
Regulating 3D-Printed Guns Post-Heller: Why Two Steps Are Better Than One

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“There’s all kinds of hybrid guns ... I’ve seen printable revolvers and multishot pistols and all kinds of weird, interesting stuff in resins and plastics.”¹

“The debate is over. The guns are downloadable. The files are in the public domain. You cannot take them back.”²

- *Cody Wilson, creator of the first downloadable, 3D-printed gun*

Introduction

While the Supreme Court’s landmark 2008 decision in *District of Columbia v. Heller* announced the individual right to keep and use a handgun for self-defense, it left unanswered the question of how courts should decide future Second Amendment cases. After *Heller*, several lower courts developed a two-step methodology under which judges first ask whether a regulated activity falls within the Second Amendment’s scope and, if so, whether the regulation survives means-end scrutiny. This test has become the near-consensus approach.³

But a dissenting group of judges argues that the consensus approach is inconsistent with *Heller* and renders the Second Amendment a “second-class” right.⁴ In *Heller II*, then-judge Brett Kavanaugh laid out a different approach that looks solely to text, history, and tradition to decide constitutional inquiries

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instead of the strength of the government’s interest and evidence that a particular law advances that interest. This “history-only” test has support from conservative judges and Justices, including several appointed by President Donald Trump.

We argue that advanced firearm technologies, specifically 3D-printed weapons called “ghost guns,” demonstrate why a purely historical approach to constitutional judging is inadequate when applied to new, emerging technologies. Ghost guns are unserialized, do-it-yourself weapons available with no background checks. They can be undetectable by standard security equipment when built from plastic using 3D printers. Because plastic guns have no precedent in American history, we argue that historical gun laws are inadequate tests for their constitutionality even if legal scholars or judges attempt to reason by analogy. This reality challenges the viability of a purely historical test and demonstrates why the prevailing, two-step approach is appropriate.

Existing literature either highlights the limitations of a purely historical test or proposes creative regulations for ghost guns. This article uses 3D-printed guns as a case study to illustrate the shortcomings of the history-only test. We proceed in three Parts. First, this article outlines the consensus approach to deciding Second Amendment cases and notes the history-only alternative. Second, it describes the features of plastic 3D-printed guns that make them categorically different from any technology in history. Relatedly, we discuss proposed legislative responses to the dangers that ghost guns pose. Third, this article argues why a purely historical test fails as a manner of constitutional inquiry using three examples of historical gun regulations. We end by demonstrating why a two-step inquiry is more appropriate.

After *Heller*, a Consensus on How to Review Gun Laws

Since 2008, more than 1,300 cases have raised Second Amendment claims in the lower courts.⁵ To resolve these matters, judges adopted a two-step methodology that asks whether regulated activity falls within the scope of the Second Amendment and, if so, whether the regulation survives means-end scrutiny.

At step one, courts assess whether a challenged law falls into one of several, non-exhaustive categories of “longstanding” laws that *Heller* deemed “presumptively lawful.”⁶ If it does, the law is constitutional and the inquiry ends. But if the regulation is not “longstanding” and implicates the protections of the Sec-

and tradition.”¹⁰ He suggested that modern-day regulations that can reasonably be tethered to a historical analogue should be deemed constitutional, and courts have said this accords with the practice in other areas of constitutional law.¹¹ This article posits that some technologies, namely 3D-printed ghost guns, stretch judicial analogies beyond the breaking point, necessitating judicial reliance on evidence of burden and benefit to settle the matter.

This methodological dispute is no mere academic exercise. Besides elevating the architect of the history-only approach to the Supreme Court, President Trump has appointed numerous judges who support the approach and advocate for retiring the consensus

We argue that advanced firearm technologies, specifically 3D-printed weapons called “ghost guns,” demonstrate why a purely historical approach to constitutional judging is woefully inadequate when applied to new, emerging technologies. Ghost guns are unserialized, do-it-yourself weapons available with no background checks. They can be undetectable by standard security equipment when built from plastic using 3D printers. Because plastic guns have no precedent in American history, we argue that historical gun laws are inadequate tests for their constitutionality even if legal scholars or judges attempt to reason by analogy. This reality challenges the viability of a purely historical test and demonstrates why the prevailing, two-step approach is appropriate.

ond Amendment, then courts assess whether the law burdens the “core” right and to what degree. Laws that impose severe burdens on the core right may be subject to strict scrutiny, while laws that impose lesser burdens are generally assessed under intermediate scrutiny. The lower courts have been near unanimous in embracing this approach.⁷

