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The Second Amendment Implications of Regulating 3D Printed Firearms

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ABSTRACT

3D printed firearms have arrived, and commentators are beginning to ask whether and how this new technology can be regulated. An inevitable question that governments and courts will need to confront when considering restrictions on 3D printed firearms is whether these restrictions violate the Second Amendment. In this paper, I argue that most restrictions on 3D printed firearms would survive Second Amendment challenges. In carrying out this argument, I consider a complete ban on the manufacturing and possession of 3D printed firearms, and conclude that even this complete ban would be likely to survive Second Amendment challenges. Because these particularly restrictive bans are likely to survive, I conclude that most restrictions on 3D printed firearms will survive similar challenges. The main obstacle for governments will not be overcoming Second Amendment arguments against restrictions on 3D printed firearms, but ensuring that these restrictions are effective.

INTRODUCTION

On May 1, 2013, the first firearm that had ever been produced with a 3D printer was successfully fired.[1] Several weeks later, an engineer in Wisconsin used his own (relatively) cheap personal 3D printer to make a firearm that successfully fired nine shots.[2] These two developments generated national media attention and prompted calls for restrictions on 3D printed firearms. But critics responded by arguing that restricting 3D printed firearms would violate the Second Amendment right to keep and bear arms.[3]

The issue of the Second Amendment implications of 3D printed firearms combines an emerging and evolving area of the law with an even more cutting-edge area of technology. The Second Amendment as an individual right is a recent development: before the Supreme Court's 2008 decision, *District of Columbia v. Heller*,[4] it was far from clear whether the Second Amendment protected an individual right.[5] In the wake of the Court's decision in *Heller*, and its

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[1] Andy Greenberg, *Meet the "Liberator": Test-Firing the World's First Fully 3D-Printed Gun*, FORBES (May 5, 2013, 5:30 PM) http://www.forbes.com/sites/andygreenberg/2013/05/05/meet-the-liberator-test-firing-the-worlds-first-fully-3d-printed-gun/.

[2] Andy Greenberg, *$25 Gun Created With Cheap 3D Printer Fires Nine Shots (Video)*, FORBES, (May 20, 2013, 11:51 AM), http://www.forbes.com/sites/andygreenberg/2013/05/20/25-gun-created-with-cheap-3d-printer-fires-nine-shots-video/. The printer this engineer used was a $1,725.00 "Lulzbot" printer, which was far cheaper than the $8,000.00 printer that had been used to produce the first working 3D printed firearm. *Id.*

[3] *See NRA Statement on the Reauthorization of the "Undetectable Firearms Act", HR 3626*, NRA-ILA INSTITUTE FOR LEGISLATIVE ACTION (Dec. 3, 2013), http://www.nraila.org/news-issues/news-from-nra-ila/2013/12/nra-statement-on-the-reauthorization-of-the-undetectable-firearms-act-hr-3626.aspx.

[4] 554 U.S. 570 (2008).

[5] For an outline of the debate between the individual right theorists and the group right theorists, *see* ADAM WINKLER, GUNFIGHT: THE BATTLE OVER THE RIGHT TO BEAR ARMS IN AMERICA 106-13 (W.W. Norton & Co. eds., 1st ed. 2011). For an example of scholarship from the time that took the individual right position, *see, e.g.*, Robert E. Shalhope, *The Armed Citizen in the Early Republic*, 49 L. & CONTEMP. PROB., no. 1 (1986) 138-39 (exploring whether the Second Amendment protected a militia's right to bear arms or an individual right and concluding that both rights are protected).

incorporation of Second Amendment rights to the states in *McDonald v. City of Chicago*,[6] there has been an explosion in scholarly coverage of the Second Amendment as commentators attempt to draw out the implications and limits of the individual right to bear arms. 3D printing is an even more recent development – and courts and commentators are just beginning to address issues that this technology will raise.

In this article, I will explore the Second Amendment implications of regulating 3D printed firearms. Despite the rapidly developing state of Second Amendment law and 3D printing technology, it is possible to apply trends in existing Second Amendment case law to the current and future development of 3D printed firearms. In particular, I will explore the Second Amendment implications of a complete ban on 3D printed firearms, and conclude that such a ban would most likely be constitutionally permissible. Following this conclusion, I will highlight the problems of enforcing such a ban. Lawmakers who are considering limiting or banning 3D printed firearms should strive to regulate this technology in a way that will promote the safety of firearm users and the public without imposing too many burdens on the continuing development of this new technology.

Part I of this Paper will briefly survey the rise of 3D printing technology, paying specific attention to the development of 3D printed firearms. Part II will summarize the current state of Second Amendment law, focusing primarily on the Supreme Court's decisions in *District of Columbia v. Heller* and *McDonald v. City of Chicago*, and the lower courts' following treatment of Second Amendment challenges to restrictions on firearms. Part III contains the bulk of my analysis. Here, I will contemplate a complete ban on 3D printed firearms. I will explore whether this ban would fall into any categories of traditional firearm regulation, the government's interests in enacting such a ban, and the different levels of scrutiny courts may apply to this type

[6] 130 S. Ct. 3020 (2010).

of ban. I will conclude that it very likely that courts would uphold a complete ban on 3D printed firearms. In Part IV, I will explore the difficulty of enforcing a restriction on 3D printed firearms and suggest several strategies for effective regulation, as well as several approaches that governments should avoid. In Part V, I conclude that while the Second Amendment will probably not be a substantial problem for restrictions on 3D printed firearms, significant questions about the practicality of these restrictions remain.

I. THE RISE OF 3D PRINTING

3D printing has captured the public's attention and imagination. *The Economist* contends that 3D printing marks a "third industrial revolution" that will be characterized by the merger of digital communication and efficiency with the physical manufacture of goods.[7] Others admit that while 3D printers may not change the world on their own, they will likely have a major impact on how items are manufactured.[8] Legal writers are also beginning to take note of the issues 3D printing may raise, with commentators noting the technology's influence in fields of intellectual property,[9] product liability,[10] and the Fourth Amendment.[11]

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[7] *A Third Industrial Revolution*, ECONOMIST (Apr. 21, 2012), *available at* http://www.economist.com/node/21552901.

[8] Peter Day, *3D Printing: A Force for Revolutionary Change*, BBC (May 21, 2013), http://www.bbc.co.uk/news/business-22559022; *see also* Jim Chalmers, *3D Printing: Not Yet a New Industrial Revolution, But Its Impact Will Be Huge*, GUARDIAN (Dec. 10, 2013, 5:36 PM), http://www.theguardian.com/commentisfree/2013/dec/11/3d-printing-not-yet-a-new-industrial-revolution-but-its-impact-will-be-huge.

[9] Deven R. Desai & Gerard N. Magliocca, *Patents, Meet Napster: 3D Printing and the Digitization of Things*, 102 GEORGETOWN L. J., Forthcoming, 2014, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2338067.

[10] Nora Freeman Engstrom, *3-D Printing and Product Liability: Identifying the Obstacles*, 162 U. PA. L. REV. ONLINE 35 (2013).

[11] Julian J. Johnson, Note, *Print, Lock, and Load: 3-D Printers, Creation of Guns, and the Potential Threat to Fourth Amendment Rights*, 2013 ILL. J. TECH. L. & POL. 337 (2013).

A. 3D Printing Technology: A Brief Background

3D printers are machines that convert digital "blueprints" of objects into physical objects by building the physical versions "layer-by-layer."[12] A user downloads or creates a digital blueprint of some object, often created using a computer aided design (CAD) program.[13] Websites like Thingiverse offer users the opportunity to search for and download blueprints of objects that they wish to print.[14] Users can also upload their own designs to these websites so that others may view and download them.[15]

Once a user has downloaded a digital blueprint to his or her computer, the user then connects the computer to a 3D printer. After sending the blueprint to the printer, the printer "spreads thin layers of plastic or metal powder on top of each other" and then welds these layers together, ultimately creating a physical replica of the digital input.[16] Because of the precise scale on which these printers operate, 3D printers can "create objects with internal, movable parts.[17]

Users can purchase a 3D printer directly from 3D printer manufacturers such as Makerbot. Other retailers are beginning to carry 3D printers as well – for example, Staples is now selling the Cube brand of 3D printers.[18] The range of prices for 3D printers varies

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[12] Michael Weinberg, *It Will be Awesome if They Don't Screw It Up: 3D Printing, Intellectual Property, and the Fight Over the Next Great Disruptive Technology*, PUBLIC KNOWLEDGE 2 (Nov. 2010), http://publicknowledge.org/files/docs/3DPrintingPaperPublicKnowledge.pdf.

