatened to complicate licensing of information and upend established legal principles. Indeed, the broadest interpretation would have extended 2B to all information, not just packaged software. In resisting this effort, Samuelson anticipated many of the issues we confront: As she notes, "UCC2B may herald the shrinkwrapping of information of all kinds: books, magazines, CDs, movies, you name it."[475]

Because of 2B's failure to gain traction, courts instead applied other aspects of Article 2 in some cases. Stacy-Ann Elvy has described the various tests that courts use when attempting to apply the UCC to hybrid transactions and details the difficulty of using these standards.[476] In particular, she focuses on the "predominant purpose" test and the "gravamen of the claim" test.[477] The "predominant purpose" approach forces courts to determine what a product's primary purpose is and to determine whether the UCC or common law should apply.[478] There is a great deal of subjectivity inherent in this sort of decision,

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470 *See, e.g.*, U.C.C. § 2-102 (Am. Law Inst. & Unif. Law Comm'n 1977).

471 *See* Pamela Samuelson, *Legally Speaking: Does Information Really Have to Be Licensed?*, 41 Comm. ACM 15, 15–16 (1998).

472 *See id.* at 17–18.

473 *See id.*

474 *See id.* at 20.

475 *Id.* at 17.

476 *See generally* Elvy, *supra* note 63.

477 *See id.* at 105, 112.

478 *Id.* at 105.

however, and different courts may arrive at different conclusions about the same product, thus creating uncertainty.[479]

The "gravamen of the claim" test provides a bright line rule but one which is ill-suited to the realities of tethered products. It asks whether the claim is related to the transaction's goods or services, as strictly defined by Article 2.[480] This interpretation would exclude any service from consideration under the UCC, even if it was deeply embedded within the good. While such an approach would provide a fairly consistent rule, it offers consumers little protection.[481]

Instead, Elvy suggests a "functionality approach" that would ask whether a device could function without its embedded services and software.[482] If the answer is yes, then it would be classified as a good, and its embedded software would not be considered part of the package.[483] On the other hand, if the device could not function without its embedded software, then that software is part of the package, and therefore can be governed by the UCC.[484] She proposes this functionality approach primarily as a way to avoid completely redefining the nature of the product/service divide, while still recognizing that tethered products resist easy classification into either good or service.[485]

Returning to the original question—could contract law suffice for tethered products? In a business-to-business (B2B) sales environment, perhaps it could. B2B buyers have long dealt with historical analogs of the tether, for instance, legacy systems that accrete stifling switching costs.[486] In the B2B context, buyers have developed many innovations, including service-level guarantees,[487] professional consultancies that report on business reputation and reliability,[488] and buyers who spend

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479 *See id.*

480 *Id.* at 112.

481 *See id.* at 113.

482 *Id.* at 149.

483 *Id.*

484 *Id.* at 148–49.

485 *Id.* at 152–53.

486 *See* MERRILL WARKENTIN, BUSINESS TO BUSINESS ELECTRONIC COMMERCE: CHALLENGES AND SOLUTIONS 17 (2002) (describing the switching costs businesses face, including ongoing compatibility with legacy systems and investment in established relationships).

487 *See* Christopher Ryan, *The Power of a Guarantee in Driving B2B Revenue*, FORBES (May 16, 2018), https://www.forbes.com/sites/forbesagencycouncil/2018/05/16/the-power-of-a-guarantee-in-driving-b2b-revenue/#3c91f8e76ff2 [https://perma.cc/D3RH-MZY2].

488 *See* Doug Wendt, *What, Exactly, is a B2B Business Growth Consultant?*, WENDT PARTNERS, http://blog.wendtpartners.com/what-is-a-b2b-business-growth-consultant [https://perma.cc/P8TK-CVK8].

months evaluating competing offers to spot hidden costs and lock-in.[489]

Consumers operate in a different contracting world, one unmoored from tradition.[490] Form agreements, with take-it-or-leave-it terms, are the norm.[491] Electronic disclosures enable contract drafters to write instruments that are absurdly burdensome to read, yet the common law still imposes a duty to read on consumers.[492] In practice, no one believes consumers read this documents.[493] They lack the time and, in many cases, the literacy skills.[494]

Nor does it make sense to read when there is no indication that retailers can adjust them.[495] The embrace of notice-based contracting also creates opportunities for sellers to simply change terms. This might suggest that consumers would prefer an Article 2 approach, with its relatively strong defaults surrounding the formation of warranties. After all, companies do like to tout their products, and in so

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489 *See A B2B Buying Process Timeline Indicates That Vendors Can Engage Buyers Early*, MARKETING CHARTS (July 25, 2018), https://www.marketingcharts.com/industries/business-to-business-105084 [https://perma.cc/67LR-REXP].

490 In the context of consumer credit, Oren Bar-Gill and Elizabeth Warren have argued that consumer protection law rather than contract law better safeguards the interests of consumers. Oren Bar-Gill & Elizabeth Warren, *Making Credit Safer*, 157 U. PENN. L. REV. 1, 70–79 (2008).

491 *E.g.*, David A. Hoffman, *Relational Contracts of Adhesion*, 85 U. CHI. L. REV. 1395, 1452 (2018).

492 *See, e.g.*, Feldman v. Google, Inc., 513 F. Supp. 2d 229, 236–37 (E.D. Pa. 2007); Alan M. White & Cathy Lesser Mansfield, *Literacy and Contract*, 13 STAN. L. & POL'Y REV. 233, 234 (2002).

493 *E.g.*, Hoffman, *supra* note 491, at 1452–53.

494 White & Mansfield, *supra* note 492, at 241–42. The Program for the International Assessment of Adult Competencies (PIAAC), a large scale of literacy, finds that only 13% of Americans operate at the highest levels of reading literacy. *See PIAAC 2012/2014 Results*, NAT'L CTR. FOR EDUC. STATISTICS, https://nces.ed.gov/surveys/piaac/results/summary.aspx [https://perma.cc/T286-P94D]. On a scale of 1–5, about 50% of Americans perform at level 3 or lower. *Id.* One component of PIAAC tests problem solving in technologically-rich environments. *Id.* In that context, only 36% of Americans reach a level that requires "[s]ome integration and inferential reasoning" or higher. *PIAAC Proficiency Levels for Problem Solving in Technology-Rich Environments*, NAT'L CTR. FOR EDUC. STATISTICS, https://nces.ed.gov/surveys/piaac/pstreproficiencylevel.asp [https://perma.cc/4KUF-7FER]; *see also PIAAC 2012/2014 Results*, *supra*. The remainder are in a category requiring "no need to contrast or integrate information" or no "categorical or inferential reasoning, or transforming of information." *PIAAC Proficiency Levels*, *supra*; *see also PIAAC 2012/2014 Results*, *supra.*

495 We note that at the beginning of the Web economy, some thought that the internet would bring a contract utopia, where each person could obtain tailored terms. *See* Esther Dyson, *Protect Internet Privacy—Privately*, WALL ST. J., June 17, 1997, at A, 18:3.

doing, they create a landscape of promises under the UCC approach.[496]

On the other hand, some of the key affordances of tethered goods may not be apparent to consumers, and thus may not be considered in the bargain. When shopping, few consumers think about the lock-in to an ecosystem.[497] Instead, they are focused on the more immediate rewards. Promises of interoperability, length of support, and quality of support are key to avoiding tethered product problems but are not likely to be as salient as price and product capabilities.[498] One approach might be to make surprising terms more salient by placing them inside a warning box or other prominent placement.[499] Yet as this Article has shown, there is so much room for opportunism in the tethered economy, that such disclosures may become as large as existing terms of service.