Most conservative judges have followed the prevailing test.⁸ But a growing contingent have advocated for an alternative approach that was first outlined by then-Judge Kavanaugh in a follow-on case to *Heller*. He argued that courts should look solely to text, history, and tradition to surmise the meaning of the Second Amendment. Now on the Supreme Court, Justice Kavanaugh telegraphed his continued preference for a historical test in an April 2020 New York City gun case.⁹

According to Justice Kavanaugh, this history-only test could adequately address new firearm technologies if courts simply “reason by analogy from history

methodology. The Trump administration’s Department of Justice has begun presenting solely historical argumentation in Second Amendment litigation, even when binding circuit precedent mandates the two-step test and application of heightened scrutiny.¹²

With the administration’s thumb on the scale and conservative Justices eager to decide another gun case,¹³ the Supreme Court may have an opportunity to resolve this dispute in the near future. This article uses 3D-printed ghost guns to explain why the Court should not upset the circuit consensus.

The Threat of 3D-Printed Ghost Guns

Ghost Guns are so named because they lack serial numbers, and thus cannot be traced by law enforcement. This makes their history and the ways they are acquired invisible. The parts to build ghost guns can be obtained or made without background checks, which makes them attractive to prohibited users and others who would fail these checks. Moreover, plastic

3D-printed ghost guns are largely undetectable by x-ray machines, and may be smuggled into high-security environments, like airplanes.

Some ghost guns are assembled using kits in which a key part — the “frame” or “receiver” — is sold in an unfinished, not-yet-functional form. Federal regulators at the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) have ruled that these unfinished frames or receivers do not trigger the regulations that apply to operable guns or finished frames and receivers. Kits with unfinished components are essentially unregulated even though they can be used to easily build guns that are functionally indistinguishable from traditional firearms.¹⁴

This article focuses on plastic ghost guns built with 3D-printers because their elusive capabilities represent a significant challenge to historical analogizing. Using digital blueprints called computer-aided design (CAD) files, 3D-printers layer sheets of plastic to create three-dimensional objects. They make components that fit with other gun parts to form functional firearms or they can print fully-operable, self-contained guns. While the composite plastic materials are not as durable as the materials used to build traditional guns, the plastic in 3D-printed guns may be undetectable by traditional security means.

Ghost guns are frequently used in the commission of crimes. In January 2020, a couple in Rhode Island was accused of murdering a woman using a 3D-printed gun.¹⁵ A year before that, police arrested a man who carried a “hit list” of politicians and who built a rifle using a 3D-printed receiver after failing a background check.¹⁶ American law enforcement agencies are recovering hundreds of illegal ghost guns from sea to shining sea, including in California, where 30 percent of guns ATF recovers are ghost guns.¹⁷ The number of federal prosecutions involving ghost guns may also indicate the scope of the problem. According to one report, more than 2,500 ghost guns were connected to criminal activity in 114 federal cases from 2010 to April 2020.¹⁸

There is a high risk that ghost guns will be used to support future criminal activity. Law enforcement has recovered plastic guns in carry-on luggage at the Reno airport,¹⁹ in Australia,²⁰ Sweden,²¹ and the United Kingdom.²² Journalists in Israel smuggled a 3D-printed gun into the Israeli Knesset during a speech by Prime Minister Benjamin Netanyahu.²³ And, although the Transportation Security Administration (TSA) has intercepted 3D-printed guns at airport checkpoints,²⁴ legislators and scholars warn that as 3D-printing technology advances, the size and shape of printed firearms will make detection impossible.²⁵

Further, the sale of ghost guns is likely to increase during national emergencies. Giffords Law Center reported that online purchases of untraceable and undetectable gun kits and 3D printers have skyrocketed since the outbreak of COVID-19.²⁶ Yet, federal officials have left this advanced technology largely free of regulation.

An Absence of Federal Leadership Allows the Ghost Gun Threat to Proliferate

The elusive capabilities of 3D-printed ghost guns threatens to undermine existing federal legislation. The Undetectable Firearms Act of 1988 (UFA) prohibits the manufacture, sale, or possession of firearms that are not detectable by security screening devices.²⁷ With the support of the National Rifle Association, President Reagan signed the UFA into law in 1998 and Congress renewed it in 2003 and 2013. Given the ubiquity of downloadable manufacturing instructions, 3D printers allow users to easily make plastic guns that, while illegal under the UFA, can be smuggled into secure areas.