[13] *Id.*

[14] *See MakerBot Thingiverse*, THINGIVERSE, http://www.thingiverse.com/about (last accessed January 30, 2014).

[15] *Id.*

[16] Day, *supra* note 8.

[17] Weinberg, *supra* note 12, at 2.

[18] *See Cube 3D Printers*, STAPLES, http://www.staples.com/Cube-3D-Printers/product_SS2044291 (last accessed January 30, 2014) (selling Cube 3D printers for "as low as $1,299.99").

depending on the size and range of materials the printer can process. The Makerbot line of 3D printers varies in price from $1,375.00 for its forthcoming 12.5-inch tall[19] 3D printer, to $6,499.00 for its forthcoming, 18-inch tall[20] "Z18" printer.

Most printers that are designed for general use by the public print objects made out of various types of plastics, while printers that are able to print metal components are generally far more expensive.[21] But 3D printing technology is a rapidly evolving industry, and prices are projected to fall as the technology becomes more advanced and popular.[22] Some commentators argue that enthusiasm and worries about 3D printing is misplaced, as printers are expensive, slow, and prone to errors.[23] But proponents of the technology point out that overcoming these barriers is only a matter of time, analogizing today's 3D printing industry to the early stages of computer development in the 1990s.[24]

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[19] *Makerbot Replicator Mini Compact 3D Printer*, MAKERBOT, http://store.makerbot.com/replicator-mini (last accessed January 30, 2014).

[20] *Makerbot Replicator Z18 3D Printer*, MAKERBOT, http://store.makerbot.com/replicator-z18 (last accessed January 30, 2014).

[21] Doug Gross, *Texas Company Makes Metal Gun With 3-D Printer*, CNN (Nov. 8, 2013, 7:06 PM), http://www.cnn.com/2013/11/08/tech/innovation/3d-printed-metal-gun/.

[22] *See* Nick Bilton, *Disruptions: The 3-D Printing Free-For-All*, N.Y. TIMES BITS (Nov. 13, 2011, 2:17 PM), http://bits.blogs.nytimes.com/2011/11/13/disruptions-the-3-d-printing-free-for-all/. Prices are already much lower now than even a year or two earlier – with some printers selling for $500.00. *See* Rich Brown, *You Don't Bring a 3D Printer to a Gun Fight—Yet*, CNET (Sept. 6, 2012, 4:00 AM), http://news.cnet.com/8301-11386_3-57499326-76/you-dont-bring-a-3d-printer-to-a-gun-fight-yet/.

[23] *See* Charles W. Finocchiaro, Note, *Personal Factory or Catalyst for Piracy?: The Hype, Hysteria, and Hard Realities of Consumer 3-D Printing*, 31 CARDOZO ARTS & ENT. L.J. 473, 489-90 (2013). For illustrations of 3D printer errors, see *3D Printing Failures Shared Online*, BBC, (Aug. 17, 2013, 8:29 PM) http://www.bbc.co.uk/news/technology-23727229.

[24] *See* Weinberg, *supra* note 12, at 4.

B. The Creation, and Rapid Development, of 3D Printed Firearms

In May, 2013, the first firearm made entirely from 3D printed parts was successfully fired.[25] This firearm was called the "Liberator," and it confirmed that 3D printers could be used to print usable firearms.[26] The inventor of this firearm was Cody Wilson, a law student at the University of Texas, and founder of the non-profit organization, Defense Distributed.[27] Wilson's organization had already printed firearm parts – and had fired 600 rounds with an AR-15 assault rifle "with a 3D printed part . . . ."[28] The Liberator was printed from an $8,000.00, 3D printer, and the only non-printed component of the firearm was the firing pin, which was a nail.[29] Wilson included the metal firing pin in order for the gun to be visible to metal detectors, as a completely undetectable gun would be prohibited by federal law.[30]

Wilson's invention and firing of this 3D printed firearm was met by widespread media coverage and unease. The government ended up asking Defense Distributed to remove the blueprints for the Liberator from its website, but the design for the firearm had already been widely shared over the Internet.[31] Wilson's development of the Liberator signaled that even

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[25] Greenberg, *supra* note 1.

[26] *Id.*

[27] *Id.*

[28] *'Pirate Bay' for 3D Printing Launched*, BBC (March 12, 2013, 1:55 PM), http://www.bbc.co.uk/news/technology-21754915.

[29] Adam Gabbatt, *Shots Fired From the World's First 3D-Printed Handgun*, GUARDIAN (May 6, 2013, 2:43 PM), http://www.theguardian.com/world/2013/may/06/3-handgun-fired-cody-wilson.

[30] *Id.* The law prohibiting firearms that are invisible to metal detectors is codified at 18 U.S.C. § 922(p).

[31] Charles C.W. Cooke, *There's No Stopping 3-D-Printed Guns*, NATIONAL REVIEW ONLINE (Nov. 11, 2013, 4:00 AM), http://www.nationalreview.com/article/363590/theres-no-stopping-3-d-printed-guns-charles-c-w-cooke.

printers that were capable of printing only plastic components could produce a working firearm.[32]

And these firearms did not even require an $8,000.00 investment to produce. Less than three weeks after Cody Wilson tested the Liberator, an engineer in Wisconsin used a $1,725.00 "Lulzbot" printer to make a pistol that successfully fired nine shots.[33] This signaled that firearms were effectively within reach of anybody with a working 3D printer and a firearm blueprint.

3D printed firearms did not remain constrained to the realm of plastic. Soon, another company, Solid Concepts, produced an all-metal firearm using a 3D printer.[34] Solid Concepts announced that the firearm had successfully fired over fifty rounds, and posted a video of the firearm in action.[35] This was a marked improvement over Wilson's Liberator, which had misfired at one point during Wilson's demonstration, and exploded after several more shots.[36] Solid Concepts was quick to point out that its firearm could not be manufactured using standard, desktop 3D printing technology.[37] But metal printers are evolving alongside regular 3D printers, and their price is also projected to fall.[38] Other 3D printing enthusiasts have created what appear to be working revolvers,[39] although whether these firearms can withstand sustained use is a

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[32] *Id.*

[33] Greenberg, *supra* note 2.

[34] Alyssa Parkinson, *World's First 3D Printed Metal Gun*, SOLID CONCEPTS BLOG (Nov. 7, 2013, 12:00 PM), http://blog.solidconcepts.com/industry-highlights/worlds-first-3d-printed-metal-gun/.

[35] *See id.*

[36] Greenberg, *supra* note 1.

[37] Alyssa, *supra* note 34.

[38] *See* RT, *Home-Made Browning: 3D Printers Stoke Fears of Backyard Technology Explosion*, YOUTUBE (Nov. 28, 2013), http://www.youtube.com/watch?v=_EXsAeJ7RsU.

matter of debate.[40] However effective the gun may have been, its designer was arrested and sentenced to two years in prison for violating Japan's "strict gun laws."[41] And some developers have produced 3D printed bullets – although it seems that the printed component of the bullet is limited to the slug that is fired (since users are unable to print gunpowder).[42]

Meanwhile, 3D printed firearm designs were making advances in the digital context. Cody Wilson had already developed Defcad, a search engine for 3D printed parts, before the first test-firing of the Liberator pistol.[43] Users can search this website for various designs, including what seems to be a working, 3D printed revolver.[44] Encryption technology for 3D printing designs has also progressed, and users are now capable of scrambling the images of designs they share online.[45] This technology can be used by individuals who wish to hide contraband items, including firearms, from detection by authorities.[46]

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[39] *See*, *infra*, note 44.

[40] John LaRocco, *Simulated Testing of a 3D Printed Revolver Cylinder*, PEEREVALUATION (2013), *available at* http://peerevaluation.org/data/f410588e48dc83f2822a880a68f78923/PE_doc_29812.pdf.

[41] Brian Krassenstein, *Two Year Sentence Handed Down to Yoshitomo Imura in Japanese 3D Printed Gun Case*, 3DPRINT.COM (Oct. 20, 2014) http://3dprint.com/20019/sentence-imura-3d-printed-gun/.

