CTRL, HATE, PRINT: terrorists and the Appeal of 3D-Printed Weapons

Veilleux-Lepage, Y.

Publications

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Yannick Veilleux-Lepage

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This summer two separate individuals with links to the extreme right were arrested or convicted in the United Kingdom (UK) on charges including offenses related to 3D-printed firearms. On 14 June, Dean Morrice, a former Army driver and neo-Nazi was sentenced to 18 years in prison for ten terrorism related offences. A 2020 police raid of his home led to the discovery of chemical precursors to make explosives, two 3D printers, and instructions on how to manufacture 3D-printed firearms and parts. Police also found a non-viable 3D-printed weapon leading them to issue a warning over potential terrorist use of 3D-printed firearms. Two days later, it was announced that a 15-year-old was due to stand trial on six terrorism related offences after being caught

with digital documents that provided information on how to make explosives from household material and firearms using a 3D printer.

Considering these developments, this perspective investigates whether 3D-printed weapons represent a game-changer for the manufacturing of improvised firearms, before briefly investigating the legality of these firearms in various jurisdictions. Instances of terrorist use of 3D-printed firearms are discussed along with factors that may impede and promote the adoption of this technology.

A Brief History of Improvised Firearms

The use of improvised firearms by violent non-state actors long predates the emergence of additive manufacturing technologies (a process described in the next section). As such, 3D printing technologies do not necessarily represent a true paradigmatic shift in the ability of non-state actors to manufacture firearms.

The Polish resistance movement during the Second World War produced cheap and simple machine pistols which could be manufactured in small workshops by inexperienced gunsmiths. Similarly, the Pacific Ocean theatre saw the use of highly effective and easily manufactured improvised shotguns known in the Philippines as *paltik* or *sumpak*. During the Cyprus Emergency, the National Organization of Cypriot Fighters manufactured crude single- shot pistols made from a 20mm shell strapped to a wooden pistol grip, along with some slightly more sophisticated improvised firearms. More recently, the Provisional Irish Republican Army produced scores of improvised firearms, ranging from .22LR revolvers, to pen guns, shotguns and rifles. The Troubles also saw the emergence of the 'Avenger' submachine gun manufactured by Ulster loyalist paramilitary groups. Other groups such as the FARC and Chechen rebels also supplemented their arsenals with improvised firearms. Improvised or modified firearms have also been used extensively by lone actors. For example, both Mohamed Merah and Amedy Coulibaly employed reactivated firearms – deactivated weapons which are

illegally modified to become operational again – to commit terrorist attacks in France in 2012 and 2015, respectively.

Likewise, criminals have a long and bloody history of manufacturing or acquiring improvised firearms for reasons ranging from limited funds or access to conventional firearms, to the desire for a weapon that is difficult to trace or easier to conceal. According to a 2018 report on improvised and craft-produced small arms improvised or modified firearms accounted for nearly 90 percent of firearms used during the commission of a crime in the UK between 2011 and 2012.

That said, the manufacturing of improvised firearms is not only the prevue of nefarious elements such as terrorists and criminals. Gun enthusiasts and hobbyists have also engaged in not only the manufacturing of improvised firearms, but also the creation of detailed how-to guides. As early as the 1960s, newsletter publishers adapted unclassified US Army manuals, often merely copying, and rebranding step-by-step instructions on how to make improvised firearms. Notable examples included a set of detailed plans on how to construct a submachine gun for under $7 US using parts from hardware stores and showcasing how to create *paltik* or *sumpak* shotguns. More recently, Philip A. Luty, a British designer of homemade firearms and advocate for universal firearm ownership, sought to widely disseminate his how-to book entitled *Expedient Homemade Firearms: The 9mm Submachine Gun*. While Luty was sentenced to four years in prison for illegal firearm construction in the 1990s, and the subject of other investigations at the time of his death, his publication remains widely available on the internet and has inspired numerous copycat designs. Many other books, magazine articles, and printed publications containing instructions for the manufacture of improvised firearms have been digitized and are readily available online. In fact, several hobbyists – mostly based in the United States (US) where the production of improvised firearms remains legal – have well curated social media accounts. They routinely share technical know-how related to the manufacturing of

improvised weapons, using a variety of techniques including computer numerical control (CNC) milling, investment casting, or 3D printing.

3D Printing Technology

3D printing is an additive manufacturing process in which a material (often but not exclusively thermoplastic) is deposited, joined, or soldered, typically layer by layer, to create a three-dimensional object. The technology is not new; it was used extensively by designers as early as the 1980s for so-called 'rapid prototyping' – the quick creation of scale models of physical parts. However, in the early 2010s, the cost of 3D printers decreased while the production quality, the ease of use, and the amount of tutorial and technical know-how easily available increased significantly, allowing hobbyists access to this technology. Today, there are numerous high-quality 3D printers on the market for under $1,000 US, with entry level models retailing for as little as $200 US.

