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## REALITY CHECK: THE REGULATORY LANDSCAPE FOR VIRTUAL AND AUGMENTED REALITY

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### INTRODUCTION

The mobile game Pokémon Go burst onto the scene in July 2016 and, within weeks, had acquired an amazing 45 million daily users. Alas, its popularity began to fade just as quickly, losing a quarter of its peak base by August and prompting some critics to dismiss the phenomenon as a “fad.”<sup>1</sup>

But the game remains profitable and is likely to retain more than 20 million users in 2017, according to analysis by the technology website *Ars Technica*.<sup>2</sup> More importantly, Pokémon Go popularized the concept of “augmented reality,” or AR, in a way no other product had done to date. The Tech Policy Lab at the University of Washington defines AR as “a

1. Hayley Tsukayama, “Pokemon Go and the Lifespan of Fads in the Internet Age,” *The Washington Post*, Sept. 3, 2016. <http://www.chicagotribune.com/bluesky/technology/ct-pokemon-go-internet-fads-wp-bsi-20160903-story.html>

2. Kyle Orland, “How Long Can We Expect the Pokémon Go Craze to Last?” *Ars Technica*, Aug. 25, 2016. <http://arstechnica.com/gaming/2016/08/how-long-can-we-expect-the-pokemon-go-craze-to-last/>

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mobile or embedded technology that senses, processes and outputs data in real time, recognizes and tracks real-world objects, and provides contextual information by supplementing or replacing human senses.”<sup>3</sup> Google searches for augmented reality reached their all-time high in the week following Pokémon Go’s July 6 launch.<sup>4</sup>

For Pokémon Go players, stepping out of one’s front door marks the beginning of an adventure in which strangers become allies and public areas become stages for exploration. The game offers a window into the potentially endless ways creative developers could “augment” the physical world. AR superimposes artificial elements onto one’s physical surroundings, in contrast to virtual reality (VR), which offers self-contained artificial environments. Technologist Tomi Ahonen has called AR “the eighth mass medium,” following print, recordings, cinema, radio, television, internet and mobile; he predicts exponential growth on a pace similar to the trajectory of those earlier media.<sup>5</sup>

Though still a new technology, early AR applications already have included Waze, which offers real-time traffic navigation; Google Sky, which offers educational insights about astronomy; and informational apps like Yelp’s Monocle, which overlays ratings for local businesses. AR apps can provide live descriptions of television and movie scenes for the blind or overlay subtitles for the deaf.<sup>6</sup> VR can help paraplegics to recover and help those with cerebral palsy to walk normally.<sup>7</sup> Augmented reality and virtual reality could be used to teach people to drive and may even lower the cost and risk of training people to perform dangerous jobs, such as welding or even surgery.

3. Ryan Calo, et al., “Augmented Reality: A Technology and Policy Primer” Tech Policy Lab, University of Washington, September 2015. [http://techpolicylab.org/wp-content/uploads/2016/02/Augmented\\_Reality\\_Primer-TechPolicyLab.pdf](http://techpolicylab.org/wp-content/uploads/2016/02/Augmented_Reality_Primer-TechPolicyLab.pdf)

4. Google Trends, search term “Augmented Reality,” accessed Sept. 25, 2016. <https://g.co/trends/F5eUC>

5. Tomi Ahonen, “Augmented Reality - the 8th Mass Medium,” TEDx Bangkok, June 12, 2012. <https://www.youtube.com/watch?v=EvyfHuKZGXU>

6. Rachel Metz, “Augmented-Reality Glasses Could Help the Legally Blind Navigate,” *MIT Technology Review*, June 15, 2015. <https://www.technologyreview.com/s/538491/augmented-reality-glasses-could-help-legally-blind-navigate/>

7. Ananya Bhattacharya, “Paraplegics are Learning to Walk Again with Virtual Reality” *Quartz*, Aug. 15, 2016. <http://qz.com/757516/paraplegics-are-learning-to-walk-again-with-virtual-reality/>

With the rise of the internet of things, 5G wireless networks, smart cities and open data, augmented reality – just like the smartphone itself – could revolutionize and streamline how we interact with our world. Full adoption of VR and AR by 2020 could mean as much as \$126 billion in global economic impacts, according to a report by the Analysis Group.<sup>8</sup> Bank of America estimates VR will become a \$150 billion industry, with more than 300 million global users by 2022.<sup>9</sup>

In addition to popularizing AR, Niantic Inc.'s release of Pokémon Go also served as a test case for the technology's legal and regulatory complications. Public response to its launch revealed concerns about safety, privacy, free expression, cybersecurity, e-commerce and intermediary liability. These include issues stemming both from the input of sensory information that the AR or VR device or platform receives, as well as the output or information conveyed.