[42] *See* Fidel Martinez, *Bullets Join the 3-D Printed Arsenal*, THE DAILY DOT (May 24, 2013), http://www.dailydot.com/news/3d-printed-bullets-fired/.

[43] *'Pirate Bay' for 3D Printing*, *supra* note 28.

[44] *See Caliber Zig Zag Revolver Tank Gan Mk.*, DEFCAD, https://defcad.com/cad_objects/caliber-zig-zag-revolver-tank-gan-mk. While it is not immediately apparent on Defcad's web page that the displayed product is a working revolver, the page links to a YouTube video of the weapon being fired. *See* imura2011, *3D Printed Revolver First in the World Prototype Test Shooting*, YOUTUBE (Nov. 19, 2013), http://www.youtube.com/watch?v=HubsiAZSasA.

[45] Andy Greenberg, *3D-Printing 'Encryption' App Hides Contraband Objects In Plain Sight*, FORBES (Nov. 4, 2013, 9:38 AM), http://www.forbes.com/sites/andygreenberg/2013/11/04/3d-printing-encryption-app-hides-contraband-objects-in-plain-sight/.

[46] *Id.*

While 3D printing technology may be expensive and inefficient in its current stages, the technology is clearly capable of producing firearms. Working (albeit, unreliable) firearms can be produced using readily available printers that print plastic components, and more effective firearms can be produced by advanced printers that can print metal components. The massive strides that have been made in the past year alone indicate that 3D printed firearms will likely continue to develop, and the technology's current unreliability and inaccessibility may soon be overcome.

II. THE SECOND AMENDMENT BACKGROUND

While the Second Amendment has attracted the attention of legal commentators for some time, the Second Amendment as an individual right was largely constrained to the realm of scholarly commentary before the Supreme Court's decision in *District of Columbia v. Heller*.[47] While *Heller* clarified that the Second Amendment protects an individual right to bear arms, it left the extent of this protection unclear – meaning that lower courts have had to determine the permissibility of laws and regulations that restrict the possession of firearms. This Part explores *Heller* and its aftermath, and summarizes some of the lower court trends and developments following the *Heller* decision.

A. District of Columbia v. Heller

In 2008, the Supreme Court held, in *District of Columbia v. Heller*,[48] that the District of Columbia's ban on handgun possession in the home violated the Second Amendment right to keep and bear arms.[49] It had been almost 70 years since the Court had applied the Second

[47] 554 U.S. 570 (2008).

[48] 554 U.S. 570.

Amendment.[50] The Court's determination that the Second Amendment protected an individual, rather than a group, right to keep and bear arms, put an end to the debate over whether the amendment protected individuals at all.[51] The Court's ruling that the Second Amendment protected individual rights was soon incorporated against the states in *McDonald v. City of Chicago*.[52]

In *Heller*, the Court held that the Second Amendment protected an individual's right to keep a handgun in the home for purposes of self-defense.[53] The District of Columbia's handgun ban infringed on this right by prohibiting people from having working handguns readily available, and this type of ban violated the Second Amendment under any standard of scrutiny the Court might apply.[54] In reaching this strong conclusion about the protection of handguns in the home, the Court did not enunciate any standard of review for statutes that limited the ability of citizens to keep, carry, or purchase firearms.[55]

While the Supreme Court did not specify a standard of review for statutes restricting firearms, the Court did indicate that "longstanding regulations" were not threatened by its decision. Specifically, the Court noted:

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[49] *Id.* at 622, 635.

[50] *See* Brannon P. Denning & Glenn H. Reynolds, *Five Takes on* McDonald v. Chicago, 26 J.L. & POL. 273, 274 (2011) (noting that the Supreme Court's "only real Second Amendment case of the twentieth century" was *United States v. Miller*, 307 U.S. 174 (1939)).

[51] *See*, WINKLER, *supra* note 5 at 106 – 13; Shalhope, *supra* note 5.

[52] 130 S. Ct. 3020, 3026 (2010).

[53] *Heller*, 554 U.S. at 592, 599.

[54] *Id.*

[55] *See McDonald*, 130 S. Ct. at 3105 (Stevens, J., dissenting); *see also* See Philip J. Cook et al., *Gun Control After* Heller*: Threats and Sideshows From a Social Welfare Perspective*, 56 UCLA L. REV. 1041, 1064 (2009).

> Nothing in our opinion should be taken to cast doubt on longstanding prohibitions on the possession of firearms by felons and the mentally ill, or laws forbidding the carrying of firearms in sensitive places such as schools and government buildings, or laws imposing conditions and qualifications on the commercial sale of arms.[56]

The Court reiterated this caveat in *McDonald* as well.[57]

While the Court did not enunciate a standard of scrutiny for constitutional review, there are several takeaways from these portions of the *Heller* opinion. The Court appeared to hold that a ban that prohibits the possession of firearms in the home for purposes of self-defense is unconstitutional under the Second Amendment. But firearms may still be regulated and restricted in ways that are consistent with longstanding regulations. So, presumably, even though a law banning felons from possessing firearms would prevent those felons from possessing firearms in their homes for self-defense, this sort of law would likely survive Second Amendment scrutiny, since the Court specifically indicated that this type of law is not threatened by its holding in *Heller*.[58]

B. Lower Court Decisions After Heller

Following *Heller*'s unclear discussion of Second Amendment rights, the lower courts were left to determine the scope of the Second Amendment's protection. But despite the failure of the Supreme Court to enunciate a standard of constitutional review for Second Amendment cases, lower courts have generally reached a consensus on how to determine when laws infringe people's Second Amendment rights.[59] While there have been several decisions that have struck

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[56] *Heller*, 554 U.S. at 626–27.

[57] *See McDonald*, 130 S. Ct. at 3047.

[58] *See Heller*, 554 U.S. at 626–27.

[59] Nelson Lund, *Second Amendment Standards of Review in a* Heller *World*, 39 FORDHAM URB. L.J. 1617, 1622 (2012).

down laws as violating the Second Amendment, most decisions following *Heller* have upheld laws – particularly those laws that *Heller* indicated were "longstanding regulations."[60] Beyond these longstanding regulations, the level of scrutiny applied to laws restricting the right to bear arms for purposes of self-defense largely depends on the level of those laws' intrusion on the right.[61]

The Court's decision in *United States v. Masciandaro*[62] illustrates courts' attention to laws' level of intrusion on the right to bear arms for self-defense when determining what level of scrutiny to apply. In *Masciandaro*, the Fourth Circuit upheld a federal ban on the possession of loaded firearms in vehicles in national parks.[63] In upholding this ban, the court noted that the need to possess firearms for purposes of self-defense in national parks was less acute than it may otherwise be, as the parks are patrolled by U.S. park police.[64] Because the ban on loaded firearms in cars did not burden the "core" Second Amendment right to possess firearms in the home for self-defense, the court applied intermediate scrutiny, rather than strict scrutiny.[65] Accordingly, the government only needed to prove that the firearm restriction served an important government interest, and that the restriction was substantially tailored to achieve this interest.[66]

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[60] *Id.*

[61] *Id.*

[62] 638 F.3d 458 (4th Cir. 2011).

[63] *Id.* at 474.

[64] *Id.*

[65] *Id.* at 469-71.

[66] *Id.*

Lower courts seem to agree that in many cases, an initial focus on a regulation's impact on the core right of law abiding citizens to self-defense in the home is required when it comes to determining whether a law violates the Second Amendment.[67] Alternatively, courts may seek to circumvent the decision on what level of scrutiny to apply and analogize a law to the "longstanding prohibitions" that *Heller* noted were not threatened by the Court's holding.[68] If a law infringes on the core right to self-defense, or substantially restricts law abiding individuals' ability to possess firearms for self-defense, then courts will apply a higher level of scrutiny than intermediate scrutiny.[69]

Under this framework for Second Amendment analysis, courts typically end up applying intermediate scrutiny to firearms restrictions. But strict scrutiny – which requires a compelling government interest, and that the law be narrowly tailored to achieve that interest[70] – is still relevant in discussions of firearm regulation. If a law ends up substantially restricting the core Second Amendment right to self-defense in the home, then the reviewing court must apply strict scrutiny. Moreover, some states grant stronger protections for the right to bear arms than the Second Amendment. For instance, Louisiana's constitution protects the individual right to bear

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[67] *See, e.g.*, United States v. Mahin, 668 F.3d 119, 123 (4th Cir. 2012) (noting that intermediate scrutiny should be applied to firearms ban on citizens who do not follow the law because that these people fall outside of the Second Amendment's core protection); United States v. Marzzarella, 614 F.3d 85, 97 (3d Cir. 2010) (holding that a ban on firearms with obliterated serial numbers did not severely restrict the right to bear arms, and was therefore subject to intermediate scrutiny).