3D-Printed Firearms

In 2013 Defense Distributed – an open-source hardware organisation – released the digital files for the Liberator, the world's first almost entirely 3D-printed firearm. The Liberator consists of fifteen 3D-printed parts and a common nail, which acts as the firing pin. The Liberator took its namesake from the FP-45 Liberator – a single shot US manufactured pistol during the Second World War and intended to be dropped *en masse* on Europe for use by resistance forces against the Axis occupier. While Defense Distributed had previously released digital files for the printing of AR-15 and AK-47 magazines, the Liberator attracted a great deal of media and law enforcement attention. Within 48 hours of being released, the files were downloaded more than 100,000 times.

Despite media attention surrounding the creation of the Liberator, its effectiveness and the danger it might pose to the operators of the firearm were subjected to much debate. Along with the plans, Cody Wilson, the founder of Defense Distributed, posted a video on YouTube of himself firing the pistol. Law enforcement agencies from around

the world printed their own copy and tested it with mixed results. The Austrian Interior ministry concluded that the pistol was indeed a deadly weapon, but the US Bureau of Alcohol, Tobacco, Firearms and Explosives found that the performance of the pistol depended greatly on the type of plastic used with some of the pistols they manufactured exploding during testing.

Undeterred, the 3D printing community has produced several other weapons since the release of the Liberator files. In 2013, files for the printing of a .22LR calibre semi-automatic rifle were posted on a popular 3D-printed design website. Like the Liberator, apart from a handful of parts, namely, the firing control group, firing pin, buffer spring, and a metal insert for case extraction, all parts were made of plastic. A video of an updated model, called the Grizzly 2.0 was later released and showed an unnamed Canadian hobbyist firing 14 rounds before his rifle sustained irreparable damage.

In recent years, a large digital community of 3D printing and firearm enthusiasts have emerged and coalesced on various social media platforms, despite attempts by mainstream tech companies to ban the sharing of plans for 3D-printed firearms on their platforms. Moreover, a litany of websites and chat servers emerged to fill the void left by these crackdowns. At the same time, plans for 3D-printed firearms have become significantly more sophisticated in comparison to the Liberator.

Today, 3D-printed firearms fall into one of three categories: fully 3D-printed firearms (F3DP); hybrid 3D-printed firearms; and parts kit completions (PKC). F3DP contain no pressure-bearing non-printed components, and few metal components. Most of these firearms are only viable for a limited number of shots before they malfunction. The Liberator is the archetype example of such a firearm.

Hybrid 3D-printed firearms rely on some readily available and unregulated components like steel tubing, metal bar stocks, and springs. This partly explains why U-bolts routinely appear in the ‘often bought together”’ section of Amazon listing for

thermoplastic filaments. Hybrid 3D-printed firearms offer a comparable performance to some mass-produced firearms. One of the most popular examples of a Hybrid 3D-printed firearms is the FGC-9 (which stands, incidentally, for 'F**k Gun Control' with the nine being a reference to the 9mm calibre ammunition it uses), which can be produced for less than $400 US using readily available springs screws, nuts, and bolts. A Spanish workshop fabricating 3D-printed firearms, recently dismantled by authorities, appears to have been fabricating hybrid 3D-printed firearms.

PKC, the final category, includes firearms that have been assembled with a combination of 3D-printed receivers and factory-made pressure-bearing components such as the barrel and slide. PKC are typically the most reliable type of firearms that use 3D-printed parts. However, unlike hybrid 3D-printed firearms, PKC are often more expensive and involve parts which might be restricted by law. Nonetheless, PKC have gained popularity in the US since the beginning of the COVID-19 pandemic as supply chain disruptions and increased customer demands for firearms have led to firearm shortages.

Legality of 3D-Printed Firearms

The legality of 3D-printed firearms depends largely on which aforementioned categories they fall into, and on the jurisdiction in which they are manufactured and/or possessed. It is also important to distinguish between creating instructions on how to manufacture a 3D-printed firearm, possessing a copy of such instructions, and building such a firearm.

In the US, the legality of sharing the files required to print firearms is murky. Immediately after the release of the Liberator files, Defense Distributed found itself within the crosshairs of the US State Department which requested the removal of the files on the ground that they might be in violation of the Arms Export Control Act and International Traffic in Arms Regulations because it could be accessed in countries where the US has embargoed the sale of weapons. However, Wilson appealed this

ruling arguing that it not only violated the Second Amendment to the US Constitution, which protects the right to keep and bear arms, but also that it violated the First Amendment which prevents the government from abridging the freedom of speech. Roughly put, building upon a series of court cases in the 1990s aimed at challenging restrictions on the exportation of cryptography from the US – which ruled that source code was 'speech' – Wilson argued that the distribution of the Liberation files was protected by his First Amendment rights. Several legal scholars have since debated the merit of these arguments ad nauseum.