## HEALTH AND SAFETY

Health and safety are common areas of concern surrounding emerging technologies; AR and VR, which can distract users from full awareness of their physical surroundings, are no exception. There may be risk of injury where a user trips over furniture, engages in distracted driving or walks into traffic.

Since Pokémon Go's launch, there have been dozens of reports of car crashes and robberies allegedly associated with the app. A paper published in *JAMA Internal Medicine* found that Pokémon Go caused distraction and was associated with 14 car crashes in the span of 10 days.<sup>10</sup> This led the authors to conclude that "it is in the public interest to address augmented reality games before social norms develop that encourage unsafe practices." New York state Assemblyman Felix Ortiz, D-Brooklyn, declared that Pokémon Go's makers had a corporate responsibility for the safety of their users and threatened legislation if Niantic did not fix safety issues.<sup>11</sup>

It's clear that AR will test product-liability law.<sup>12</sup> While reference books and how-to videos haven't traditionally been held culpable if they were to lead to a user's misidentification of a poisonous snake or an edible plant – not to mention offering

instructions in auto maintenance or even surgery – AR apps that use artificial intelligence to make positive identifications could be subject to more stringent scrutiny. If a handyman app misidentifies a car part and that mistake leads to injury, users may sue. Furthermore, manufacturers and app developers could be charged with negligence if information overlaid in real time distracts a user from identifying a hazard, such as a cliff or a moving vehicle.

The Consumer Product Safety Commission (CPSC) would be the entity empowered to enforce federal product safety standards applicable to VR and AR devices. Because the technology is new, the long-term effects of AR and VR on health are not well-established. VR and AR have been cited in some complaints for causing eyestrain, eye trauma, eye-development issues or motion sickness. While no definitive research has been done on the effects of AR and VR on a child's eye development, most devices recommend a minimum age threshold.<sup>13</sup>

One area of particular concern is an eye-focusing issue called the "vergence-accommodation conflict," which occurs when the lenses of user's eyes respond to a VR device close-up while simultaneously converging on an artificially distant point far away.<sup>14</sup> This can result in nausea and discomfort for some users. One way to circumvent the problem is to use light fields to mimic light bouncing off objects and to approximate more closely the real world's visual experience. While head-mounted displays such as Oculus Rift and HTC Vive rely on stereoscopic displays, it has been reported the in-development Magic Leap technology will use light fields.<sup>15</sup>

There also are concerns with the psychological effects of virtual experiences, with violent or pornographic content, with addiction or desensitization, with effects on civil society and with ethical concerns arising from gameplay in inappropriate locations, such as memorials or cemeteries. These fears in many cases parallel those that have been voiced since the earliest video games in the 1970s; most do not appear to justify either new laws or new regulations.<sup>16</sup> Those health and safety concerns that do arise from AR and VR likely would best be governed within the existing framework of tort law, product-liability law and product-safety standards.

8. Laurits Christensen, et al., "The Global Economic Impacts Associated with Virtual and Augmented Reality" The Analysis Group, Feb. 16, 2016. [http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis\\_group\\_vr\\_economic\\_impact\\_report.pdf](http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_vr_economic_impact_report.pdf)

9. Giovanni Moreano, "How to Invest in the \$150 billion Virtual Reality Boom," CNBC, Sept. 7, 2016. <http://www.cnbc.com/2016/09/07/how-to-invest-in-the-150-billion-virtual-reality-boom.html>

10. John W. Ayers, et al., "Pokémon GO—A New Distraction for Drivers and Pedestrians," *JAMA Internal Medicine*, Sept. 16, 2016. <http://archinte.jamanetwork.com/article.aspx?articleid=2553331>

11. Jimmy Vielkind, "Assemblyman ponders Pokemon Go legislation," *Politico*, July 13, 2015. <http://www.politico.com/states/new-york/albany/story/2016/07/assemblyman-ponders-pokemon-go-legislation-103747>