[68] *See, e.g.*, United States v. Yancey, 621 F.3d 681, 683-85 (7th Cir. 2010) (analogizing a prohibition on possession of firearms by those in possession of or addicted to controlled substances to the longstanding prohibition on firearm possession by felons).

[69] *See, e.g.*, Ezell v. City of Chicago, 651 F.3d 684, 708 (7th Cir. 2011) (noting that "a severe burden on the core Second Amendment right of armed self-defense will require an extremely strong public-interest justification and a close fit between the government's means and its end" and distinguishing this level of scrutiny from intermediate scrutiny).

[70] *See Marzzarella*, 614 F.3d at 96 & n.14 (defining strict scrutiny and rejecting it in the Second Amendment context).

arms, and goes on to require that any law restricting this right shall be subject to strict scrutiny.[71] Despite this strong language, the government may still overcome this level of scrutiny. Louisiana's ban on firearm possession by those on probation or parole survived strict scrutiny analysis.[72] Most recently, Louisiana's law restricting minors from possessing handguns survived strict scrutiny, with the Louisiana Supreme Court noting the tradition of the firearms ban and the immaturity of minors.[73]

III. APPLYING THE SECOND AMENDMENT TO A BAN ON 3D PRINTED FIREARMS

With this background on 3D printing and the Second Amendment in mind, this paper now turns to the question of the Second Amendment implications of restrictions on 3D printed firearms. Before getting to the analysis, however, a discussion of this section's framework is warranted.

In this section, I will be contemplating a complete ban on 3D printed firearms. This ban would contain two major parts: (1) a ban on the act of printing firearms,[74] and (2) a ban on possessing firearms that have been made through 3D printing. Of course, these outcomes might be achieved in a number of ways. For instance, a state may decide to ban the act of printing firearms by prohibiting the possession of digital blueprints for these firearms – which would

[71] LA. CONST. art. I, § 11.

[72] *See* State v. Draughter, 2013 WL 6474419 (La. 2013).

[73] State ex rel. J.M., 2014 WL 340999 at *1-2, *6-7 (La. 2014)

[74] The city of Philadelphia recently passed an ordinance that closely mirrors this proposal by banning the manufacture of firearms with a 3D printer by those who do not have a federal license to manufacture firearms. *See* Zenon Evans, *Philadelphia Becomes First City to Ban 3D-Printed Gun Manufacturing*, REASON.COM (Nov. 22, 2013, 4:23 PM), http://reason.com/blog/2013/11/22/philadelphia-becomes-first-city-to-ban-3.

make printing the firearms impossible. But for the sake of simplified analysis, I will focus on the two-part ban on printing and possessing 3D printed firearms.[75]

Because I ultimately seek to conclude that regulations on 3D printing will survive Second Amendment challenges, considering a complete ban on 3D printed firearms is particularly useful. Questions of constitutionality in the Second Amendment context often come down to whether a law significantly burdens the core Second Amendment right of possession of firearms for purposes of self-defense, and whether the law being considered is tailored substantially or narrowly to achieve the purpose of the law.[76] A complete ban on 3D printed firearms would burden any relevant Second Amendments more than a partial ban, and the complete ban, by definition, is less narrowly tailored than a partial ban. The upshot is that if a complete ban on 3D printed firearms would survive Second Amendment challenges, then narrower bans will also be likely to survive Second Amendment challenges.

In framing my approach this way, I recognize that this type of ban would restrict the printing of firearms by both private individuals and large-scale companies. The printing and selling of firearms by larger, established companies may be more amenable to regulation – perhaps by giving specialized licenses to these companies. This is certainly something worth exploring when it comes to planning maximally-effective regulations, and it is something I will discuss in more detail later in this paper.[77] But for the present purposes of the Second Amendment argument, I will accept that a complete ban on 3D printed firearms will restrict

[75] And for the sake of simplified phrasing, when I refer to a "ban on 3D printed firearms," that phrase will encompass both restrictions described herein unless specified otherwise.

[76] *See supra*, Part II. B.

[77] *See infra* Part IV.

printing and possession of all 3D printed firearms – regardless of whether they are made on personal or industrial printers.[78]

Of course, when it comes to the question of how narrowly the law is tailored, there is the possibility that courts may conclude that laws are improperly tailored to achieve government interests because a law is underinclusive.[79] The Supreme Court has taken this approach in First Amendment cases, noting that if unprotected speech is selectively banned, this practice may still violate the First Amendment because the law may discriminate based on the viewpoints expressed in the unprotected speech.[80] While this concern may be relevant, I will not address it in this paper. No cases striking down laws on Second Amendment grounds have done so on the grounds that the laws are underinclusive. And laws that tend to restrict firearms more narrowly than blanket bans tend to narrow restrictions along the lines longstanding restrictions on firearms that *Heller* indicated were not threatened by its holding.[81]

With this approach in mind, I will approach the Second Amendment question by first exploring whether a ban on 3D printed firearm would fall under one of the "longstanding" restrictions on firearm that *Heller* mentioned. I will then explore whether a ban on 3D printed firearms would substantially burden the core Second Amendment right to possess firearms in the

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[78] Accordingly, this law would likely be even stricter than the United Kingdom's approach, which outlaws the manufacturing, transfer, and possession of firearms made from printed components, because the United Kingdom has a licensing scheme in place that may permit some parties to do so. *See* Freya Berry, *Britain Updates Rules Banning 3D-Printer Guns*, REUTERS (Dec. 5, 2013, 3:22 PM), http://uk.reuters.com/article/2013/12/05/us-britain-guns-idUKBRE9B40OV20131205.

[79] A law may fail to be sufficiently tailored to achieve a government interest because it is over inclusive, meaning that the law restricts more behavior than is necessary to achieve that interest, or because the law is under inclusive, meaning that the law does not restrict enough behavior to achieve the government's interest.

[80] *See* R.A.V. v. St. Paul, 505 U.S. 377, 386-88 (1992).

[81] *See* Lund, *supra* note 59, at 1622 (noting that courts tend to uphold those regulations that *Heller* indicates are longstanding restrictions on firearm possession).

home for purposes for self-defense. Next, I will evaluate whether the ban on firearms would survive intermediate scrutiny. I will do this by exploring the government's interest behind a ban on 3D printed firearms and how an innovative approach by the government at this stage of the analysis would give the government strong arguments in favor of the constitutionality of bans on 3D printed firearms. This section will conclude with a brief note on applying strict scrutiny to the ban on 3D printed firearms.

A. Would a Ban on 3D Printed Firearms Fall Under a Longstanding Restriction?

As has already been mentioned, the *Heller* ruling was not without caveats. The Court noted that its decision would not cast doubt on a number of "longstanding" restrictions on firearms, including laws restricting firearm possession by felons and the mentally ill, restrictions on possessing firearms in sensitive places like schools and government property, and conditions on the commercial sales of firearms.[82] The Court noted that this list of "presumptively lawful regulatory measures" was not exhaustive.[83]

The Court also looked to history in order to determine what types of firearms restrictions existed at the time of the Second Amendment's adoption. The Court noted that "the majority of the 19th-century courts to consider the question held that prohibitions on carrying concealed weapons were lawful under the Second Amendment or state analogues."[84] And the Court pointed out "the historical tradition of prohibiting the carrying of 'dangerous and unusual weapons.'"[85]

[82] District of Columbia v. Heller, 554 U.S. 570, 626–27 (2008).

[83] *Id.* at 627, n.26.

[84] *Id.* at 626.