There may also be situations where service-style regulation is appropriate in a tethered product, as when the device performs some function traditionally entrusted to a licensed professional. For instance, a consumer may expect that software claiming to detect melanoma would perform similarly to a physician, would have done research to support its efficacy,[500] would keep data confidential consistently with professional norms, and would have options to complain to a board of qualified experts if it fails.

2. Tort

Tort law provides another potential private law solution. Broadly, it holds one party accountable for a harm caused to another.[501] Typically, this takes the form of an injury caused by negligence.[502] Insofar as companies engage in behavior that harms consumers in this man-

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496 *See* Curtis R. Reitz, *Manufacturers' Warranties of Consumer Goods*, 75 WASH. U. L.Q. 357, 360 (2018).

497 *See* Perzanowski, *supra* note 449.

498 *See id.*

499 *See generally* Ian Ayres & Alan Schwartz, *The No-Reading Problem in Consumer Contract Law*, 66 STAN. L. REV. 545 (2014) (proposing FTC rule requiring mass market sellers to substantiate consumer expectations about contract terms and to warn consumers of unfavorable terms by placing them in a standardized warning box).

500 *See* Stipulated Final Judgment and Order for Permanent Injunction and Other Equitable Relief Against Defendant Avrom Boris Lasarow at 4–5, FTC v. Lasarow, No. 1:15-cv-01614 (N.D. Ill. Aug. 18, 2015).

501 *See* 1 DAN B. DOBBS, PAUL T. HAYDEN & ELLEN M. BUBLICK, THE LAW OF TORTS § 9 (2d ed. 2012).

502 *See id.* § 2.

ner, tort law may provide an effective mechanism to hold them accountable.

Rebecca Crootof argues powerfully for specific tort reforms that could adequately address the rise of business models that present tether-like problems.[503] She suggests introducing a form of "service liability" that would serve as a contemporary parallel to existing product liability rules.[504] She argues that the advent of the Internet of Things is akin to the same kinds of seismic shifts in American social and economic life that resulted from the Industrial Revolution.[505] The Industrial Revolution raised the real possibility that various machines (cars, manufacturing equipment, etc.) could seriously harm people without there ever being a relationship between the manufacturer and victim.[506] Similarly, she argues that the proliferation of IoT presents the same kind of concerns except with user data.[507]

A "service liability" rule would essentially extend the current products liability regime to services.[508] Crootof also recognizes this would address the current problem that the product/service divide creates for applying existing law to products that blend elements of both goods and services.[509] The same way these hybrid goods escape the purview of contract law, tort law also struggles to adequately deal with them today.[510] Crootof argues that expanding product liability to include services is one way to make tort law more effective with respect to the hybrid products associated with IoT.[511]

Crootof also argues for extending the concept of "information fiduciaries" to makers of IoT devices.[512] Professionals in areas such as accounting, law, and health generally have "fiduciary" obligations that compel them to act in the best interest of their clients.[513] Extending this concept to the makers of tethered goods would create a version of the duties of care and of loyalty for IoT companies similar to those that currently exist for some service industry professionals.[514] Specifi-

503 *See generally* Crootof, *supra* note 140.

504 *Id.* at 63–64.

505 *See id.* at 51–54.

506 *Id.*

507 *See id.* at 12–15.

508 *Id.* at 54–65.

509 *See id.* at 12.

510 *See id.* at 35–48.

511 *See id.* at 54–65.

512 *See id.*

513 *Id.*

514 *Id.* at 63–64; *see also* Jack M. Balkin, *Information Fiduciaries and the First Amendment*, 49 U.C. DAVIS. L. REV. 1183, 1229 (2016) (proposing that online service providers be considered

cally, "[c]ompanies would not be able to use data gathered by IoT devices to enrich themselves at the expense of device users, to identify violations of contractual terms, or to report certain categories of illegal activity to law enforcement."[515] At a basic level, she argues that companies should not be able to "overreach on contracts" or harm their users.[516]

Essentially, Crootof argues that at least one approach to dealing with the emergent pathologies is to empower consumers to hold companies accountable for the harms that stem from the design of their products and embedded services.[517] Again, this approach primarily helps to deal with the fact that the product/service divide is blurring in an era where hybrid goods abound.[518] The recognition that these information services essentially raise the same concerns that products did in the late 19th century could help provide a way forward in protecting consumers from the harms that sellers may perpetuate.[519]

We remain skeptical of some of these approaches. At the core of tethered business models is an incentive conflict between serving the user, spying on her, and developing new revenue streams post-transaction. Jack Balkin, the chief proponent of the fiduciary approach, acknowledges business model realities and resolves them by proposing a weak form of fiduciary duty. Balkin's approach suggests information fiduciaries could sell user data, and that services should refrain from "what we would reasonably consider unexpected or abusive for them to do."[520]

Yet, defining fiduciary duties as avoiding "abusive" behavior is a dramatic dilution of the concept of loyalty and care so central to trusted entities; in fact, general consumer protection law already commands companies to avoid abuse and negative consumer surprise.[521] Nevertheless, the Balkin approach would address one harm we have articulated here. Balkin provides few bright-line conduct rules for online service providers, but he does specify that some service providers

"special-purpose information fiduciaries," with some basic obligations to users, which are less strict than those owed by the traditional professions).

515 *Id.*

516 *Id.* at 54–57.

517 *See id.* at 54–65.

518 *See id.* at 12.

519 *See id.* at 51–53.

520 *See* Balkin, *supra* note 514, at 1227.

521 Chris Jay Hoofnagle, Federal Trade Commission Privacy Law and Policy 119–41 (Cambridge Univ. Press 2016). For an extended critique of the information fiduciary concept, see Lina Khan & David Pozen, *A Skeptical View of Information Fiduciaries*, 133 Harv. L. Rev. (forthcoming 2019).

should not, "attempt to threaten or embarrass you to keep you from criticizing [the service.]"[522] Recall that Facebook seems to be doing exactly that by asking minors participating in privacy litigation about drug use and their foul language in deposition.[523] Balkin's lightweight fiduciary duties should at least stop Facebook from using user posts against them.

