FIRST AMENDMENT PROTECTION FOR COMPUTER ASSISTED DESIGN FILES

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A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Arts in the School of Journalism and Mass Communication (Interdisciplinary Health Communication).

Chapel Hill
2019

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ABSTRACT

Mariam Badiei Turner: First Amendment Protection for Computer Assisted Design Files
(Under the direction of Victoria S. Ekstrand and Amanda Reid)

This thesis examines the possible extent of First Amendment protection for computer assisted design (CAD) files, the pages of code that instruct a 3-D printer on what to print. This thesis draws a comparison between traditional computer code and CAD files, and first asks whether the factors relied upon by courts in determining whether computer code receives First Amendment protection can be applied to CAD files. This thesis also reviews the foundational theories of the First Amendment, and asks whether CAD files fulfill the objectives of the First Amendment under the reasoning of each theory. It concludes by arguing that CAD files should be treated in the same manner as computer code – receiving presumptive protection under the First Amendment, and requiring that any regulation or restriction be content-neutral and narrowly tailored.

ACKNOWLEDGEMENTS

I am truly grateful for my committee members, Dr. Amanda Reid, Dr. Victoria Ekstrand, and Ashley Messenger for the never-ending support they have provided throughout this process. I would also like to thank my co-advisors, Dr. Reid and Dr. Ekstrand, again for their patience and for the invaluable mentorship and feedback they gave me. I would also like to thank Dr. Michael Hoefges for his guidance through the beginning of this project and for his support throughout my time here.

I would also like to thank David Ardia and Mary-Rose Papandrea for fueling my interest in media law. Without them, I would never have gotten to this point, and I am forever grateful for everything they have done for me.

TABLE OF CONTENTS

CHAPTER I

Introduction

In 2015, central Nepal was hit by an earthquake that devastated the area.[1] Around 9,000 people were killed, thousands more were injured, and much of the infrastructure was destroyed by the magnitude 7.8 quake.[2] Entire villages were flattened, densely populated cities were demolished, and historical monuments crumbled. Around 3,000,000 people, 1/10 of Nepal's population, were left homeless.[3] In the wake of this disaster, the standard relief efforts were implemented, along with a different approach from an organization called Field Ready, a non-profit humanitarian group dedicated to "transforming international aid so it is faster, cheaper and better than current alternatives."[4] Rather than dealing with the hassle and inevitable breakdown of traditional supply chains, or with the logistics of attempting to bring everything they may possibly need, the team from Field Ready just carries a 3-D printer with them.

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[1] *Nepal Earthquake: Eight million people affected*, UN says, BBC (April 28, 2015), https://www.bbc.com/news/world-asia-32492232

[2] John P. Rafferty, *Nepal earthquake of 2015 Magnitude, Death Toll, Aftermath, & Facts*, ENCYCLOPEDIA BRITANNICA (April 18, 2018), https://www.britannica.com/topic/Nepal-earthquake-of-2015.

[3] Sudip Kaini, *Great Earthquake wipes out Barpak*, THE KATHMANDU POST (May 4, 2015), https://web.archive.org/web/20150504211559/http://www.ekantipur.com.np/the-kathmandu-post/2015/04/29/news/great-earthquake-wipes-out-barpak/275829.html.

[4] *About Field Ready*, FIELD READY, https://www.fieldready.org/about-us (last visited April 10, 2019).

In multiple areas, Field Ready is able to use the printer to solve problems that would have taken a prohibitively long time to solve otherwise. They print a replacement part for an electrical socket that had broken, leaving a hospital ward without power – the alternative would have involved waiting for the unique part, which came from a kit that was originally sold in Italy and was currently off the market, to be found and shipped to the hospital while the patients waited without power.[5] It took Field Ready around two days to measure the part, turn the measurements into a CAD file, and print it out. Mistakes could be rectified immediately – when the first version was not a perfect fit, the measurements were revised and reprinted without delay. Two days for a working solution, compared to however long it would have taken for the part to be found, and then make it to Nepal from Italy.

At other hospitals, Field Ready prints medical equipment. Disposable tweezers, malleable wrist braces, and umbilical cord clamps are a few of the items in short supply, but these are easily replaced using the 3-D printer. The team is not limited by location or proximity to an electrical grid – the printer can be powered by jumper cables connected to a car battery, if needed. Nor is their aid limited to medical facilities. For example, in one community, they printed new pipe fittings for the pipes that had been damaged by the quake, impacting the fresh water supply. In another, they designed and printed cribs to replace broken ones that had become dangerously sharp in places. They were able to design solutions to many problems on the same day that they learned about them. The logistical issues that typically plague humanitarian aid become virtually nonexistent.