Governments seeking to ban 3D printed firearms may claim that a restriction on these weapons are necessary to maintain the efficacy of the "presumptively lawful regulatory measures" that *Heller* specified. 3D printed firearms – particularly those that can be printed on personal computers – may be far easier to obtain than traditional firearms. People who want to print a firearm simply must obtain a 3D printer and the raw material for printing, and download a blueprint of a firearm. Blueprints may typically be found on websites that specialize in distributing CAD files for 3D printers – but these files may just as easily be obtained from individual users who possess the files, or from websites where those other users may post the files.[86] If 3D printed firearms can be downloaded and printed by anybody with a 3D printer, then there is virtually nothing preventing students from printing out firearms in dormitories, or felons from printing out firearms. Governments may argue that banning 3D printed firearms is the only way to prevent longstanding restrictions on the possession of firearms from becoming meaningless.

Critics may argue that there is no longstanding prohibition on the manufacture of firearms for personal use, so the government would be mistaken to claim that a ban on 3D

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[85] *Id.* at 627. The Court used this tradition to justify the federal ban on machineguns and short-barreled shotguns – a move that has drawn criticism from commentators who point out that those weapons are not in common use because they were outlawed well after the adoption of the Second Amendment. *See* Adam Winkler, Heller*'s Catch-22*, 56 UCLA L. REV. 1551, 1560-61 (2009). While these arguments may be correct, I will not address them in this paper, as the fact remains that *Heller* indicated that prohibitions on dangerous and unusual weapons are apparently lawful, and this is the authority that will govern lower court decisions on the issue.

[86] *See* Liz Klimas, *3-D Printed Gun Designs 'Gone Dark': Wiki-Weapons Project Removes Designs After Gov't 'Claims Control of the Information'*, BLAZE (May 9, 2013, 11:55 PM), http://www.theblaze.com/stories/2013/05/09/3d-printed-gun-designs-gone-dark-wiki-weapons-project-removes-designs-from-web-at-govt-request/ (reporting that even after the government requested the removal of 3D printed firearm blueprints from Defcad, the files were still available on other websites, including Pirate Bay, "one of the largest bit torrent sites on the Web").

printing would fall into the category of longstanding restrictions.[87] But this is not what the government is arguing. The government's argument is that there are several longstanding restrictions on firearms that are very likely to be found constitutional under *Heller*. And if 3D printing continues to make technological advances and become more mainstream, restricting 3D printed firearms may be the only way for the longstanding restrictions to remain meaningful.

The Government may also argue that 3D printed firearms fall into the category of "dangerous and unusual firearms," the carrying of which has been historically prohibited.[88] 3D printed firearms, as a new technological development, are unusual. Moreover, these firearms can be uniquely dangerous, since they may be printed from undetectable plastic and produced in sensitive locations that happen to have 3D printers available.

Critics may point out that 3D printed firearms – especially those that are made on personal printers – tend to be less powerful and reliable than existing firearms.[89] Because of this, those 3D printed firearms that prompt the most concern – the ones printed from personal machines – are not uniquely dangerous under the Court's meaning in *Heller*.[90] They may, in fact, be "about as likely to kill the gunman as the target."[91]

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[87] *See* Peter Jensen-Haxel, Comment, *3D Printers, Obsolete Firearm Supply Controls, and the Right to Build Self-Defense Weapons Under* Heller, 42 GOLDEN GATE U.L. REV. 447, 479 (2012).

[88] Heller, 554 U.S. at 627; *see also* WILLIAM BLACKSTONE, COMMENTARIES ON THE LAWS OF ENGLAND: IN FOUR BOOKS; WITH AN ANALYSIS OF THE WORK, VOLUME 4 *148-49 ("The offense of *riding* or *going armed* with dangerous or unusual weapons is a crime against the public peace").

[89] *See* Henry Fountain, *Tools of Modern Gun Making: Plastic and a 3-D Printer*, N.Y. TIMES (Jan. 29, 2013) http://www.nytimes.com/2013/01/30/science/surprising-tools-of-modern-gunmaking-plastic-and-a-3-d-printer.html?_r=0.

[90] Jensen-Haxel, *supra* note 87, at 489-92.

[91] Fountain, *supra* note 89.

While 3D firearms produced by personal printers may not be as strong or reliable as normal firearms, the ease with which they can be concealed from metal detecting technology may make them uniquely dangerous. Federal law prohibits the manufacture and possession of firearms that cannot be detected by walk-through metal detectors "after removal of grips, stocks, and magazines."[92] As Cody Wilson illustrated with the Liberator, 3D printed firearms may be produced that are entirely made from plastic – the one metal component of the Liberator was included in the design simply to ensure compliance with federal law.[93] Governments may argue that 3D printed firearms are unusually dangerous because they can be easily made from undetectable materials, and banning 3D printed firearms is the only way to effectively restrict undetectable firearms.

Admittedly, many of these arguments do not apply to 3D printed firearms that are made from metal, meaning that critics of bans on 3D printed firearms can argue that the bans would be overbroad. Users who have advanced printers that can produce metal firearms would not fall into the category of producing unusually dangerous weapons – as these firearms would be just as detectable as traditional firearms. Moreover, 3D printers that are capable of printing metal firearms are often very expensive and belong to large companies that would likely produce firearms for sale, rather than personal use.[94] The upshot of this is that bans that seek to cleanly rely on longstanding restrictions on firearms may need to be restricted to personal 3D printers.

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[92] 18 U.S.C. § 922(p)(1)(A) (2014).

[93] *See* Gabbatt, *supra* note 29.

[94] *See* David Szondy, *Solid Concepts Manufactures First 3D-Printed Metal Pistol*, GIZMAG (Nov. 8, 2013), http://www.gizmag.com/worlds-first-3d-printed-gun/29702/ ("The printers used [to produce a metal firearm] weren't the desktop sort using plastic filaments, but industrial printers that require expert handing and cost many thousands of dollars").

B. 3D Printed Firearms Bans and Substantial Burdens on the Right to Bear Arms

Setting aside questions of longstanding restrictions, the first question courts will consider in evaluating the constitutionality of a ban on 3D printed firearms is whether the ban is a substantial burden on the core Second Amendment right. The general consensus of the courts is that the Second Amendment protects the core right of law-abiding citizens to engage in self-defense when in the home.[95]

If courts conclude that a ban on 3D printed guns would not substantially burden the core Second Amendment right, then the law would need to survive intermediate scrutiny – meaning the government would need to prove that it has an important interest, and that the ban on 3D printed firearms is substantially tailored to achieve that interest.[96] But if the court concludes that a ban on 3D printed firearms substantially burdens the core Second Amendment right, then the ban will probably have to survive strict scrutiny, or something close to strict scrutiny.[97] If the court applies strict scrutiny, then the government would need to prove that it has a compelling interest and that the ban is narrowly tailored to achieve this interest.[98]

The government has a strong argument that a ban on 3D printed firearms does not put a substantial burden on the right to bear arms for purposes of self-defense in the home. Even if the government completely bans 3D printed firearms, people can still purchase and own traditional firearms. So while one extra option for defending oneself in the home may be foreclosed by a

[95] *See* United States v. Mahin, 668 F.3d 119, 123 (4th Cir. 2012); *see* United States v. Masciandaro 638 F.3d 458 (4th Cir. 2011); *see generally* Lund, *supra* note 59, at 1622.

[96] *Masciandaro*, 638 F.3d at 469-71.

[97] *See* Ezell v. City of Chicago, 651 F.3d 684, 708 (7th Cir. 2011) (while the court did not apply strict scrutiny to a law that burdened the core Second Amendment right, it applied a higher standard of scrutiny than intermediate scrutiny in striking down the ban).

[98] *See* United States v. Marzzarella, 614 F.3d 85, 96 & n.14 (3d Cir. 2010) (defining strict scrutiny and rejecting it in the Second Amendment context).

ban on 3D printing, this loss of an option is far from a loss of the ability to defend oneself in the home.

Peter Jensen-Haxel raises an interesting point that people who are disabled may require customized firearms in order to defend themselves in their homes, and that banning 3D printed firearms could interfere with this ability.[99] While Jensen-Haxel's claim that his argument is supported by longstanding common law is strained,[100] critics of a ban on 3D firearms may claim that a total ban on these firearms substantially burdens the core Second Amendment rights of those who may be unable to use traditional firearms.

The government may reply that while individuals with disabilities may be burdened by a ban on 3D printed firearms, the burden on this particular group does not necessarily mean that a law banning 3D printed firearms substantially burdens core Second Amendment rights. The class of individuals who would be detrimentally affected is small – limited to those who with disabilities – but not with disabilities so severe that they could not defend themselves even with access to 3D printed firearms. The small size of the group may lead courts to conclude that the infringement of the law on Second Amendment rights is not substantial.