12. Calo, 2015.

13. Eric E. Sabelman and Roger Lam, "The Real-Life Dangers of Augmented Reality," *IEEE Spectrum*, June 23, 2015. <http://spectrum.ieee.org/consumer-electronics/portable-devices/the-reallife-dangers-of-augmented-reality>

14. Sarah Zhang, "The Obscure Neuroscience Problem That's Plaguing VR," *Wired*, Aug. 11, 2015. <https://www.wired.com/2015/08/obscure-neuroscience-problem-thats-plaguing-vr/#slide-2>

15. Tom Warren, "Magic Leap has created its own HoloLens," *The Verge*, April 19, 2016. <http://www.theverge.com/2016/4/19/11457880/magic-leap-photonic-lightfield-chip-features>

16. Steven Kent, "The Ultimate History of Video Games" *Crown/Archetype*, June 16, 2010. <http://www.penguinrandomhouse.com/books/91835/the-ultimate-history-of-video-games-by-steven-l-kent/9780761536437/>

## FREE EXPRESSION

Pokémon Go has faced court challenges in India on grounds that it has disrespected the religious sentiments of Hindus and Jains, many of whom are vegetarian, by showing egg-shaped Pokémon in places of worship.<sup>17</sup> PokéStops in the Holocaust Memorial Museum in Washington, D.C., and in Japan's Hiroshima Peace Memorial Park have been removed following complaints that cited ethical concerns.<sup>18</sup> These incidents brought to light the potential for debates over free speech and internet etiquette surrounding AR, which also predictably will extend to such issues as hate speech, political speech, harassment and threats of physical harm.

Jurisdictions differ in the legal and regulatory requirements that govern different types of speech and association. For example, the European Union's Charter of Fundamental Rights requires member states to criminalize hate speech directed against certain protected classes. In the United States, legislative and regulatory approaches to the issue of expression largely are governed by First Amendment jurisprudence.

In the 1990s, U.S. courts struck down on First Amendment grounds provisions of the Communications Decency Act (CDA) of 1996 and the Child Online Protection Act (COPA) of 1998 that sought to limit the presentation of obscene content to minors. However, the Federal Communications Commission continues to enforce provisions of Children's Internet Protection Act (CIPA) of 2000,<sup>19</sup> which requires institutions that receive funding from the FCC's Universal Service Fund for schools and libraries, commonly known as E-Rate, to adopt internet-safety policies that limit minors' access to obscene and harmful content. Congress also has passed legislation requiring internet service providers to report child pornography.<sup>20</sup>

AR also potentially could intersect with First Amendment rights to record or photograph matters of public interest, or with state laws that prohibit recording without consent. Researchers at the University of Washington's Tech Policy Lab have argued that continuous use of AR devices to sense or record situations and areas where there is a reasonable expectation of privacy could be subject to legal challenges.<sup>21</sup>

17. BBC News, "Pokemon Go in India Court for 'Hurting Religious Sentiments,'" Sept. 7, 2016. <http://www.bbc.com/news/world-asia-india-37294286>

18. Tim Mulkerin, "You officially can't play Pokémon Go at the Hiroshima Memorial or the Holocaust Museum," *Tech Insider*, Aug. 9, 2016. <http://www.techinsider.io/pokemon-go-pokestops-removed-from-hiroshima-memorial-and-holocaust-museum-2016-8>

19. Federal Communications Commission, "Consumer Guide: Children's Internet Protection Act (CIPA)," Nov. 3, 2015. <http://transition.fcc.gov/cgb/consumerfacts/cipa.pdf>

20. Dentons, "Congress Passes New Rules for Child Pornography Reporting by ISPs," *Lexology*, Oct. 22, 2008. <http://www.lexology.com/library/detail.aspx?g=f7bc565c-a046-4470-9503-4140e42d29b7>

21. Calo, 2015.

Regulations limiting users' ability to record and gather information also could impede use of AR to keep government or law enforcement accountable.