More broadly, tort-based approaches require courts to reconceptualize seller/consumer relationships. Courts are unlikely to impose fiduciary responsibilities on companies selling inexpensive, even frivolous IoT devices. In fact, judges' inclinations seem to be running in the opposite direction, with courts seeing users as "getting what they paid for" when their data become the counter performance in a transaction.

B. Public Law

Two primary bodies of public law bear on tethered offerings—antitrust and consumer protection law. Both are concerned with maintaining functioning competitive marketplaces. But as we discuss below, antitrust law is hampered in important respects that limit its ability to successfully reign in the harms of tethering. Consumer protection law, on the other hand, allows for a range of targeted interventions that protect individuals and the integrity of the marketplace.

1. Antitrust

Antitrust law offers courts and regulators a potentially powerful set of tools to shape the marketplace, encourage competition, and ultimately protect the interests of consumers. But the prevailing interpretations of cognizable harm, combined with the shifting dynamics between consumers and digital platforms, likely prevent meaningful intervention in the absence of broader trends towards robust antitrust enforcement.

Two particular challenges are worth noting. First, defining the relevant market can be difficult for firms that operate ecosystems of interrelated, tethered products and services. Competition analysis starts by identifying a market, and then determining whether certain structural problems such as monopoly power, high barriers to entry and exit, and other inefficiencies exist.[524] But determining the market or

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522 *See* Balkin, *supra* note 514, at 1227.

523 *See supra* Section III.B.3.

524 *See generally* U.S. DEP'T OF JUSTICE & FED. TRADE COMM'N, HORIZONTAL MERGER GUIDELINES §§ 4–10 (Aug. 10, 2010), available at https://www.ftc.gov/system/files/documents/

markets on which regulators should focus their analysis presents a problem in the tethered economy because of the complex interplay and overlap between the products, services, and platforms firms operate.

Platforms may be competing in an entirely new market, one not fully understood or clearly defined.[525] But other interpretations of the relevant market are plausible. One way to think about Google, for example, is as a surveillance platform that has expanded into horizontal markets in order to capture consumer data. By acquiring products, services, and potential competitors that could displace its core technologies in the long-run, Google controls the direction of valuable consumer data flows.[526] Another is to see platforms as owners of consumer relationship that they can govern and from which they can profit. After a consumer relationship is established, users are unlikely to bear the transaction costs of switching, and thus the inertia of the first-to-market platform prevails.[527] For example, after purchasing Nest, Google stripped away many of the platform's features, and then rebranded its own Google Home product and software line under the Nest moniker.[528] Yet another perspective is to see Google as a labor market, with its users serving as workers who provide data to the platform in exchange for various free services.[529] Under this view, Google may be the 21st-century company town, a monopsony collecting data below the cost a competitive marketplace would have set.

But the traditional view of what constitutes a market is starting to give way to the realities of the power technology platforms wield. Joseph Stiglitz argues that, "[t]he presumption is that in the absence of a large market share . . . it would be impossible for any firm to engage in anticompetitive abuses. But, increasingly, it is being recognized that

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public_statements/804291/100819hmg.pdf [https://perma.cc/23MA-D5RH] [hereinafter HORIZONTAL MERGER GUIDELINES].

525 *See* Lina Khan, *Sources of Tech Platform Power*, 2 GEO. L. TECH. REV. 325, 325–31 (2018) (discussing the power of platforms as gatekeeping "distribution channels" or "arteries of commerce" across multiple digital markets and as information exploiters).

526 *See id.* at 329–31 (outlining how Amazon and other platforms use data to enter markets).

527 *See* Kenneth A. Bamberger & Orly Lobel, *Platform Market Power*, 32 BERKELEY TECH. L.J. 1051, 1065–67 (2017).

528 Ron Amadeo, *Nest, the Company, Died at Google I/O 2019*, ARS TECHNICA (May 10, 2019), https://arstechnica.com/gadgets/2019/05/nest-the-company-died-at-google-io-2019/ [https://perma.cc/AF2M-HCT7].

529 *C.f.* Giacomo Luchetta, *Is the Google Platform a Two-Sided Market?*, 10 J. COMPETITION L. & ECON. 185, 197 (2014) (suggesting that Google "search results are actually an in-kind payment from Google to end users").

this standard approach may be inadequate for dealing with some of the important anticompetitive abuses today . . . ."[530] Given the transaction and switchover costs associated with leaving a platform, consumers are locked into relationships with platform providers that closely resemble those sorts of relationships that the law has traditionally regulated.[531]

The second major challenge is rooted in the Chicago School's emphasis on price signals.[532] If the price paid by consumers for a good or service does not increase, contemporary antitrust thinking treats market or consumer harm as unlikely, if not impossible. But this approach ignores the dynamic risks to competition that accompany what may seem, at first blush, to be pro-consumer offerings and acquisitions. Digital platforms compete in a range of ways apart from price. In some cases, they offer a minimum viable product, even at substantial losses. In others, rather than introduce new innovations, firms degrade quality over time and charge a premium for what was once standard service.[533] For many of these products, their value will ultimately be derived from network effects, creating incentives to underprice them, or even offer them free, at least initially.[534] Firms may also hide costs or risks that consumers will only discover later. Discounted prices may also signal the collection of data about consumer preferences and behavior to be deployed at a later date.

The problems with price signals are exacerbated when it comes to free product and services. John Newman argues that these "zero-price" markets still deserve antitrust scrutiny.[535] Similarly, Maurice Stucke and Allen Grunes argue that industries enabled by "big data" compete with data instead of price, and can be analyzed through an

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530 Joseph E. Stiglitz, *Towards a Broader View of Competition Policy* 11 (Roosevelt Inst., Working Paper, 2017), http://rooseveltinstitute.org/wp-content/uploads/2017/06/durbanbricscompetition_FinalClean.pdf [https://perma.cc/Y3WA-L6QT].

531 *See* Bamberger & Lobel, *supra* note 527, at 1066–67.

532 *See* Lina M. Khan, *Amazon's Antitrust Paradox*, 126 YALE L.J. 710, 737–39 (2017).

533 Uber, for example, introduced its premium Select service after years of declining standards for its vehicles. *See* Ryan Felton, *1 in 6 Uber and Lyft Cars Have Open Safety Recalls, Consumer Reports' Study Suggests*, CONSUMER REP. (May 21, 2019), https://www.consumerreports.org/ride-hailing/uber-and-lyft-cars-have-open-safety-recalls/ [https://perma.cc/TLQ6-F2AW] (noting that Uber permits 15-year-old vehicles); *Introducing uberSELECT: A Step Above the Everyday*, UBER BLOG (Mar. 5, 2015), https://www.uber.com/blog/phoenix/introducing-uberselect-a-step-above-the-everyday-2/ [https://perma.cc/49XM-4D7S].

534 *See* Bamberger & Lobel, supra note 527, at 1068–69.

535 *See generally* John M. Newman, *Antitrust in Zero-Price Markets: Foundation*, 164 U. Pa. L. Rev. 149 (2015).

antitrust lens.[536] Focusing solely on price undermines the range of genuine consumer protection concerns that arise from the markets created by digital platforms.