Josh Blackman argues that the Second Amendment protects a right to make firearms, and notes that making firearms has traditionally been subjected to far less regulation than purchasing firearms.[101] Blackman notes that people have made their own firearms since the time of the

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[99] Jensen-Haxel, *supra* note 87, at 481.

[100] Jensen-Haxel attempts to draw support from William Blackstone's commentaries by pointing out that Blackstone "explained that limbs threatened with debilitating injury could be defended with deadly force, even if life was not threatened, precisely because loss of their function meant privation of self-defense." *Id.* While Blackstone's point is a notable illustration of the strength of the right to self-defense, the selection that Jensen-Haxel cites say nothing about the rights of those who are already disabled.

[101] Josh Blackman, *The 1st Amendment, 2nd Amendment, and 3D Printed Guns*, 81 TENN. L. REV. 479, 496-97 (2014).

American Revolution and that the ability to make one's own firearms gives people the ability to make guns that are customized to their self-defense needs.[102] Blackman concludes that restrictions on making firearms therefore do not fall under any "longstanding" restriction on the right to keep and bear arms.[103] He also concludes that a ban on making personalized firearms would not survive Second Amendment review, even if people could purchase firearms.[104]

While people have indeed been making their own firearms for some time, and while people may make firearms that are more suited to their individualized wants or needs, Blackman's prediction that a ban on the ability to make one's own guns would be unconstitutional is by no means guaranteed. The *Heller* Court indeed noted that "longstanding" restrictions on the right to possess firearms were not affected by the ruling.[105] This point that exceptions may exist to Second Amendment protections in the case of longstanding restrictions does not imply that a longstanding *lack* of restrictions gives rise to Second Amendment protections.

Moreover, it is not clear why a prohibition on making one's own firearms would violate the Second Amendment, since people could still purchase firearms from gun manufacturers. Blackman contends that a prohibition on making one's own guns would "not be narrowly-tailored enough to survive review" without "a showing of an important state interest."[106] First, this argument is nonsensical, since a law implicating constitutional scrutiny must have both a sufficiently strong government interest in which it is based *and* be sufficiently tailored to achieve

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[102] *Id.*

[103] *Id.* at 497.

[104] *Id.*

[105] District of Columbia v. Heller, 554 U.S. 570, 626–27 (2008).

[106] Blackman, *supra* note 100, at 497.

that interest without imposing overly broad restrictions on the constitutional right.[107] A law that is insufficiently tailored does not become sufficiently tailored if the government's interest is sufficiently strong, since those are two independent steps of the constitutionality analysis. Second, Blackman does not provide any reason why people's ability to purchase firearms would not allow them to fulfill their self-defense needs in the absence of the ability to make their own firearms. Even if people cannot make their own guns, they may still purchase pre-made firearms from gun manufacturers. It is not clear why restricting people's ability to make their own guns when they still have the ability to buy guns is an overly broad restriction on Second Amendment protections.

Finally, even if a law prohibiting people from making their own firearms would violate the Second Amendment, it does not follow that a law banning 3D printed guns would violate the Second Amendment, since people could make guns by means other than 3D printing. And as Blackman admits, these guns are arguably safer and more effective than 3D printed guns.[108]

Because people would still have constitutionally-protected access to traditional firearms, a government ban on 3D printed firearms would probably not substantially burden the right to self-defense in the home. In *Heller*, the Court noted that a handgun may be preferred to alternative long guns in a self-defense situation – handguns may be easier to store and access, they are easier to lift, and people can hold a handgun in one hand while calling the police with the other.[109] All of these benefits of handguns remain if the government bans 3D printed firearms – people simply need to purchase traditional firearms instead of printing firearms. If courts conclude that a ban on 3D printed firearms does not substantially burden the core Second

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[107] *See*, *infra*, Part III. C (describing intermediate scrutiny).
[108] Blackman, *supra* note 100, at 487-88.

[109] *Heller*, 554 U.S. at 629.

Amendment right to self-defense in the home, the government must then show that a ban on 3D printed firearms passes intermediate scrutiny.

C. Subjecting a Ban on 3D Printed Firearms to Intermediate Scrutiny

A law or regulation passes intermediate scrutiny if the government enacting the law has an important interest and if the law is substantially tailored to achieve that interest.[110] Intermediate scrutiny, while a more stringent standard than rational basis scrutiny, has not been a very difficult obstacle for laws restricting the possession of firearms.[111] In intermediate scrutiny review, two questions need to be addressed: (1) whether the government has an important interest behind banning 3D printed firearms and, (2) whether banning 3D printed firearms is substantially tailored to that interest.

1. The Government's Interests in Banning 3D Printed Firearms

The government may argue that it has an interest in protecting public safety. This is an interest that is commonly invoked when regulations restricting firearms are challenged on Second Amendment grounds, and courts tend to conclude that it is an important interest.[112] Specifically, the government may argue that it has an interest in protecting the safety of members of the public who may be injured by somebody with a 3D printed firearm.

3D printing may involve other interests the government may invoke, however, and it would be strategic for the government to point out a variety of interests driving any ban on 3D

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[110] *See, e.g.*, United States v. Reese, 627 F.3d 792, 802 (10th Cir. 2010); United States v. Marzzarella, 614 F.3d 85, 97 (3d Cir. 2010).

[111] *See, e.g.*, United States v. Skoien, 614 F.3d 638, 646–47 (7th Cir. 2010) (en banc) (Sykes, J., dissenting) (noting that the majority was taking a lenient approach to a law when applying intermediate scrutiny).

[112] *See, e.g.*, United States v. Masciandaro, 638 F.3d 458, 473 (4th Cir. 2011) (holding that a government's interest in protecting public safety is sufficient under an intermediate scrutiny standard of review); *Skoien*, 614 F.3d at 642 ("no one doubts that the goal of . . . preventing armed mayhem, is an important governmental objective").

printed firearms. In particular, the government may want to emphasize that it is concerned with the safety of the firearms *user* – in addition to members of the general public – because of the risks associated with 3D printed firearms. Currently, 3D printed firearms that are produced using personal printers are criticized as being unreliable, and are prone to malfunction or even explode.[113] If users mistakenly print firearms using the wrong type of plastic, the firearm may end up misfiring or exploding, causing serious injuries.[114]

Beyond the printing and assembly of firearms, users may face a danger of harm from the electronic aspect of 3D printing. In order to print anything on a 3D printer, users must first develop or download a digital blueprint of the object they would like to print. Digital blueprints are available for download on specialized websites like Thingiverse, but may also be uploaded onto private websites, or emailed between individuals. If 3D printing blueprints become more widespread, it is possible that unreliable blueprints may proliferate, leading to the printing of unreliable firearms. The security firm, Symantec, has predicted that blueprints for 3D printers will be a target for cybercriminals as the technology becomes more mainstream, and the government may argue that restricting 3D printed firearms may be the only way to prevent attacks in cyberspace from causing physical injury arising from printed weapons.[115] Focusing on the digital vulnerability of 3D printed firearms is particularly strategic because the danger of

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[113] *See* Greenberg, *supra* note 1.

[114] *See* Andy Greenberg, *3D-Printed Gun Stands Up to Federal Agents' Testfiring—Except When it Explodes (Video)*, FORBES (Nov. 14, 2013, 11:41 AM), http://www.forbes.com/sites/andygreenberg/2013/11/14/3d-printed-gun-stands-up-to-federal-agents-testfiring-except-when-it-explodes-video/ (Reporting that a 3D printed firearm made out of a particular plastic, VisiJet, exploded as soon as it was fired).

[115] *See* Divina Paredes, *Symantec: Global Training Programme in Cyber Security to be Piloted in New Zealand and Australia*, CIO (Nov. 30, 2013, 6:00 AM), http://www.cio.co.nz/article/533150/symantec_global_training_programme_cyber_security_piloted_new_zealand_australia/.

cyber-attack will remain, even as 3D printing technology improves, and as personally-printed firearms become more reliable.

In advancing arguments about its interest, the government should emphasize both the danger 3D printed firearms may pose to the public-at-large, and to firearm users. By structuring its interest arguments this way, the government will have more options available when it comes to defending how specifically the law is tailored.