## PRIVACY

One week after Pokémon Go's launch, Sen. Al Franken, D-Minn., wrote to Niantic CEO John Hanke inquiring about the company's privacy practices with respect to user data, including why the company collects certain types of data, what it plans to do with that data and whether it would consider only collecting data from users who affirmatively opt-in.<sup>22, 23</sup> Franken also queried Niantic about the company's compliance with the Children's Online Privacy Protection Act (COPPA), which requires apps and websites to notify parents of data collection from those under age 13.<sup>24</sup>

The spread of AR and VR likely will raise new concerns about such issues as passive data collection, facial recognition, surveillance and targeted advertising. AR also could reveal sensitive information whose use may be prohibited in contexts that could lead to discriminatory treatment. For example, a facial recognition app could inform merchants or service providers of an individual's age, marital status, credit score, medical record or criminal record.

At the federal level, the Federal Trade Commission (FTC) enforces privacy regulations, with Section 5 of the Federal Trade Commission Act prohibiting "unfair or deceptive acts or practices in or affecting commerce." The FTC in 2010 produced guidelines covering how marketers use "online behavioral advertising," with subsequent congressional proposals to require that consumers be allowed to "opt out" of having their online activities tracked.<sup>25</sup>

Some states have gone further than existing federal rules for consumer privacy and may present a more proximate regulatory threat for AR and VR services. In 2003, California passed the first law nationwide to require website operators and apps to post a privacy policy.<sup>26</sup> States also have passed laws limiting collection of student data, regulating collection

22. Sen. Al Franken, *Letter to John Hanke*, U.S. Senate, July 12, 2016. [https://www.franken.senate.gov/files/letter/160712\\_PokemonGO.pdf](https://www.franken.senate.gov/files/letter/160712_PokemonGO.pdf)

23. Courtney Greene Power, *Letter to Sen. Al Franken*, Niantic Inc., Aug. 26, 2016. <https://www.franken.senate.gov/files/documents/160826NianticResponse.pdf>

24. Federal Trade Commission, "Children's Online Privacy Protection Act (COPPA), 16 C.F.R. Part 312," <https://www.ftc.gov/enforcement/rules/rulemaking-regulatory-reform-proceedings/childrens-online-privacy-protection-rule>

25. Federal Trade Commission, "FTC Staff Report: Self-Regulatory Principles for Online Behavioral Advertising," February 2009. <https://www.ftc.gov/sites/default/files/documents/reports/federal-trade-commission-staff-report-self-regulatory-principles-online-behavioral-advertising/p085400behavadreport.pdf>

26. State of California, "Business and Professions Code Section 22575-22579," July 1, 2004. <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=bpc&group=22001-23000&file=22575-22579>

of biometric data and setting standards for privacy rights with respect to location.<sup>27</sup>

Another area of concern relates to how government espionage or law enforcement agencies will treat information gathered by AR and VR companies. According to the third-party doctrine, the U.S. government can legally obtain information voluntarily submitted to third parties.<sup>28</sup> As AR and VR services expand, their user will further call into question what data is collected and what third parties should have access to it – including the government and law enforcement.

## CYBERSECURITY

Cybersecurity experts pointed to security problems with the initial version of Pokémon Go, including an account-creation process that erroneously requested full access to users' Google accounts.<sup>29</sup> Users also sometimes were prompted to download malicious third-party apps and other add-ons that were plagued by remote-access tools.<sup>30</sup> Vendors, such as the one Niantic uses to verify personal information, can be sources of vulnerability, as well.

At least 25 states have introduced cybersecurity bills or resolutions in 2016,<sup>31</sup> while 47 states have security-breach-notification laws.<sup>32</sup> In addition to common cybersecurity concerns – such as hacking, data breaches and information-sharing requirements – AR and VR pose new potential concerns, such as data localization and the intersection of augmented reality with the so-called “internet of things.” When identifying technology tied to objects, such as radio-frequency identification (RFID) tags, is paired with AR, users can be allowed to interact virtually with objects in the real world. Such “mixed reality” applications could face heightened vulnerability to security breaches if they compromise the device’s functionality or open the larger network up to denial of service attacks, tracking, eavesdropping or reverse engineering.