The ability to self-print plastic firearms also undermines the federal background check law. The Gun Control Act of 1968 (GCA) requires the central component of a firearm that houses the firing mechanism — the frame or receiver — to bear a serial number, and it cannot be purchased from a dealer without a background check. But a firearm is defined as any weapon that will “expel a projectile by the action of an explosive” or “the frame or receiver of any such weapon.”²⁸ Those who use 3D-printing technology to create their own frames or receivers, do not submit to background checks, and generally do not serialize gun components, making their weapons invisible to law enforcement.

The extent of the ghost guns problem has only widened due to federal inaction. While some members of Congress have urged ATF to address the panicked buying of ghost guns, including by introducing comprehensive reform,²⁹ Congress has failed to act. Simultaneously, President Trump’s Department of Justice has acted to allow the online distribution of blueprints to build 3D-printed guns to anyone with a computer. Leadership on this issue has fallen to the states. Two dozen states have sued the Trump administration to stop the distribution of downloadable guns. In California,³⁰ Connecticut,³¹ and Washington,³² legislatures have passed their own bans on undetectable ghost guns.

If courts are to determine whether such bans on 3D-printed ghost gun inhibit a protected Second Amendment right then, under the history-only test, there must be a comparable historical technology or law. We next explore the challenges of using a purely

historical framework to resolve the constitutional question.

Why A Purely Historical Test Doesn't Work for 3D-Printed Ghost Guns

Beginning in the colonial period and continuing since the ratification of the Second Amendment in 1791, federal, state, and local governments have regulated the kinds of firearms that law abiding citizens may possess as well as the purposes for which they can be used.³³ The Founders could not have contemplated 3D-printing technology capable of producing functional, undetectable firearms made of plastic. To state the obvious, no study of eighteenth or nineteenth century statute books, however comprehensive, will reveal on-point statutory precedent for contemporary responses to this modern threat. But supporters of the history-only test would suggest this simply means that judges must “reason by analogy” when assessing such legislation.

The problem with historical analogies is not the particular analogy that might be invoked. Any crafty litigator or judge can dust off historical laws that share superficial similarities to modern-day firearm regulations. The problem may be the more basic one of fit. Especially where historical laws, and the context in which they were passed, present glaringly distinguishable features upon closer review. Without a rule of relevance, the methodology fails to constrain the ideological preferences of adjudicators and threatens the stability of constitutional decision-making. This issue is particularly threatening in the Second Amendment context where judicial rulings striking down regulations could have catastrophic consequences.

To assess the viability of a purely historical approach, we evaluate historical laws that could arguably serve as analogues to restrictions on undetectable, 3D-printed guns. The goal here is not to provide a taxonomy of potential approaches to judicial analogies, but to note the difficult legwork that analogies must do under any purely historical test.

Historical Metal Detection and 3D-Printed Guns

The first metal detector was invented in 1881 by Alexander Graham Bell, and it was not until four decades later that the first portable metal detector was invented. Modern metal-detection systems were not widely adopted until even later. The first airport to install metal detectors did so in 1970, and other airports only gradually followed suit. So it is not surprising that the first federal law prohibiting plastic guns that cannot be detected by a magnetometer, the UFA, was not passed until the end of the twentieth century, in 1988.

We assume, for two reasons, that under a text, history, and tradition approach, legislative precedent

dating to the end of the twentieth century would be insufficiently “longstanding” to establish a presumption of constitutionality.³⁴ First, courts have not held laws of this vintage as sufficiently grounded in history to be presumptively lawful. This is true even though *Heller* endorsed laws dating to the nineteenth and early twentieth centuries as longstanding. Second, scholars have argued that judicial reliance on contemporary laws to ascertain the original meaning of the Constitution contradicts the goals of originalism.³⁵ We also assume that 3D-printed guns are “arms” for purposes of Second Amendment analysis, since they are closer in functionality to the handguns *Heller* deemed protected than to other weapons courts have held are “arms,” from stun-guns to nunchakus, dirk knives, and police batons.³⁶ So if the Undetectable Firearms Act is not sufficiently longstanding to justify a 3D-printed gun ban under a history-only test, the question becomes whether there are other, older laws sufficiently analogous to uphold federal firearm detection laws without assessing the burdens imposed on gun rights and the benefits for public safety. We examine some potential candidates and conclude there are not.