2. Whether a Ban on 3D Printed Firearms is Substantially Related to Government Interests

Courts must also evaluate whether a ban on 3D printed firearms is substantially related to the government's interests motivating the ban. While this test is more demanding than the rational basis test, which examines whether a law is "rationally related" to the government interest behind the law, courts may still be lenient in concluding that a law is substantially related to a government interest.

In *United States v. Skoien*, an en banc Seventh Circuit upheld the defendant's conviction for violating a federal law banning the possession of firearms by those who have been convicted of misdemeanor domestic violence.[116] Following the government's concession that a standard of intermediate scrutiny should be applied to the law, the court concluded that "[b]oth logic and data establish a substantial relation between § 922(g)(9) and this objective."[117] The court noted that people who commit misdemeanor domestic violence tend to reoffend, and that firearms are more dangerous than other weapons in domestic disputes.[118] The dissent pointed out that the court was particularly lenient when it came to the government's burden to prove a substantial

[116] 614 F.3d 638, 639, 645 (7th Cir. 2010) (en banc). The statute at issue was 18 U.S.C. § 922(g)(9) (2006).

[117] *Skoien*, 614 F.3d at 641-42.

[118] *Id.* at 633-34.

connection between the law and the government's interest in preventing armed mayhem, and warned that the court's understanding of the evidence may be mistaken.[119] *Skoien* illustrates that while governments must prove something more than a rational connection between the law and the government interest, there is room for leeway when it comes to determining whether a law is substantially tailored to meet that interest.

With this in mind, governments that seek to pass laws banning 3D printed firearms have a strong argument that the laws are substantially tailored to achieve government interests. As far as the government's interest in public safety is concerned, the government can point out that users can print out firearms anywhere, as long as a 3D printer is present in that location. These locations could include *Heller*'s sensitive locations, including government property and schools. These locations are sensitive because a firearm there may present a particular threat to other people or to government officials. Moreover, the government can argue that the ease with which people can print plastic firearms using 3D printers makes it more likely that people can print firearms that can avoid detection by metal detectors.[120]

People challenging the ban on 3D printed firearms can respond that a complete ban is overbroad. The government could (and the federal government already does) ban firearms that cannot be detected by metal detectors.[121] This law would make it illegal to carry firearms made entirely from plastic, so a separate ban on 3D printed firearms would not meaningfully contribute to the elimination of undetectable firearms. And laws could be passed that restrict the location of 3D printers, which would keep them out of sensitive locations, which would keep printed

[119] *Id.* at 651-52 (Sykes, J. dissenting).

[120] *See* Jana Winter, *Homeland Security Bulletin Warns 3D-Printed Guns May be 'Impossible' to Stop*, FOX NEWS (May 23, 2013), http://www.foxnews.com/us/2013/05/23/govt-memo-warns-3d-printed-guns-may-be-impossible-to-stop/.

[121] *See* 18 U.S.C. § 922(p)(1)(A) (2006).

firearms out of those locations rather than banning them entirely. While these arguments might not be enough to convince a court that a law banning 3D printed firearms is not substantially tailored, they may, at least, make the government's job harder when it comes to arguing for the constitutionality of the law.

The government could bolster its position by pointing to its interest in protecting the users of firearms. The government can point to the unreliability of firearms that are printed by personal 3D printers and argue that users of these firearms would be at a high risk of harm because these firearms may misfire or explode. Moreover, the government can argue that 3D printed firearms need to be prohibited because of the danger of flawed or hacked blueprints for these firearms. Unsuspecting users might download a compromised blueprint that produces a useless firearm, or worse, produces a firearm that is even more likely to explode. These arguments for substantial tailoring based on user safety may be more convincing than arguments concerning general public safety because the dangers that 3D printed firearms pose to their users are largely unique to the printed firearms – particularly the concerns of flawed digital blueprints.

Admittedly, challengers of a ban on 3D printed firearms can push back by arguing that there are some 3D printed firearms that are reliable. Would-be purchasers from industrial-scale producers of printed, metal firearms can argue that these firearms are safer than personally-printed firearms.[122] These challengers may also argue that a complete ban on 3D printed firearms is overbroad because it would prohibit the possession of metal firearms that happened to be printed, rather than made traditionally, by industrial producers.

While these challenges may have merit, it is unlikely that they would rise to the level of disproving a substantial connection between the ban on 3D printed firearms and the

[122] *Compare* Alyssa, *supra* note 34 (announcing that Solid Concepts' printed firearm had fired 50 shots) *with* Greenberg, *supra* note 1 (noting that the plastic Liberator pistol had exploded after several shots).

government's interest in user and public safety. Solid Concepts, the makers of the first 3D printed metal firearm, noted that the firearm was not for mass consumption.[123] And this stance is not surprising. While industrial 3D printers are particularly suited for printing prototypes of new products or parts, traditional manufacturing still tends to be more cost-effective when it comes to the mass production of goods.[124] If reliable, printed firearms are not widely available, restricting them will not meaningfully undermine the government's arguments that the law is substantially related to protecting user safety.

The government has a strong argument that prohibiting 3D printed firearms is substantially related to its interest in protecting public safety. And the government may avoid the most obvious problems with this argument by emphasizing the additional interest in protecting the safety of firearms users. Between these two interests, the government will probably be able to show that a complete ban on 3D printed firearms passes intermediate scrutiny.

D. A Brief Note on Strict Scrutiny

As argued in Part III.B, because a ban on 3D printed firearms does not substantially burden the right to bear arms, the government will probably only need to argue that a ban on 3D printed firearms passes intermediate scrutiny. But if courts come out differently on the substantial burden question, the government will probably need to argue that the ban on 3D printed firearms passes strict scrutiny, or something similar to it.[125] Additionally, my conclusion

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[123] *See* RT, *supra* note 38.

[124] *See* BENJAMIN GRYNOL, DELOITTE, DISRUPTIVE MANUFACTURING: THE EFFECTS OF 3D PRINTING 6-7 (2013) *available at* http://www.deloitte.com/assets/Dcom-Canada/Local%20Assets/Documents/Insights/Innovative_Thinking/2013/ca_en_insights_disruptive_manufacturing_102813.pdf.

that the restriction will simply need to pass intermediate scrutiny does not apply to the state of Louisiana. Louisiana's constitution requires any restriction on the right to bear arms to pass strict scrutiny.[126]

To pass strict scrutiny, the government must show that its law is based on a compelling government interest and that the law is narrowly tailored to meet this interest.[127] A law that is subjected to strict scrutiny is unlikely to survive review, although it is not impossible.[128] In fact, a law prohibiting parolees and probationers from possessing firearms recently survived strict scrutiny review in the Louisiana Supreme Court.[129] But if courts end up applying strict scrutiny review, a law that completely bans 3D printed firearms is unlikely to survive.

IV. THE PROBLEM OF ENFORCEMENT AND EFFECTIVE REGULATION

The primary goal of this paper is to show that bans on 3D printed firearms will survive Second Amendment challenges. While my preceding arguments have shown that the Second Amendment will not be a significant obstacle to restrictions on these weapons, constitutional challenges may be the least of the government's worries. Digital blueprints for 3D printed firearms can be downloaded from websites and distributed between users. And these firearms

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[125] *See* Lund, *supra* note 59, at 1622; *see also* Ezell v. City of Chicago, 651 F.3d 684, 708 (7th Cir. 2011) (noting that "a severe burden on the core Second Amendment right of armed self-defense will require an extremely strong public-interest justification and a close fit between the government's means and its end" and distinguishing this level of scrutiny from intermediate scrutiny).

[126] LA. CONST. art. I, § 11 ("The right of each citizen to keep and bear arms is fundamental and shall not be infringed. Any restriction on this right shall be subject to strict scrutiny").

[127] *See* United States v. Marzzarella, 614 F.3d 85, 96 & n.14 (3d Cir. 2010) (defining strict scrutiny and rejecting it in the Second Amendment context).

[128] *See* Adam Winkler, *Fatal in Theory and Strict in Fact: An Empirical Analysis of Strict Scrutiny in the Federal Courts*, 59 VAND. L. REV. 793, 795–96 (2006).

[129] *See* State v. Draughter, 2013 WL 6474419 (La. 2013).

can be printed from 3D printers, which anybody can purchase from specialized websites or major retailers. Even if the government bans 3D printed firearms, the law may do little to actually prevent the making and possession of these firearms.