Since the release of the Liberator files, Defense Distributed has been embroiled in a series of legal challenges until the State Department settled and agreed to permit the distribution of blueprints for 3D firearms. However, a coalition of state attorneys filed an injunction and won. In response, Defense Distributed began exploiting a loophole in the State Department's policy and launched DEFCAD, a large online library of downloadable design files. While DEFCAD is only available to adults residing in the US, the files contained in the library are also available on popular torrent websites and elsewhere.

Globally, other jurisdictions have installed clearer prohibitions against the possession or sharing of the files required to print firearms. For example, in January 2021 Singapore passed new legislation that prohibited the ownership of digital blueprints of firearms or firearms parts. Likewise, the Australian state of New South Wales passed a law in 2015 which criminalised the possession of the files required to print firearms.

Rules regarding the manufacturing of 3D-printed weapons are also equally convoluted and depend largely on jurisdiction and the type of firearms. For example, in the US, the Bureau of Alcohol, Tobacco, Firearms and Explosives allows individuals to make guns at home "solely for personal use," provided they meet certain specifications. These specifications (broadly speaking) permit the creation of hybrid 3D-printed firearms, but

fully 3D-printed firearms containing no metal parts and thus able to walk-through a metal detector would violate the Undetectable Firearms Act of 1988.

Legislation covering the manufacturing of 3D firearms can be divided in three categories. The first category is countries where such manufacturing is either legal or largely unregulated, such as the US. The second category is countries where the manufacturing of firearms is prohibited or heavily restricted regardless of the method of production. For example, in Canada, the Criminal code makes it a criminal offense to manufacture any firearms or ammunition regardless of the method without authorisation to do so. Similarly, there is a de facto ban on 3D-printed firearms in Germany and the UK since both countries prohibit all forms of firearm manufacturing by unauthorised individuals. The third category is countries that have introduced or updated existing firearm control legislations specifically to tackle this emerging question and to prohibit the manufacturing of 3D-printed firearms, such as Singapore.

The effectiveness of legislation aimed at prohibiting the possession of digital files for the printing of firearms or the manufacturing of such firearms is also rather uncertain. As previously described, these files remain easily available online and – if the almost two decade long and largely futile copyright enforcement efforts by the music and film industries have taught us anything – difficult to remove. Ultimately, online content is difficult to manage and once the 'cat is out of the bag,' it tends to stay out.

3D printing enthusiasts have also argued that prohibiting the manufacturing of 3D-printed firearms would not have much impact in terms of stopping criminal elements getting their hands on firearms. Those intent on committing a crime (or a terrorist act) can generally access a firearm by easier means, either by acquiring them legally but under false pretence, as did Anders Breivik and Brenton Tarrant, purchasing them from criminal networks, reactivating deactivated prop firearms, stealing firearms from lawful owners, or manufacturing them using other techniques. With regard to the last point, it is worth noting that Defense Distributed has not concentrated its attention exclusively

on additive manufacturing but also recently released a desktop CNC mill machine specifically designed to manufacture AR-15 semi-automatic receivers – which are classified by the US government as a firearm. A review of this machine in the technology magazine *Wired* called it "absurdly easy to use."

Terrorist use of 3D-printed Firearms

The spectre of terrorists using 3D-printed firearms to unleash fresh atrocities emerged almost immediately after the release of the Liberator files. In a rather sensationalist stunt, a reporter for the British tabloid, *The Mail on Sunday,* printed a copy of the *Liberator*, travelled on board the London-Paris Eurostar train, and assembled the firearm (minus the firing pin) in the train lavatory. The article goes on to decry how easily a terrorist could do the same.

This potential threat of terrorist use of 3D-printed weapons did not manifest itself in any concrete fashion until the Halle synagogue shooting. On 9 October 2019, Stephan Balliet attempted to force his way into a synagogue in Halle, Germany, armed with a series of improvised firearms while livestreaming the event. According to his manifesto which he uploaded prior to the attack to Meguca – a now defunct German-language imaging board similar to 8chan – Balliet's arsenal was composed of a longsword (not used during the attack), a series of pipe bombs and improvised explosive devices, and six firearms – five of which were improvised firearms, including two Luty 9mm submachine guns. While these weapons were mostly constructed out of steel, aluminium, and wood, Balliet used some 3D-printed components. One of the Luty, which he called 'the Plastic Luty' was comprised of a 3D-printed grip, feed ramp, trigger clip, torch barrel, and magazines which could allegedly be used interchangeably with the other steel-made Luty in his possession. In addition, a picture of one of the two slam-fire shotguns in his arsenal also features a 3D-printed shell holder attachment.

According to his manifesto, one of Balliet's motivations was to "prove the viability of improvised weapons" – essentially this functioned partly as a proof-of-concept attack.