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27. National Conference of State Legislators, “State laws Related to Internet Privacy,” Jan. 5, 2016. <http://www.ncsl.org/research/telecommunications-and-information-technology/state-laws-related-to-internet-privacy.aspx>

28. Richard M. Thompson II, “The Fourth Amendment Third-Party Doctrine,” Congressional Research Service, June 5, 2014. <https://www.fas.org/sgp/crs/misc/R43586.pdf>

29. Joey Nolfi, “Pokémon Go Developers Fix ‘Full Access’ Error,” *Entertainment Weekly*, July 12, 2016. <http://www.ew.com/article/2016/07/12/pokemon-go-google-account-error-fixed>

30. Joseph Keller, “Researchers Find Remote Access Tool in Modified Pokémon Go APK,” *Android Central*, July 8, 2016. <http://www.androidcentral.com/researchers-find-remote-access-tool-slide-loading-pokemon-go-apk>

31. National Conference of State Legislators, “Cybersecurity Legislation 2016,” April 11, 2016. <http://www.ncsl.org/research/telecommunications-and-information-technology/cybersecurity-legislation-2016.aspx>

32. National Conference of State Legislators, “Security Breach Notification Laws,” Jan. 4, 2016. <http://www.ncsl.org/research/telecommunications-and-information-technology/security-breach-notification-laws.aspx>

## E-COMMERCE

Sponsored content, licensed content, virtual paywalls, in-app purchases and micropayments all are significant revenue models for AR and VR apps. Pokémon Go relies on an e-commerce business model of microtransactions – that is, in-game mobile purchases. Microtransactions have brought in more than \$200 million in global revenue for investors Niantic, Google and the Pokémon Co.<sup>33</sup> This has led some to criticize the app as “pay to win.”<sup>34</sup> Others have expressed worries that children would unwittingly use their parents’ money for in-game purchases.<sup>35</sup> Niantic announced that it also will partner with U.S. businesses to allow sponsored PokéStops, as it does with McDonald’s in Japan.<sup>36</sup>

There are not yet federal laws or regulations specifically targeting mobile payments. However, most mobile-payment platforms rely on regulated financial products, such as debit and credit cards or electronic transfers. These practices are principally regulated by the Federal Reserve, which also regulates payment fees, fraud losses, electronic transactions between accounts and overseas financial transactions. The FTC regulates policies concerning shipping and delivery, refunds, terms and conditions and financial data protection. The Children’s Online Privacy Protection Act also applies to the collection of financial data from children under 13 years of age. The Payment Card Industry (PCI) Security Standards Council governs the handling of financial data.<sup>37</sup> In addition, many states have adopted laws to govern electronic and other commercial transactions, including guidelines regarding records and signatures.

## INTELLECTUAL PROPERTY

AR and VR will change the way consumers interact with patents, trademarks and copyrighted works. User-generated content and new ways of sharing experiences will ensure that issues will arise surrounding fair use and intermediary liability.

Many mobile apps and platforms are considered intermediaries, rather than merchants. Section 230 of the Communications Decency Act (CDA) and section 512 of the Digital Millennium Copyright Act (DMCA) both provide platforms

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33. Darrell Etherington, “Pokémon Go Crosses \$200M in Global Revenue One Month into Launch,” *TechCrunch*, Aug. 7, 2016. <https://techcrunch.com/2016/08/07/pokemon-go-crosses-200m-in-global-revenue-one-month-into-launch/>

34. Paul Tassi, “Is ‘Pokémon GO’ Pay-To-Win? Yes and No,” *Forbes*, July 12, 2016. <http://www.forbes.com/sites/insertcoin/2016/07/12/is-pokemon-go-pay-to-win-yes-and-no/#1a1acd195769>

35. Thinkmoney, “Unexpected Costs,” August 2016. <https://www.thinkmoney.co.uk/news-advice/pokemon-go-how-to-stop-your-kids-spending-money-0-6183-0.htm>

36. Allegra Frank, “Pokémon Go to Join with Business Sponsors to Get Buyers in Stores,” *Polygon*, July 13, 2016. <http://www.polygon.com/2016/7/13/12171920/pokemon-go-businesses-pokestops-sponsored>

37. Pew Charitable Trusts, “Mobile Payments: Regulatory Gaps, Ambiguities, and Overlap,” Feb. 10, 2016. <http://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2016/02/mobile-payments>

with legal immunities for what their users do or say.<sup>38</sup> Categorizing apps like Pokémon Go differently could expose them to more stringent data laws and new copyright issues.