[5] Sam Davies, *Industry 4.0 manufacturing principles leveraged in disaster areas by Field Ready*, TCT MAGAZINE (June 28, 2018), https://www.tctmagazine.com/api/content/aaed7f72-7ab1-11e8-b2bb-12408cbff2b0/.

2015 was an interesting year for 3-D printing news. That same year, hearing the term "3-D printer" might have conjured up the image of a machine that can print infinite plastic guns. This is partially due to the actions of Defense Distributed, a company that creates and distributes "Wiki Weapons." Defense Distributed came into the public eye in 2013, when the United States Department of State demanded that a Computer Assisted Design ("CAD") file that the company had published, containing the digital schematics for a completely 3-D-printed gun, be removed from the internet immediately.[6]

The Department of State cited the International Traffic in Arms Regulation ("ITAR") as their reason, arguing that the release of this CAD file on the internet constituted a "transfer of … controlled defense articles and related technical data" and was therefore illegal to export out of the country.[7] Posting the files online made it possible for virtually anyone with an internet connection, U.S. based or not, to download and create a 3-D-printed gun.[8] By spreading this code online, Defense Distributed played the role of an arms manufacturer and distributer in the eyes of the U.S. government.[9]

While the thought of untraceable, single-use weaponry becoming commonplace is not a comforting one, the actions of the U.S. government may be cause for greater concern. Forbidding the distribution of this specific code may be an action supported by many, but it sets an

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[6] Dan Nosowitz, *U.S. State Department Tells Defense Distributed to Take Down 3-D Printed Gun Plans*, POPULAR SCIENCE (May 9, 2013), https://www.popsci.com/technology/article/2013-05/us-state-department-tells-defense-distributed-take-down-3-d-printed-gun-plans.

[7] Andy Greenberg, *State Department Demands Takedown Of 3-D-Printable Gun Files for Possible Export Control Violations*, FORBES (May 9, 2013, 2:36 PM), https://www.forbes.com/sites/andygreenberg/2013/05/09/state-department-demands-takedown-of-3d-printable-gun-for-possible-export-control-violation/

[8] *Id.*

[9] *Id.*

unsettling precedent. It is, at the most basic level, governmental control over information shared online.

Defense Distributed was eventually permitted to publish their files online, but while the federal government has reversed course, multiple states have taken up arms against the proliferation of these files.[10] As the Electronic Frontier Foundation puts it, "[t]he states are arguing that the government should be required to prevent publication because foreigners abroad might do things that the U.S. opposes and they are arguing that the courts themselves should order the designs to be kept offline because people might make the guns and use them in domestic crimes."[11]

Consider this mentality applied to a CAD file containing the schematics for a prosthetic hand.[12] Perhaps the individual components can be used for multiple purposes, including as parts of a single use weapon – following the logic of the argument against publishing the aforementioned weapon schematics, distributing the file containing the prosthetic hand schematics would be almost as dangerous. After all, an enterprising foreign criminal could easily repurpose the valves and levers this file prints into something dangerous – lethal weapons can

[10] Cyrus Farivar, *8 states take aim at 3-D gun company, sue to get files off the Internet*, ARS TECHNICA (July 30, 2018, 3:36 PM), https://arstechnica.com/tech-policy/2018/07/20-states-take-aim-at-3d-gun-company-sue-to-get-files-off-the-internet/.

[11] Kit Walsh, *Internet Publication of 3-D Printing Files About Guns: Facts and What's at Stake*, ELEC. FRONTIER FOUND. (Aug. 2, 2018), https://www.eff.org/deeplinks/2018/08/internet-publication-3d-printing-files-about-guns-facts-and-whats-stake.

[12] *3-D-Printable Prosthetics*, NIH 3-D PRINT EXCHANGE, https://3dprint.nih.gov/collections/prosthetics (last visited April 10, 2019).

already be created by combining pipes, fertilizer, and rocks, so it stands to reason that if the schematics in a file can be weaponized, they will be.[13]

Taking this logic one step further, the publication of CAD files containing the schematics of a printable 3-D printer would be an even greater danger than schematics for the weaponry itself.[14] RepRap is a self-propagating 3-D printer made almost entirely of 3-D-printable parts, and is designed to be low-cost and simple to reproduce.[15] The existence of these files means that a single 3-D printer in the hands of a hostile entity allows for the creation of infinite printers, and by extension, infinite printable weapons.