An extended discussion of policy proposals that can assure effective enforcement is beyond the scope of this paper. But there are several approaches the government should consider taking, and several approaches that may be particularly problematic that I will discuss in this section. Ultimately, regulating and enforcing regulations on 3D printed firearms is a matter that many experts (with technical knowledge ranging beyond constitutional law) must discuss and develop.

A. Potential Approaches for Regulation

When regulating 3D printed firearms, it is important for the government to keep in mind that there are many actors involved. Deven Desai and Gerard Magliocca emphasize that "[t]here are several parts to the 3D printer environment," including design files stored on specialized repositories like Thingiverse, users who generate designs on their owns, Internet service providers, makers of raw materials that are put into 3D printers, 3D printer manufacturers, and the end users of the printers and design files.[130] This paper's subject so far has been a ban on the printing and possession of 3D printed firearms, but this ban would only affect one part of the 3D printing system – the end user.

In regulating 3D printed firearms, the government should contemplate all stages of the 3D printing process. Banning the printing and possession of 3D printed firearms creates a disincentive for the user to print and possess the firearm for fear of being caught. But the government could create incentives and disincentives at other stages of the process. One

[130] Desai & Magliocca, *supra* note 9 at 42-43.

extreme example might be to ban the distributions of the designs for 3D printed firearms, and to prosecute people who distribute these designs. Or, in lieu of criminal prosecution, governments could enact laws that provide for those distributing firearm designs to be held liable for any harm caused by their firearms.

An alternate, less disruptive approach, may be to enact regulations that control certain aspects of the 3D printing process without resorting to widespread criminal or civil liability. For example, Create it REAL, a manufacturer of 3D printers, has also "developed software that looks for the characteristics of weapon designs and, when detected, blocks the printer from making a firearm."[131] Governments might require companies that make 3D printers to develop and install similar software in their printers. This requirement would not interfere with the sale and use of 3D printers for non-firearm purposes. Even if users were able to obtain digital blueprints to print firearms, they would not be able to print from these blueprints.

Admittedly, users may try to work their way around these barriers through the use of encryption technology. For example, the program "Disarming Corruptor," allows the makers of digital blueprints to digitally scramble the appearance of their blueprints and selectively distribute the key for this encryption to specific users.[132] This can allow sellers or distributers of digital blueprints to transfer blueprints that may be illegal, or that may infringe on copyright protections (something the software's makers strongly imply – as a scrambled blueprint for a Mickey Mouse sculpture is one of the items included in their promotional video).[133] The Disarming Corruptor software does not appear capable of "fooling" printers – as users must

[131] Georgi Kantchev, *Authorities Worry 3-D Printers May Undermine Europe's Gun Laws*, N.Y. TIMES (Oct. 17, 2013), http://www.nytimes.com/2013/10/18/business/international/european-authorities-wary-of-3-d-guns-made-on-printers.html?ref=technology&_r=1&.

[132] *See* Greenberg, *supra* note 45.

[133] *Id.*

decrypt the files before printing them, meaning that the printer would still be printing from a non-encrypted blueprint. But this type of encryption technique indicates that attempts to install preventative software will require constant effort and upgrading. All may not be lost, however, since type of constant effort and upgrading may be something that quickly-evolving 3D printing companies can undertake.

Finally, governments should consider exceptions or licenses that may allow for the creation of 3D printed firearms by industrial printers. As companies like Solid Concept have shown, advanced 3D printers are capable of printing metal firearms that are of comparable durability and quality to traditional firearms.[134] But the printers required to manufacture these firearms are extremely expensive and likely to be owned only by large companies.[135] Governments should allow companies that use advanced 3D printers to apply for a license to print metal firearms. As I mentioned previously, even once the government has specified that its interest in banning 3D printed firearms is to prevent harm to the firearm user, the law is still overbroad because it would prohibit the manufacture of firearms by companies that employ advanced techniques to produce reliable, metal firearms. A licensing scheme for these companies would eliminate this overbreadth.

B. Regulations to Avoid

There are some restrictions relating to 3D printing that may make a ban on 3D printed firearms more effective, but these restrictions may have too negative of an impact on technological development. Alternatively, some restrictions that indirectly prevent the use of 3D

[134] *See*, Alyssa, *supra* note 34.

[135] *Id.*

printed firearms may veer dangerously close to creating a substantial restriction on people's right to possess firearms for purposes of self-defense, which could violate the Second Amendment.

Examples of laws that would unduly constrain technological development include laws outlawing the use of personal 3D printers, and, potentially, laws that would criminalize the distribution of digital blueprints for firearms. If the government outlaws personal 3D printers entirely, then this technology's potential will be stifled. And despite all of the concern these machines generate when it comes to the printing of firearms and weapons, 3D printers may be used for many other purposes.[136] Personal 3D printers are in a stage of rapid development, and banning them outright would greatly impede the potential positive consequences of this development. Moreover, even if they are not yet mainstream technology, 3D printers have become relatively popular, and are being sold by major retailers.[137] Because of this, an outright ban would probably be politically unpopular.

Governments that want to ban the dangers of undetectable, printable-anywhere firearms may seek to enact broader laws that would have an effect of reducing the danger caused by 3D printed guns. For example, a government may seek to place heightened restrictions on ammunition. Even if 3D printed firearms are difficult to detect and can be printed in sensitive places, they are not dangerous if they are not loaded, and ammunition may be easier to control through restrictions.

The problem with an approach like this would be that a restriction on ammunition, if effective enough to curtail the use of 3D printed firearms, would likely constitute a substantial burden on the core, Second Amendment right to self-defense in the home. While 3D printed

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[136] *See, e.g.*, Stuart Dredge, *30 Things Being 3D Printed Right Now (And None of Them are Guns)*, GUARDIAN (Jan. 29, 2014, 7:40 AM), http://www.theguardian.com/technology/2014/jan/29/3d-printing-limbs-cars-selfies.

[137] *See Cube 3D Printers*, *supra* note 18.

firearms cannot be used for nefarious purposes without ammunition, traditional firearms cannot be used for self-defense without ammunition.

A strong restriction on ammunition would likely be held to be more restrictive of firearm use than Chicago's ban on gun ranges, which was held likely to be unconstitutional in *Ezell v. City of Chicago*.[138] There, the court held that the ban on firing ranges burdened citizens' abilities to engage in target practice, which was "an important corollary" to the right to bear arms in self-defense.[139] The court noted that Chicago required training with firearms before people could successfully obtain a firearms permit – which gave the court an "additional reason to closely scrutinize the range ban."[140] Because ammunition is required for firearms to function, the right to purchase and possess ammunition would also probably be found to be an important corollary to the right to bear arms in self-defense.

While there are certain approaches to regulation the government may take to ensure that a ban on 3D printed firearms is effective, governments must make sure that they do not stray too far in the direction of restricting the right to bear arms in self-defense. Moreover, governments must take heed of the potential of 3D printing, and try to mitigate damage to this quickly-evolving industry that strong restrictions could cause.

CONCLUSION

Restrictions on 3D printed firearms are likely to evoke strong opinions and resistance due to the inherently charged nature of political debate on firearms policy.[141] But even if

[138] *See* Ezell v. City of Chicago, 651 F.3d 684, 708-10 (7th Cir. 2011).

[139] *Id.* at 708.

[140] *Id.*

governments seeking to restrict these firearms meet political resistance, these bans would most likely survive Second Amendment challenges. Lower courts tend to recognize limits on the right to bear arms, and the availability of traditional firearms would mean that a restriction on 3D printed firearms would be very unlikely to significantly burden the core Second Amendment right.

But restricting 3D printed firearms is difficult, given the nature of 3D printing and the proliferation of digital designs. Governments seeking to effectively restrict 3D printed firearms will need to balance considerations of security, technological development, and constitutionality in enacting an effective set of restrictions. Balancing these factors will require careful attention to the impact of regulations and continuing developments in 3D printed technology. While this Paper proposes several initial policy considerations, there are certainly more that are being examined now, and more considerations that have yet to be realized.

[141] *See, e.g.*, Ana Marie Cox, *On 3D Guns, Congress Proves Yet Again How Scared it is of the Gun Lobby*, GUARDIAN (Dec. 11, 2013, 8:45 AM), http://www.theguardian.com/commentisfree/2013/dec/11/congress-3d-guns-scared-gun-lobby.