However, during the attack Balliet's firearms appeared to repeatedly struggle with numerous malfunctions, leading him to exclaim in frustration on his livestream, "I have certainly managed to prove how absurd improvised weapons are!" That said, it is unclear whether the malfunctions were a result of the firearm designs or of low-quality homemade primer and gunpowder.

Whilst Balliet considered his experimental use of improvised firearms a failure, Daniel Koehler warns that it would be imprudent to simply dismiss this threat, arguing that "[f]or his target audience, however, Balliet likely did accomplish enough to show the potential of such weapons and to trigger more development and fine-tuning of the manufacturing process by others." Moreover, in her fantastic book on terrorist use of emerging technologies, Audrey Kurth Cronin argues that the effectiveness of a new technology is by no means the only determinant of whether a new technology will be seized upon by terrorists and insurgents. Instead, she argues that symbolic resonance is an important factor amongst several, which can make a particular technology, "more potent than just their tactical effectiveness."

The idea of 3D-printed firearms appears to be imbued with significant symbolic resonance within the extreme right. In his analysis of posts on the neo-Nazi internet forum Stormfront, Robbie Fordyce found great enthusiasm amongst users for both additive manufacturing in general and 3D-printed firearms specifically. Early discussions about the Liberator, often accompanied with links to the Liberator files, praised the pedigree of the white inventors. Additive technology was also routinely framed as a catalyst for a future change in the economic system, either by allowing a few skilled white workers to gain economic advantage over their adversaries and monopolise the means of production for their 'folk,' or by allowing white communities to be self-sufficient and thus isolate themselves from 'corrupting' elements. Stormfront users also hypothesised (and debated acrimoniously) about the broader societal impact of 3D-printed firearms. Some users have hailed these innovations as a means by which a violent overthrow of governments could be accomplished, whereas others

have expressed a concern that this technology may change the demographic of gun ownership in the US by allowing their adversaries to arm themselves.

Another indication of the symbolic resonance of 3D-printed firearms can be found in a criminal complaint filed in October 2020 against Timothy Watson, a West Virginia man selling 3-D printed auto sears disguised as wall hooks. An auto sear allows a user to convert a legal AR-15 semi-automatic rifle into an illegal, fully automatic rifle. According to the complaint, Watson's auto sears were advertised on Boogaloo Facebook pages using coded language to signal his allegiance to the loosely organised but heavily armed extremist anti-government group. It is also alleged that amongst Watson's customers was Steven Carrillo, a man accused of committing two attacks against law enforcement officers in California.

Looking ahead

Analyses of the threats posed by potential terrorist use of 3D-printed firearms need to consider the existing limitation of these additive technologies and manufacturing techniques, along with alternative (and often easier) means by which terrorists can obtain firearms. However, this needs to also be balanced by an understanding and recognition that the appeal of 3D-printed weapons far exceeds their effectiveness. The simple act of choosing a 3D-printed weapon to commit a terrorist act can have a large symbolic meaning in and of itself. Right wing extremists might be particularly attracted to the prospect of being able to manufacture their own weapons without any government oversight, evading any attempt by the authorities at tracing purchases of weapons. It this case, the manufacture of unregulated firearms resonates with the groups' opposition to government control.

Moreover, and perhaps most importantly, it is important to recognise the phenomenal speed at which additive technologies are being developed and democratised. Entire communities of hobbyists and enthusiasts have formed around these technologies and will continue to push the boundaries of what is possible and what is legal. In order to

properly understand how this threat will evolve in the future, it is therefore crucial to remain keenly aware of the technological developments arising from within these communities, as terrorist innovation rarely if ever occurs in a vacuum. Perhaps one of the most striking lessons from the Report of the 9/11 Commission was the suggestion that the failure to prevent the attack was partly a failure of imagination – a situation wherein something seemingly predictable and undesirable was not properly planned for. Indeed, as additive manufacturing technologies continue to decrease in price and increase in quality, and with existing legislations doing little to curb access or dissemination of the technical know-how required to manufacture 3D-printed firearms – a task which in and of itself might be futile – the sometimes faulty Liberators, Balliet's perceived failure, and the absence of highly salient cases of terrorist use of 3D printers should not lull us into a sense of false security.

About the author

Dr. Yannick Veilleux-Lepage is an Assistant Professor of Terrorism and Political violence at Leiden University in The Netherlands. He is also a Senior Research Associate of the Canadian Network for Research on Terrorism, Security and Society, a Fellow of the Royal Historical Society, and a member of the ICCT journal editorial board. Dr. Veilleux-Lepage's research interests include terrorist innovation and uses of emerging technologies, the creation of online narratives and propaganda which fosters or normalises terrorism; historical antecedents to terrorism; and far-right extremism and the transnational links of far-right group.