One potential solution is to adopt a "small but significant and non-transitory decrease in quality" ("SSNDQ") approach. The U.S. Department of Justice and the FTC traditionally use the "small but significant and non-transitory increase in price" ("SSNIP") approach as a test for assessing a firm's market power when considering mergers.[537] The test looks to evaluate whether a monopolist could profit from a price increase of five percent in the smallest relevant market.[538] The intuition is that it measures demand elasticity, and disallows firm behavior (mergers, monopolistic pricing, etc.) that can take advantage of inelastic demand.[539]

However, SSNIP clearly does not work in markets that do not have price signals. Instead, we propose articulating a standard that would penalize behavior that takes advantage of consumers' inelasticities regarding switching over to a new platform. The European Union and China have started using the concept, though questions still remain.[540] There is no straightforward way to measure quality across products, even if companies have their own internal measures.[541] SSNDQ is attractive in that it does not punish network effects per se, but rather only the incentives for potential abuses by platforms with monopoly power.

Defining the scope of competition policy in the digital economy will be critically important for regulating tethered products. It would be a mistake to consider the relevant market for tethered devices to be the market for the physical vessels. While such an approach may lend itself to traditional economic analysis reliant on price signals, it misses crucial features of the relevant market. Consumers are ulti-

536 MAURICE E. STUCKE & ALLEN P. GRUNES, NO MISTAKE ABOUT IT: THE IMPORTANT ROLE OF ANTITRUST IN THE ERA OF BIG DATA (2015).

537 HORIZONTAL MERGER GUIDELINES, *supra* note 524, § 4.1.1.

538 *Id.*

539 *Id.*; *see also id.* § 7.2 ("Coordination generally is more profitable, the lower is the market elasticity of demand.").

540 *See* Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data, and Repealing Directive 95/46/EC (General Data Protection Regulation), OFFICIAL J. OF THE EUR. UNION (2016); Samm Sacks, *China's Emerging Data Privacy System and GDPR*, CSIS (Mar. 9 2018), https://www.csis.org/analysis/chinas-emerging-data-privacy-system-and-gdpr [https://perma.cc/MRC2-255Q].

541 *Quality Score: Definition*, GOOGLE, https://support.google.com/google-ads/answer/140351?hl=en [https://perma.cc/PQ8Z-BWV7].

mately purchasing AI assistants and other embedded software that leverage the power of platforms. These tethered offerings ultimately exist as part of digital platforms' broader business strategies to expand market power in the digital economy.

Thus far, antitrust action has been ineffective, in large part because its focus on price signals overlooks the platform dynamics that drive the design of tethered ecosystems. Without clear price signals, demonstrating harm to consumers under a traditional analysis becomes difficult. Yet, platforms do compete for something valuable, namely consumer data and attention. Newman,[542] Stucke, and Grunes[543] argue that regulators may start incorporating privacy harms into an antitrust framework. More aggressive interventions that promise to break up some of the biggest players today would require reimagining the fundamentals of contemporary antitrust analysis. We do not propose such an approach here. Instead, in the near term, we turn to consumer protection law to encourage the development of healthy competitive markets.

2. Consumer Protection

Despite the promise of private law approaches to modernize the law to deal with a new class of products, adopting them would not adequately prevent the macro-level effects of lock-in, nor prevent companies from circumventing the spirit of several existing consumer rights. And antitrust law, despite its focus on market-wide effects, is limited in its practical capacity to respond to developments in the modern tethered economy.[544] Statutory consumer protection law, in contrast, focuses on individual harms and consumer rights, but it can also broadly promote functioning free markets and innovation.[545]

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542 *See* Newman, *supra* 535, at 202.

543 *See* STUCKE & GRUNES *supra* 536, at 8.

544 One notable challenge facing consumer protection law arises in the context of free services. Consumer protection law envisions the consumer as a person who exchanges money in return for a product. *See, e.g.*, 15 U.S.C. § 2301(3) (2012) (defining "consumer" as a "buyer" in the Magnuson–Moss Warranty Act). Users of "free" services seem to lose their consumer status. In re Facebook Privacy Litig., 791 F. Supp. 2d 705, 715 (N.D. Cal. 2011) ("Because Plaintiffs allege that they received Defendant's services for free, as a matter of law, Plaintiffs cannot state a UCL claim under their own allegations."). As a result, they also lose access to the range of protections afforded by consumer protection law, leaving their interactions with platforms largely unregulated. *See* 15 U.S.C. § 45(n) (2012) (limiting the FTC's authority to declare acts unlawful unless an act "causes or is likely to cause substantial injury to consumers"). To address this problem, consumer protection law, like antitrust law, must contend with the fact that data and attention are both powerful forms of currency in the digital economy.

545 *See FTC Announces Hearings on Competition and Consumer Protection in the 21st Cen-*

Consumer protection law is uniquely situated to prevent harms before they actually occur and shape the general contours of the economy without relying on enforcement of individual cases to motivate company behavior.[546] Moreover, updating consumer protection law to encompass the tether brings the manufacture, sale, and use of these goods into line with existing notions of fairness within the product space.

The main motivation behind offering a consumer protection approach is that simply updating existing private law remedies will not affect the problem of growing platform power. The pathologies that most threaten consumer rights are the notion of lock-in and the erosion of traditional consumer rights as a result of the continuous relationship between seller and consumer.[547] Lock-in creates powerful incentives for companies to grow their platform power by ensuring that consumers would face enormous costs to switch ecosystems.[548] Amassing such power could also permit companies to take anti-consumer actions that prevent access to certain services for no technical reason, but rather to discourage innovation from outside the ecosystem (i.e. Amazon preventing its users from accessing YouTube).[549]

The continuous relationship between seller and consumer can similarly have macro effects by accelerating the transition from a goods-based economy to a service-based one. A world in which most products have elements of services might herald a shift in consumption from one in which people generally own products, to one in which people lease or rent access to services.[550] Such a change would constitute a major change in the way the economy at large operates. While such a change carries several benefits, it necessarily diminishes many of the pro-consumer benefits that arose from ownership,[551] and therefore policy makers should pause to consider how to weigh these tradeoffs.

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tury, FTC (June 20, 2018), https://www.ftc.gov/news-events/press-releases/2018/06/ftc-announces-hearings-competition-consumer-protection-21st [https://perma.cc/R3XP-NKYR].

546 *See About the FTC: What We Do*, FTC, https://www.ftc.gov/about-ftc/what-we-do [https://perma.cc/HY8L-U8GS].

547 *See supra* Section IV.B.

548 *See* Crootof, *supra* note 140, at 26–27.

549 *See, e.g.*, Ian Morris, *Google and Amazon's Childish Little Fight is Spilling into Your Home*, FORBES (Dec. 31, 2017), https://www.forbes.com/sites/ianmorris/2017/12/31/google-and-amazons-childish-little-fight-is-spilling-into-your-home/#1846830c6fc8 [https://perma.cc/FS35-5GPV].