Restaurants that invoke the Pokémon character Pikachu to lure customers with discounts or excursion companies that offer Pokémon-themed trips both potentially violate trademark and copyright laws. In fact, the Pokémon Company International recently filed a copyright infringement lawsuit against two Seattle residents for hosting a Pokémon-themed party.<sup>39</sup>

AR applications' use of public places as location-based triggers can raise tensions between the owners of AR experiences and the owners of the places in which these experiences transpire. A camera feature within Pokémon Go allows users to take pictures of Pokémon "found" in the real world. Some of these photos include trademarked or copyrighted content, such as company logos. Recording or transforming copyrighted or trademarked material may constitute infringement.

Public display and performance rights allow copyright holders to control how their works appear in public. A display or performance can be defined as "public" if it is broadcast to multiple locations, which is likely to be the case with VR and AR experiences.<sup>40</sup> The tension between copyrighted work and fair use will continue to play out in the virtual space. The right of publicity restricts entities from benefiting from the commercial value of a person's identity — their name, likeness or other identifying indicator — without consent. A case can be made that facial or full-body recognition technology infringes this right. Publicity rights have been used to combat revenge porn and other types of harmful content. Digital avatars that replicate the likeness of celebrities are likely to raise publicity rights claims.

In mid-2012, Lennon Image Technologies — holder of a patent covering a "virtual try-on" process — filed a set of six patent infringement lawsuits against retailers like Macy's and Bloomingdale's, earning the label of the first "AR patent troll."<sup>41</sup> This sort of litigation could quash the incentive for retail companies to adopt the technology, as well as the incentive for other AR startups to improve the virtual

dressing room experience. AR and VR technology will continue to be the victim of costly patent disputes.

## CONCLUSION

The reaction of the public and legislators to Pokémon Go indicates that free expression, health and safety, privacy, e-commerce, intellectual property and cybersecurity are areas of possible future regulation. However, introducing VR and AR-specific regulation would be a mistake. The Cartoon Network's 1997 release of the animated television show Pokémon Indigo League wouldn't have been so beloved if main character Ash Ketchum had spent the first episode on regulatory compliance—signing user privacy agreements, applying for a virtual "hunting" license, acquiring a permit to travel through public lands and buying a leash for Pikachu.

As Adam Thierer of the Mercatus Center argues in his book "Permissionless Innovation," if emerging technologies are regulated to prevent bad-use cases, then the good-use cases can never come about.<sup>42</sup> For example, regulating facial recognition due to privacy concerns could prevent products that enhance experiences for the visually impaired. Regulating location-based AR apps for safety could prevent the development of more effective exercise apps, navigation apps or apps that provide educational guided tours. The legislative and regulatory response to AR apps will determine who is the bigger buzzkill: the villainous Team Rocket or the U.S. government?

## ABOUT THE AUTHOR

Anne Hobson is a technology policy fellow with the R Street Institute, specializing in free-market approaches to emerging technology, including virtual reality, artificial intelligence, the internet of things and the sharing economy.

Before joining R Street, Anne was a policy associate at Facebook's D.C. office. She is an alumna of the Mercatus Center MA Fellowship at George Mason University, where she worked with the technology policy program. In that role, she co-authored a paper on how the internet, the sharing economy and reputational feedback mechanisms solve the "lemons problem."

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38. Digital Media Law Project, "Trademark: User-Generated Content," Sept. 21, 2016. <http://www.dmlp.org/legal-guide/trademark-user-generated-content>

39. Anime News Network, "The Pokémon Company Sues Organizers of Pokémon-Themed Party for Copyright Infringement," *Rocket News 24*, Aug. 29, 2015. <http://en.rocketnews24.com/2015/08/29/the-pokemon-company-sues-organizers-of-pokemon-themed-party-for-copyright-infringement/>

40. U.S. Copyright Office, "More Information on Fair Use," August 2016. <http://www.copyright.gov/fair-use/more-info.html>

41. Bruce Sterling, "Augmented Reality: AR Patent Trolling," *Wired*, Oct. 3, 2012. <https://www.wired.com/2012/10/augmented-reality-ar-patent-trolling/>

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42. Adam Thierer, *Permissionless Innovation: The Continuing Case for Comprehensive Technological Freedom*, Revised and Expanded Edition, Mercatus Center, March 11, 2016. <http://mercatus.org/publication/permissionless-innovation-continuing-case-comprehensive-technological-freedom>