Quality Control Laws

Beginning in the 1970s, quality-control laws aimed at prohibiting the sale of cheap, fragile guns called “Saturday Night Specials” that were widely available to criminals. States like New York maintained “minimum standards of quality control” by setting specifications as to the materials used to make guns. Melting point tests were used to make sure that guns were made from strong metals.³⁷

These quality-control laws, like the UFA, date only to the latter half of the twentieth century, and may be insufficiently old to establish the UFA’s constitutionality under a history-only approach. But they arguably have roots in older laws dating to the early nineteenth century that required guns to pass safety and quality inspections before being sold. These laws authorized “provers of gun barrels,” to “try the strength” of firearms and mark them as passing inspection.³⁸ To reinforce these safe use standards, governments imposed criminal penalties, asset forfeiture, and even incarceration.

Whether dating to the nineteenth century or the 1970s, however, these laws are a sub-optimal analogue to laws prohibiting undetectable firearms made of plastic. True, throughout American history, laws have regulated materials used to build guns, just as the laws aimed at 3D-printed guns regulate guns made of plastic. The goals of these laws, however, are entirely different: through history, quality-control laws have aimed to protect users by outlawing guns that might

malfunction or explode in a user's hands, or otherwise degrade over time. In the colonial era, these laws were tied to ensuring guns were of sufficiently high quality to guarantee militia readiness in instances of attack. In the 1970s, these laws were designed to limit the availability of inexpensive and low-quality guns fueling urban crime. By contrast, regulation of the materials used in guns to ensure they can be detected by a magnetometer aim at preventing them from being smuggled into secure locations.

Quality-control laws touch on the materials from which guns are built for very different reasons. As such, they are an inadequate analogue for contemporary laws that prohibit undetectable plastic guns.

Sensitive Place and Time Laws

If bans on undetectable firearms aim at preventing guns from being smuggled into secure locations, then perhaps an adequate analogy can be found in laws that historically have banned guns from "sensitive places." *Heller* itself deemed laws "forbidding the carrying of firearms in sensitive places such as schools and government buildings" as longstanding and presumptively lawful. If sensitive-place bans are constitutional, and bans on undetectable guns are a means to effectuate them, should that resolve the question in favor of their constitutionality under a history-only test?

We would argue not. It is true that "sensitive place" laws have throughout history regulated the presence of guns in enumerated locations like schools and government buildings, and also in places like courtrooms, polling places, houses of worship, and public parks. The reasons for banning guns in sensitive places vary. In a courtroom tensions run high leading to escalation into an armed confrontation. At polling places, such laws aim to prevent voter intimidation. By contrast, modern metal detection laws are principally concerned not with *where* a firearm is possessed, but with the materials that make the gun detectable in the first instance. While the UFA does require that firearms be detectable by security screeners "commonly used at airports," it does not limit the ban on undetectable guns to airports — or any other particular locations. It makes possession of an undetectable, plastic gun illegal *anywhere*, including even in the home, where *Heller* tells us the Second Amendment right is at its apex. Laws like the UFA prohibit possession of a particular *type* of gun anywhere, not the possession of *any* type of gun in one particular place. Thus, place-based laws prohibiting people from bringing guns into particular locations seem an inadequate comparator to resolve constitutional questions concerning laws that prohibit possession of a particular variety of gun, even in the home.

Moreover, were bans on guns in sensitive places sufficiently analogous to laws like the UFA because banning undetectable guns helps effectuate bans on guns in particular places, it would be difficult to discern a limiting principle. If banning gun possession by minors might contribute to keeping guns out of schools, would sensitive place laws provide an adequate historical analogy for minimum age laws? If banning gun possession by criminal defendants helps effectuate bans on guns in courtrooms, under a history-only test would sensitive place laws justify bans on possession by those accused, but not convicted of certain crimes? As with these examples, it proves too much to suggest that a ban on carrying any type of gun into one particular place justifies banning possession of a single type of gun everywhere.

Open Carry Laws

A final analogy for undetectable gun bans might be historical laws permitting open carry or preferring openly visible guns to concealed arms. Certainly, there is ample evidence that concealed weapons have been historically disfavored, and *Heller* itself noted that the vast majority of courts through nineteenth century found bans on concealed weapons constitutional.³⁹

But here, too, the analogy breaks down. First, *Heller* only cited historical decisions from southern state courts that endorsed open carry. The South's open carry tradition differed in practice from most of the country. In the northeast, mid-west and western portions of the country, the civilian carrying of guns in public was broadly prohibited. Scholars have also argued that Southern gun culture was borne out of a shameful past of slavery and hypermasculinity.⁴⁰ Slaveowners openly carried weapons in fear of slave uprisings and skirmishes with Native Americans. Post-Emancipation, concealed carry was denounced as dishonorable because it was thought to escalate routine disagreements or public confrontations. For Southern open-carry laws to serve as the appropriate analogy to justify modern bans on undetectable (or concealed) guns would require relying on a tradition that was limited to one region and that advanced entirely different goals than those served by undetectable gun bans today.