550 *See supra* notes 52–57, 167 and accompanying text.

551 *See, e.g.*, PERZANOWSKI & SHULTZ, *supra* note 57, at 2.

Consumer protection law is uniquely situated to vigorously pursue the maintenance of functional free markets while upholding the benefits of consumer rights.[552] Contract and tort approaches certainly can have macro-level effects in that they facilitate commerce and shape behavior in important ways.[553] Consumer protection law intersects with these goals in important ways, but can also provide general principles for organizing an economy that is rapidly shifting toward a blended good/service model.[554]

Because these principles are not always clear at first blush, we outline the broad priorities that consumer protection law should take when adapting to the tether.

a. Repair and Repurposing

Because the ability to repair is being eroded for consumers of tethered products, policymakers must consider how to recalibrate the bundle of rights enjoyed by digital consumers. Although many consumers would find it daunting to repair their own device, a statutory right to repair would facilitate markets for third-party repair services.[555] Such markets, in turn, would drive down prices for new and refurbished goods, improve device longevity, and mitigate the environmental impact of the digital economy.[556] Admittedly, there is some risk that third-party repair could degrade device performance and compromise security.[557] But, those theoretical risks appear to be outweighed by the demonstrable benefits of competitive repair markets.

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552 *See supra* Section III.B.

553 *See*, *e.g.*, Lewis v. Am. Cyanamid Co., 715 A.2d 967, 985 (N.J. 1998) (Handler, J., concurring) ("Influencing the behavior of persons or entities through incentives is one of the fundamental purposes of tort law."); AVERY W. KATZ, PHILOSOPHICAL FOUNDATIONS OF CONTRACT LAW 171 (Gregory Klass et al. eds., 2014) ("[I]t has been commonplace to view the law of contracts as an important tool for facilitating and regulating economic activity.").

554 Like the private law approaches discussed above, consumer protection law focuses on individual harms to a large extent. However, unlike the private law approaches, it also broadly promotes functioning free markets, innovation, and consumer rights. *See supra* Section IV.B.; *The Bureau*, CFPB, https://www.consumerfinance.gov/about-us/the-bureau/ [https://perma.cc/6JFH-BRYB].

555 *See* Hamza Shaban, *'Right-to-Repair' Advocates Claim Major Victory in New Smartphone Copyright Exemption*, WASH. POST (Oct. 26, 2018), https://www.washingtonpost.com/technology/2018/10/26/right-repair-advocates-claim-major-victory-new-smartphone-copyright-exemption/?utm_term=.889aebc36db6 [https://perma.cc/Q4WZ-LX5U].

556 *See* Kyle Wiens & Gay Gordon-Byrne, *Why We Must Fight for the Right to Repair Our Electronics*, IEEE SPECTRUM (Oct. 24, 2017), https://spectrum.ieee.org/green-tech/conservation/why-we-must-fight-for-the-right-to-repair-our-electronics [https://perma.cc/U9K7-322S].

557 *See* Gary Brooks, *3 Risks to Right to Repair Legislation*, MANUFACTURING.NET (July 20, 2018), https://www.manufacturing.net/blog/2018/07/3-risks-right-repair-legislation [https://perma.cc/VLD8-RCQ3].

In 2013, for example, Massachusetts legislation focused on automotive repair that required carmakers to provide vehicle owners and independent repair shops "the same diagnostic and repair information, including repair technical updates" that they offer their own dealers.[558] The bill's passage led to voluntary nationwide changes in auto repair practices.[559] However, federal legislation and state-based efforts to expand the right to repair to other devices have, thus far, been unsuccessful. Although 18 states have introduced right to repair bills,[560] aggressive lobbying by Apple and other device makers has stalled these efforts.[561]

Without a formal right to repair, other, less prescriptive interventions can still promote markets for repair. California law requires makers of electronics and home appliances with wholesale prices over $100 to make service literature and functional parts available "to effect the repair of a product for at least seven years after the date a product model or type was manufactured . . . ."[562] Although the law simply requires parts to be available, it has resulted in Apple extending service from five years to seven for California consumers.[563] A 2016 Ninth Circuit decision cabined the law, interpreting it to mean that manufacturers only had to provide parts at its own and authorized repair shops, excluding independent third-party repair.[564] Additionally, the law is limited in that it only applies to hardware, having been enacted long before software-embedded products became popular.[565] Nevertheless, the approach is intriguing in that merely requiring the availability of repair parts has given traction to consumer repair.

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558 H.B No. 3757, 188th Gen. Court, First Annual Session (Mass. 2013).

559 *See* Adam Rubenfire, *'Right to Repair' Compromise Reached in Mass.*, AUTOMOTIVE NEWS (July 31, 2012), https://www.autonews.com/article/20120731/RETAIL07/120739975/right-to-repair-compromise-reached-in-mass [https://perma.cc/ZG6L-V8FR].

560 *See* Seung Lee, *California Right to Repair Bill Takes Aim at Gadget Makers Like Apple*, MERCURY NEWS, https://www.mercurynews.com/2018/03/07/california-legislator-introduces-bill-requiring-electronic-makers-to-make-repair-manuals-and-parts-publicly-available/ [https://perma.cc/3PH3-X844]; *see also 17 States Now Weighing Right to Repair Bills as Momentum Grows*, REPAIR ASS'N (Jan. 18, 2018), https://repair.org/news/2018/1/18/17-states-now-weighing-right-to-repair-bills-as-momentum-grows [https://perma.cc/9N87-9F4B].

561 *See, e.g.*, Olivia Solon, *Under Pressure from Tech Companies, 'Fair Repair' Bill Stalls in Nebraska*, GUARDIAN (Mar. 11, 2017), https://www.theguardian.com/us-news/2017/mar/11/nebraska-farmers-right-to-repair-bill-stalls-apple [https://perma.cc/R53H-JSJ6].

562 CAL. CIV. CODE § 1793.03(b) (1986) (requiring manufacturers of electronics and appliances with wholesale prices of $100 or more with express warranties to "make available to service and repair facilities sufficient service literature and functional parts").

563 *See Vintage and Obsolete Products*, APPLE, https://support.apple.com/en-us/HT201624 [https://perma.cc/SQY8-QYQ9].

564 *See* Bahr v. Canon U.S.A., Inc., 656 F. App'x 276, 277 (9th Cir. 2016).

565 *See* CAL. CIV. CODE § 1793.03(b) (1986).