Looking at these two examples of how this technology can be used, it becomes clear that the potential impact of 3-D printing technology is extremely great – both for good and bad. One device, given the right CAD file, could help provide fresh water for a village, create an undetectable "ghost gun," make a custom splint for a broken wrist, and so much more.[16] For the purposes of this thesis, the CAD file – the instructional page of code that tells a 3-D printer what to print – is the most important part of the technology. These files are similar to traditional

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[13] Peter Mansoor, *Improvised explosive device*, ENCYCLOPEDIA BRITANNICA (Aug. 30, 2018), https://www.britannica.com/technology/improvised-explosive-device (explaining that a working explosive device can be made out of fertilizer and a sealed pipe)

[14] *Handbook of Research In Mass Customization and Personalization* 568 (2009) (citing Ed Sells et al., *RepRap: The Replicating Rapid Prototyper: Maximizing Customizability by Breeding the Means of Production*,; Vasilis Kostakis & Marios Papachristou, *Commons-Based Peer Production and Digital Fabrication: The Case of a RepRap-Based, Lego-Built 3-D Printing-Milling Machine*, 31 TELEMATICS AND INFORMATICS 434, 441 (2014).

[15] REPRAP, https://reprap.org/wiki/RepRap (last visited April 10, 2019).

[16] *See* S. Saripalle et al., *3-D Printing for Disaster Preparedness: Making Life-Saving Supplies on-Site, on-Demand, on-Time*, 2016 IEEE GLOBAL HUMANITARIAN TECHNOLOGY CONFERENCE (GHTC) 205 (Oct. 2016); *See also* Angela Carella, *Stamford moves closer to banning ghost guns*, STAMFORD ADVOCATE (Mar. 6, 2019), https://www.stamfordadvocate.com/local/article/Stamford-bans-ghost-guns-13667276.php; *Grewal files suit over 3-D-printed "ghost guns"* NJTV NEWS (July 30, 2018, 5:00 PM), https://www.njtvonline.org/news/video/grewal-files-suit-over-3d-printed-ghost-guns/.

computer code, and thus, resemble "speech" as the U.S. court system has defined it.[17] However, courts have refused to decide whether or not CAD files fall into that protected category.[18] That aforementioned "potential impact" means that allowing CAD files to remain in this ambiguous, mostly unprotected state could have unfortunate consequences.

CAD files can be used to create dangerous things, but restricting their creation and distribution because of one possible use is not the appropriate course of action.[19] A regulation may be targeted at keeping undetectable firearms out of the hands of dangerous people, but it can have an impact far greater than what it is meant to, potentially chilling speech and innovation that could help many.[20] For example, New Jersey has a gun control statute on the books that is ostensibly meant to make it more difficult for dangerous individuals to acquire untraceable guns.[21] Whether the gun is made untraceable through the removal of a serial number, or through its creation via 3-D printer does not matter – both are illegal to create, own, or provide it to somebody in New Jersey.[22]

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[17] *See generally* Bernstein v. U.S. Dept. of Justice, 176 F.3d 1132 (9th Cir. 1999); Junger v. Daley, 209 F.3d 481 (6th Cir. 2000).

[18] Defense Distributed v. U.S. Dept. of State, 838 F.3d 451 (5th Cir.2016) (declining to address the question of whether the CAD files at issue were protected speech).

[19] *See* Distributed v. Grewal, No. 1:18-CV-637-RP, 2018 U.S. Dist. LEXIS 224225, at *3 (W.D. Tex. Nov. 13, 2018) (regarding a New Jersey statute banning the distribution and use of CAD files that could be used to make a firearm.)

[20] *See* N.J. Stat. § 2C:39.9(l) (2019) (making it a crime to distribute CAD files containing schematics that could be used to create firearms or firearm components to anyone in New Jersey without a firearm manufacturing license)

[21] Matt Arco, *Murphy signs new gun control law for N.J. It comes right after the nation's latest mass shooting.*, NJ.COM (Nov. 8, 2018), https://www.nj.com/politics/2018/11/murphy_signs_new_gun_control_law_says_nj_has_natio.html; Thomas DeLorenzo, *New Jersey governor signs gun control bill to prohibit 3-D printed firearms*, JURIST (Nov. 9, 2018, 9:25 PM), https://www.jurist.org/news/2018/11/new-jersey-governor-signs-gun-control-bill-to-prohibit-3d-printed-firearms/.