Second, basing constitutional judgment calls today on the traditions of a bygone era may be problematic in a context of evolving social mores. Today, those who wish to carry guns in public overwhelmingly prefer concealed to open carry. As late as the 1980s, concealed carry was illegal in almost every state; today it is legal in all 50 states. The trend is notably toward deregulation of concealed carry. As recently as 2014, all but four states required a license to carry a con-

cealed gun in public. Now, fifteen states have eliminated the licensing requirement altogether. A robust political movement claims not only that it is good policy to eliminate concealed carry licensing, but that doing so is compelled by the Second Amendment. This so-called “constitutional carry” movement suggests that any restrictions on carrying hidden guns violate the Constitution.

Ultimately, open carry analogies expose the reality that history rarely speaks with a unified voice. Making contemporary constitutional problem-solving depend on analogies to distinguishable regulations and gun cultures is problematic. Like quality control and sensitive place laws, Southern open carry laws are an inadequate historical analogue for modern regulations addressing modern technological developments.

A Two-Step Method Makes More Sense

In contrast to the uncertainty that historical analogies present, the settled two-step test that courts have embraced ensures that constitutional inquiry reflects modern realities while also taking into account the historical tradition of gun regulation. The test does look to history and tradition to evaluate whether a law is sufficiently longstanding to be deemed constitutional on the threshold inquiry. And when confronted with laws that implicate Second Amendment rights, this test evaluates the relationship between the stated interests served by the regulation and the method employed to achieve that interest. Notably, a majority of conservative judges have also adopted this approach. Legal scholars have persuasively argued that this approach is consistent with *Heller's* teachings, aligns the Second Amendment with other constitutional rights, and meaningfully protects the right to keep and bear arms.⁴¹

Several flaws with a history-only test are avoided under the prevailing methodology. First, a solely backward-looking test for constitutionality freezes gun regulation at some unspecified past point. If modern policymakers may constitutionally adopt only regulations closely tied to historical antecedents, then modern gun laws are limited to the types of laws policymakers adopted in the past, regardless of the changes in technology and societal norms. Consider state laws that permit the use of “smart gun” technology, which uses biometric recognition technology, to prevent gun theft and unauthorized use. Or the federal law against possession of a firearm on an airplane, which present safety challenges foreign to earlier means of transportation. A history-only text would restrict policymakers from effectively tailoring regulations, like these, based on contemporary policy needs because of circumstances un contemplated centuries ago.

Moreover, the history-only test requires judicial analogies that are not based in reason but intuition and inarticulable hunches. The late Justice Scalia popularly used this approach in analogizing obscene video games to reading a scary book,⁴² and comparing GPS tracking to “a constable concealing himself in the target’s coach in order to track its movements.”⁴³ Attempting to judge by analogy poses as many problems in the Second Amendment context as it does in the First or Fourth, making it reasonable to ask whether attempting to adjudicate constitutional questions by resort to such comparisons would inevitably open the door to judicial activism or introduce subjective, outcome-driven decisions by judges.

By contrast, in allowing evidence of the government interests advanced by a particular gun law, as well as its effectiveness in advancing those interests, the prevailing methodology’s use of heightened scrutiny allows courts to assess how effectively modern gun laws respond to modern problems, including the causes and patterns of contemporary gun violence.

Conclusion

Gun regulations have coexisted with gun rights since the Founding — and even before, from the 1328 Statute of Northampton, through the development of modern carry laws. A test looking purely to history, then, will find historical antecedents for many of the gun regulations enforced today. But modern gun technology, modern society, and modern patterns of gun violence also differ dramatically from their historical forebears, and present modern policymakers with new challenges that warrant new solutions. To limit the policy solutions to serious contemporary problems to those developed in an earlier era would hamper the states’ ability, as laboratories of democracy, to develop new solutions to new problems and combat modern gun violence. Moreover, judges would have to employ analogical reasoning to guns and gun laws from vastly different points in history, ignoring that the passage of time may have altered their foundational meaning and significance. As demonstrated within the context of advanced technologies like 3D-printed plastic guns, a purely historical test is insufficient.

Note

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