One could imagine fixes to the statute to require part selling to any party, so that third party repair efforts could blossom. Of course, for the tethered economy, the law requires a 21st-century adaptation, namely that it apply to software in some fashion. One could imagine approaches that required the device's software to be supported for an explicit term, held in escrow in the event the firm is shuttered or refuses to provide support, or that source code be made available to purchasers under some circumstances.[566]

b. Obsolescence

Keying product support to consumer expectations seems sensible, but what do people expect with new tethered devices? A high-quality door lock might last fifty years or longer. Do consumers expect the same longevity from a smart lock? Many new tethered products serve appliance-like functions.[567] Appliances are durable goods that consumers sometimes employ for decades and even repurpose (for example, the 30-year-old refrigerator that gets moved to the garage).[568]

Because it is difficult for consumers to evaluate the lifespan of a tethered device, one solution might be to require sellers to disclose the anticipated lifetime and obsolescence risks. Some software sellers, such as Microsoft, already specify a certain date when support ends.[569] Presumably, sellers would have insight into consumer expectations and set a date consistent with preferences and the competitive landscape.

The expiration date approach suffers from a basic problem recognized by the FTC in its study of mobile phone security updates: sellers do not know how popular their products will be.[570]

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566 *See, e.g.*, MAUREEN K. OHLHAUSEN & TERRELL MCSWEENEY, FTC COMM'N REPORT, MOBILE SECURITY UPDATES 72 (2018), https://www.ftc.gov/system/files/documents/reports/mobile-security-updates-understanding-issues/mobile_security_updates_understanding_the_issues_publication_final.pdf [https://perma.cc/KE39-V94S] (recommending device manufacturers clearly give the date on which updates and support will end).

567 *See, e.g.*, Colin Neagle, *Smart Refrigerator Hack Exposes Gmail Login Credentials*, NETWORK WORLD (Aug. 26, 2015), https://www.networkworld.com/article/2976270/internet-of-things/smart-refrigerator-hack-exposes-gmail-login-credentials.html [https://perma.cc/55SS-957S].

568 *See Durable Goods: Product-Specific Data*, EPA, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/durable-goods-product-specific-data [https://perma.cc/37YB-LNDY].

569 *See Windows Lifecycle Fact Sheet*, MICROSOFT, https://support.microsoft.com/en-us/help/13853/windows-lifecycle-fact-sheet [https://perma.cc/8GS4-4ZFZ].

570 *See* OHLHAUSEN & MCSWEENEY, *supra* note 566, at 3.

Without clear signals of reliable revenue, sellers find it difficult to articulate a guaranteed support period.[571] The FTC recommended that these problems be addressed by more uniform industry policies, perhaps even "minimum guaranteed support periods."[572] Generally, the FTC recommends that mobile devices receive updates for a period consistent with consumer expectations, and this means something less than the conceivable life of the device.[573]

Consider Tesla, a company that has sold over 300,000 premium electric cars in recent years.[574] Those vehicles depend heavily on data transmission to Tesla in order to deliver features such as its "Autopilot" assistance technology.[575] But, Tesla is $10 billion in debt and rarely turns a profit.[576] What would happen to car buyers if Tesla failed? Perhaps third parties would step in to offer compatible services, data feed, and software updates—at an additional fee, of course. But, as we have explained, legal barriers would likely stand in the way.

In other contexts, consumer law provides analogs to address lengthy periods of service in an atmosphere of uncertainty. For instance, many sellers offer "extended service contracts" to provide protection for new electronic purchases.[577] States began to conceive of such guarantees as offers of insurance.[578] State laws typically require extended service contracts to be offered by licensed operators and to hold back funds in order to ensure solvency for the full period specified.[579] Similar structures could ensure that product obsolescence guarantees are trustworthy. For instance, makers of tethered devices

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571 *Id.* at 67.

572 *Id.* at 69.

573 *Id.* at 5, 21, 40, 69.

574 Niall McCarthy, *Tesla Dominates the U.S. Electric Vehicle Market [Infographic]*, FORBES (Aug. 14, 2017), https://www.forbes.com/sites/niallmccarthy/2017/08/14/tesla-dominates-the-u-s-electric-vehicle-market-infographic/#514973917be4 [https://perma.cc/R2QR-VSP9].

575 *See* Andrew J. Hawkins, *Tesla's Autopilot Is Supposed to Deliver Full Self-Driving, so Why Does It Feel Stuck in the Past?*, VERGE (Oct. 24, 2017), https://www.theverge.com/2017/10/24/16504038/tesla-autopilot-self-driving-update-elon-musk [https://perma.cc/9UKX-D6ML].

576 Matt Wirz & Charley Grant, *Sizing Up Tesla's $10 Billion Debt Stack*, WALL ST. J. (June 17, 2018), https://www.wsj.com/articles/sizing-up-teslas-10-billion-debt-stack-1529240400 [https://perma.cc/WJ43-QNZA].

577 *See Extended Warranty Market for Consumer Electronics is Expected to Hit US$ 50.2 Billion by 2026: Credence Research*, GLOBE NEWSWIRE (July 30, 2018), https://globenewswire.com/news-release/2018/07/30/1543939/0/en/Extended-Warranty-Market-For-Consumer-Electronics-is-Expected-to-Hit-US-50-2-Billion-By-2026-Credence-Research.html [https://perma.cc/3K3E-7EDY].

578 *See, e.g.*, CAL. BUS. & PROF. CODE § 9855 (West 2008).

579 *See, e.g.*, *id.*

might hold a reserve or even insure against the risk that services will be disabled as a result of insolvency.

c. A Kill Switch

Tethered product makers have the power to disconnect a consumer's device from essential software and services;[580] perhaps the opposite should be possible as well: the consumer should be empowered to disconnect the tether.

Insecurity and other pathologies will ramp up in tethered devices as they age.[581] Tethers will provide an attack surface or simply a failure point for devices.[582] On one hand, tethered devices could be thrown away, but this would be a painful option for expensive ones, such as the connected refrigerator. The refrigerator may still cool efficiently for decades, so why should it become obsolete because of software obsolescence? A tether kill switch might be an effective way of dealing with such obsolescence.

A tether kill switch might be used opportunistically by users to sever a product from service and switch to another provider. One could imagine affordances where the switch is only enabled after a term of product support, or only after the seller firm fails in order to prevent user guile.

d. Privacy Guarantees

A privacy regime for consumer data is beyond the scope of this Article. But, some privacy features specific to tethering are worth including here. The first is explained by Balkin—that policymakers could impose a fiduciary duty on service providers to stop predation on users.[583]

As tethered products monitor us in our homes, they will collect sensitive data about our activities that would be embarrassing if revealed publicly.[584] Indeed, Facebook seemed to realize this when it sought to introduce the posts that consumer plaintiffs had made on the service.[585] One plaintiff dropped out of a suit complaining that, "I

580 *See* Gartenberg, *supra* note 31.

581 *See* Hiawatha Bray, *For US Cybersecurity, It's Code Red*, BOSTON GLOBE (July 20, 2018), https://www.bostonglobe.com/business/2018/07/20/for-cybersecurity-code-red/kuhgxSFlwk11BzNMSODwjM/story.html [https://perma.cc/2MRV-NXWY] ("[M]illions of smart devices in our homes could be used as staging areas for a cyber-Pearl Harbor.").

582 *Id.*

583 *See* Balkin, *supra* note 509.

584 *See supra* Section III.B.1.

585 *See* Joe Palazzolo, *Suing Facebook Is Kind of a Bummer, Plaintiff Says*, WALL ST. J.

did not expect that every single post I had ever made on Facebook would potentially be rehashed in interrogatory responses and deposition."[586] The Facebook incident suggests an approach that is consonant with Balkin: a nondisparagement norm should govern the seller in the relationship. Sellers should not be able to lord over users by threatening the public disclosure of their private activities.

e. Microservices Switch Over

This Article suggests that policymakers should be considering a "microservices switch over" principle. Traditionally, the switch over principle provides the basis for enacting consumer protection for major purchases. Because consumers cannot easily offload expensive lemons (houses and cars) or recover from financial loss (debt, loss of assets, etc.), they are effectively locked into their purchases and cannot easily switch over to alternative ones. As such, the government actively implemented extensive regulations protecting consumers in these industries,[587] and these regulations' effects are well studied.[588]

Focusing on big purchases would not be fruitful in a digital consumer context, however. As mentioned earlier, oftentimes consumers exchange data for platform access, which does not imply that the consumer takes a financial risk.[589] Moreover, even the most expensive tethered products are not as pricey as an entire home or a large loan.[590] However, the switch over problem remains. Tethered products offer digital goods and services that rely heavily on network effects. Social networks, search engines, and other algorithmically driven products naturally agglomerate into just one or a handful of firms in the market.[591] Further, ecosystems have effectively locked in consumers.[592] When the value of a product is driven by its network effects,

(Feb. 14, 2012), https://blogs.wsj.com/law/2012/02/14/suing-facebook-kind-of-sucks-plaintiff-says/ [https://perma.cc/R4WK-2P47].

586 *Id.*

587 *See, e.g.*, *Lemon Law*, DMV.ORG, https://www.dmv.org/automotive-law/lemon-law.php [https://perma.cc/5DWZ-8RT6].

588 *See, e.g.*, Thomas H. Oxenham, III, *Automobiles and the Lemon Law*, 7 VA. B. ASS'N J. 18 (1981).

589 *See supra* Section III.D.

590 *See, e.g.*, Sara Salinas, *Tim Cook Says the New iPhones Are so Expensive Because They Replace Most Other Gadgets You'd Need*, CNBC (Sept. 18, 2018), https://www.cnbc.com/2018/09/18/apples-tim-cook-explains-expensive-prices-of-iphone-xs-and-xs-max.html [https://perma.cc/EL4N-DUKK] (new iPhone X costs up to $1,449).

591 *See, e.g.*, Johnny Lieu, *Facebook's Plan to Merge Messenger, WhatsApp, and Instagram*, MASHABLE (Jan. 29, 2019), https://mashable.com/article/facebook-data-merge-privacy-concerns/#E6RuCL5OwPq5 [https://perma.cc/RBB6-TYG9].

592 *See supra* Section IV.B.

switch over becomes a costly proposition, thus opening a discussion about whether a new focus on microservices is warranted.

Portability has been the remedy most celebrated by consumer advocates, but the authors are skeptical that portability has worked in practice.[593] More creativity is needed to recognize the transaction costs and other forces that contribute to consumer inertia. For instance, in banking, where thousands of institutions compete, consumers hold on to accounts for many years (eight is the average for community banks).[594] Presumably, much more switching should be taking place as different banks offer better interest rates and services. The United Kingdom started a program in 2013 to ease consumer switching in banking, and it has proved to require complex considerations.[595] Detailed procedures were needed as well as participation by banks to effectuate a basic switching from one institution to another while not causing overdrafts and for delivering consumers new credentials.[596] Turning back to microservices, a similarly complex set of concerns are likely to emerge in switching digital service providers. Institutional, procedural, and substantive safeguards are likely needed when a consumer switches over the services that manage not just their banking but their digital/physical lives.

C. Combining Private and Consumer Law Approaches

Although incorporating the services component of tethered goods into the UCC is one approach, one may also consider governing tethered products under service contracts. Tethered products' main innovation is the embedding of a digital service in a physical product, thus creating a continuous relationship between the consumer and seller.[597] The relationship therefore more closely resembles the historical relationship between service providers and consumers, rather than goods providers and consumers. Instead of trying to force the UCC to

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593 *E.g.*, Allen St. John, *Europe's GDPR Brings Data Portability to U.S. Consumers*, CONSUMER REP. (May 25, 2018), https://www.consumerreports.org/privacy/gdpr-brings-data-portability-to-us-consumers/ [https://perma.cc/6G6N-TUUY].

594 *See* Achim Griesel, *Benchmarks You Need to Monitor*, AM. BANKERS ASS'N: BANK MKTG. (Oct. 4, 2015), https://bankingjournal.aba.com/2015/10/benchmarks-that-every-bank-marketer-needs-to-monitor/ [https://perma.cc/WQ5S-YUJA].

595 *See* YVETTE HARTFREE ET AL., PERSONAL CURRENT ACCOUNT SWITCHING viii, 13 (2016); *Current Account Switch Guarantee*, BACS, https://www.currentaccountswitch.co.uk/Pages/Home.aspx [https://perma.cc/2NTC-9LZQ].

596 *See id.* at ix.

597 *See* Gideon Rosenblatt, *How a Service Tether Turns a Product Into a Service*, VITAL EDGE (Oct. 8, 2013), http://www.the-vital-edge.com/service-tether/ [https://perma.cc/X4TJ-DFDC].

encompass these new types of goods/services hybrids, the existing regulations on service contracts might provide a better way to deal with the tether. This endeavor is not as straightforward as simply reclassifying tethered goods and services, and instead emerges from scaffolding existing law that governs goods with the appropriate consumer law, so that the resulting laws and regulations reflect the notion that service contracts should be reasonably clear to consumers and discourage abusive behavior on a seller's part.

At the one end, the law might simply apply existing warranty requirements to tethered goods. This approach would leave tethered goods under the purview of the UCC. Under the current law, the UCC provides for both express and implied warranties.[598] Express warranties are ones that hold sellers accountable for guarantees that they make to consumers.[599] For instance, a waterproof device should be reasonably waterproof. Implied warranties arise when the consumer and seller have a reasonable expectation of what the good will be used for.[600] In this situation, the seller is responsible for making sure that the good works as intended.[601]

A relatively light fix to the problem of tethering would be having consumer law intervene to require certain types of disclosures, which then effectively become guarantees. Consumer law already is preoccupied with preventing sellers from deceiving consumers.[602] Mandating that tethered goods manufacturers disclose certain aspects of their policies around privacy, interoperability, and other relevant terms of use would be relatively straightforward. These disclosures then become part of the manufacturer's express warranties, and the law would need to do little to adapt.

Such a disclosure approach could jumpstart market discussions about the quality of connected goods. A popular Twitter account, Internet of Shit, has for years recounted ill-advised connected products and their emergent behaviors.[603] In September 2018, the author

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598 *See* U.C.C. §§ 2-313 (express warranties), 2-315 (implied warranties) (AM. LAW INST. & UNIF. LAW COMM'N 1977).

599 *See id.* § 2-313.

600 *See id.* § 2-315.

601 *See id.*

602 *See, e.g.*, Gardner v. State Farm Fire & Cas. Co., 544 F.3d 553, 564 (3d Cir. 2008) ("[T]he [Pennsylvania Unfair Trade Practices and Consumer Protection Law] is designed to protect the public from fraud and deceptive business practices."); Williams v. Gerber Prods. Co., 552 F.3d 934, 938 (9th Cir. 2008) ("California's Consumer Legal Remedies Act ("CLRA") prohibits unfair methods of competition and unfair or deceptive acts or practices.").

603 *See generally* @internetofshit, TWITTER, https://twitter.com/internetofshit [https://perma.cc/MH3V-QSER].

posted: "Working on a project that gives 'food grade' type labels to internet of things projects,"[604] and followed up in December with a screenshot detailing the quality schema, which were privacy, software updates, security, reliability, free after purchase, sells data, local API, works offline, and GDPR compliant.[605] Judging products on these factors is tougher than it first appears, yet the authors are encouraged by this development because marketplace signals of quality coming from experts are powerful. Similarly, Consumer Reports, after decades of expert physical testing of products, announced an initiative to develop expertise in digital testing, with a focus on privacy and security.[606] The Consumer Reports standard is collaborative and evolving, and now includes consideration of product openness, repairability, and other factors.[607]

A more involved approach might involve regulatory bodies directly dictating portions of the terms of service and guaranteed warranties to the consumer. A legislature or regulatory agency might require that manufacturers of tethered products mitigate obsolescence with long service warranties or require interoperability for digital services across platforms. As discussed above, states have already passed laws that require extended service warranty contracts to be treated as insurance instruments,[608] require that parts be available,[609] and enshrine the right to repair.[610]. The Supreme Court recently weighed in on the right to tinker with its *Lexmark* decision.[611] These types of regulations would restrict sellers' abilities to dictate overly favorable terms in sales contracts, and therefore resemble the types of regulations that aim to level the playing field in service contracts.

The two approaches described so far would mitigate some of the tension in how existing law deals with individual cases where the line

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604 @internetofshit, TWITTER (Sept. 30, 2018, 1:22 PM), https://twitter.com/internetofshit/status/1046495524772302853 [https://perma.cc/L9CQ-K9Q5].

605 @internetofshit, TWITTER (Dec. 22, 2018, 10:06 AM), https://twitter.com/internetofshit/status/1076539417140056067 [https://perma.cc/EA5J-CTZ9].

606 *See Consumer Reports Launches Digital Standard to Safeguard Consumers' Security and Privacy in Complex Marketplace*, CONSUMER REP. (Mar. 6, 2017), https://www.consumerreports.org/media-room/press-releases/2017/03/consumer_reports_launches_digital_standard_to_safeguard_consumers_security_and_privacy_in_complex_marketplace/ [https://perma.cc/WY9M-5QSA].

607 *See The Standard*, DIGITAL STANDARD, https://www.thedigitalstandard.org/the-standard [https://perma.cc/QM7K-WM4Y]; *Partners*, DIGITAL STANDARD, https://www.thedigitalstandard.org/partners [https://perma.cc/6DGV-HHER].

608 *See supra* Section V.B.2.b.

609 *See supra* notes 562–63 and accompanying text.

610 *See supra* notes 263–64 and accompanying text.

611 Impression Prods., Inc. v. Lexmark Int'l, Inc., 137 S. Ct. 1523 (2017).

between product and service is blurred. They do not, however, necessarily deal with the more general problem of lock-in and growing platform power. In these situations, aggressive enforcement of competition law would be the most appropriate solution. At the point where a seller can circumvent the spirit of the aforementioned regulations that are aimed at ensuring that consumers have meaningful choices, the FTC could consider the tether a restraint on trade. Once the effects of lock-in become apparent, the seller of the good will have the ability to unfairly prevent consumers from making meaningful choices about which digital goods/services to consume, and therefore the seller will be seen as engaging in anti-competitive behavior. This Article highlights issues like obsolescence and interoperability as they are the most fashionable methods available to sellers to create lock-in today. But, the law should not be confined to regulating just these behaviors as other similar ones will surely emerge.

The overall effect of these proposed hybrid solutions is that they elevate consumer disclosures to the quality of those found in business-to-business service contracts. Fundamentally, consumers should have reasonable information about how a device will work, how long it will work, and what the terms of the relationship are between themselves and the seller. This last piece is especially critical in a world where the tether creates a continuous relationship.[612] Law governing goods contemplates issues about when and how a device will work, whereas service contracts have long dealt with the notion of defining relationships in a fair manner.[613] By improving existing private law approaches with consumer law guarantees, one can begin to approximate the general philosophy underlying service contract regulations while still acknowledging the aspects of the tether that resemble goods. Using disclosure, warranties, and terms of service guarantees can help equalize the playing field between sellers and consumers. Should a seller still be able to overcome these restrictions, competition law should be used to break the insidious effects of the tether restraining competition, and therefore consumer choice and innovation.

Conclusion

Services and products are merging as a result of a series of technological and economic forces. The tethered product may become ubiquitous, and in so doing create consumer and market-level harms

612 *See supra* Part IV.

613 *Compare, e.g.*, U.C.C. §§ 2-314, 2-315 (Am. Law Inst. & Unif. Law Comm'n 1977), *with* Cal. Bus. & Prof. Code § 9855 (West 2008).

that are not neatly addressed by existing law. As a matter of both product and business model design, tethering is likely here to stay. The question confronting both consumers and policy makers is how to best harness its potential while being mindful of its risks.

This Article provided an overview of those risks to individuals and to the broader economy. The tether creates new market pathologies that redefine the relationship between a consumer and a seller. The tether ensures a constant connection between the two. This connection leads to consumer lock-in to a product ecosystem, increases switchover costs over time, and ultimately decreases consumer choice as competition erodes.

This Article surveyed a wide variety of consumer protection interventions to find solutions that align incentives, internalize the pathologies of tethers, and that create markets to solve tethering problems. These include interventions that promote markets for third-party repair, information forcing interventions that help consumers understand product lifetime, and that enable experts to write informed comparisons of tethered products.

Some interventions require regulation and do not promote markets. For instance, because tethered devices live in the home and can collect sensitive data about users, sellers should pledge to never use the data to disparage a user. Similarly, the security of tethered devices is unlikely to improve unless the law internalizes the costs of insecurity. Finally, and most far reaching, policymakers are urged to consider a microservices switch over principle to erode the problem of lock-in and to ensure the possibility of competition in a platform era.