[22] *See* N.J. Stat. § 2C:39.9(l) (2019).

The problem arises from the language used in the section of the statute providing criminal penalties for distributing or using CAD files containing schematics that "may be used to program a three-dimensional printer to manufacture or produce a firearm, firearm receiver, magazine, or firearm component."[23] The term "firearm" is defined in part as "any … device in the nature of a weapon from which may be fired or ejected any solid projectable ball, slug, pellet, missile or bullet, or any gas, vapor or other noxious thing."[24] Read literally, it is technically a crime in New Jersey to share a CAD file containing schematics for a single screw, being that a screw could possibly be used as a component of a larger firearm. The section of the statute dealing with CAD files contains no requirement that the file containing the "firearm component" actually be meant to facilitate the creation of a firearm, or even a requirement that the file be used at all.[25]

This illustrates the main problem with allowing the unfettered regulation of CAD files without the protection of the First Amendment – the restrictions can encompass neutral, safe, or extremely beneficial creations, and this has the potential to deter someone who wishes to create a beneficial file that might fall under the vague definitions in a regulation. Vague regulations can have a chilling effect on potential speakers, causing them to censor their own speech for fear of accidentally venturing into criminal conduct, and this is something that courts have consistently found abhorrent.[26] Classifying CAD files as First Amendment protected speech would help

[23] N.J. Stat. § 2C:39.9(l) (2019).

[24] N.J. Stat. § 2C:39.1(f) (2019)).

[25] N.J. Stat. § 2C:39.9(l)(2) (2019)).

[26] *See* Reno v. ACLU, 521 U.S. 844, 872 (1997); *see also* Gentile v. State Bar of Nev., 501 U.S. 1030, 1048–1051, (1991).

ensure that any regulations targeting them were content-neutral and narrowly tailored, and would avoid the potential chilling of the creation and proliferation of beneficial files.

To restrict the distribution of most traditional speech, the government carries a "heavy burden of showing justification for the imposition of such a restraint."[27] Restricting the distribution of a CAD file, however, does not necessarily trigger the same requirements. 3-D printing, and the CAD files that make it possible, are a relatively new technology, and the question of whether the files are protected by the First Amendment is an unanswered one. CAD files are a type of written code, instructing a 3-D printer to take certain actions, but they are not exactly the same as most computer code. CAD files visually resemble computer code, but may be more analogous to a blueprint or a fairly technical instruction manual – a series of parameters for an object, describing the exact location of each edge and corner, and the specific materials and colors it would be composed of.[28]

This uncertain classification is interesting for a few reasons, but one is relevant for the purposes of this thesis. If a CAD file shares enough relevant properties with computer code to be considered a type of computer code, it stands to reason that it should be protected under the First Amendment. Computer code is protected speech, according to the Courts, and cannot be restricted except in very limited circumstances.[29] This thesis will analyze the cases that solidified computer code as protected speech, as well as the theories informing the decisions of the Courts, to understand what properties were considered by the Courts in their decisions. If computer code and CAD files share a significant number of properties that appear relevant to classifying

[27] New York Times Co. v. United States, 403 U.S. 713 (1873)

[28] J. Dale Prince, *3-D Printing: An Industrial Revolution*, 11 J. OF ELEC. RES. IN MED. LIBRARIES 39 (2014)

[29] *See* Near v. Minnesota ex rel. Olson, 283 U.S. 697 (1931); *see also* Bernstein v. U.S. Dept. of Justice, 176 F.3d 1132 (9th Cir. 1999)

something as "protected speech," this thesis will argue that CAD files should be treated in the same manner as computer code – that is, they should be presumptively protected, and only lose protection in extraordinary situations.

Symbolic Speech

When the government attempts to restrict or regulate speech, as well as certain types of conduct, the restriction must adhere to certain requirements. This section details the cases and history behind the requirements that would apply to a restriction imposed on computer code – specifically, the "symbolic speech" cases. This section will also explain the requirements themselves.

The seminal case is *United States v. O'Brien*, which upheld a law providing that any person who "forges, alters, knowingly destroys, knowingly mutilates, or in any manner changes" his draft card was committing a crime.[30] David O'Brien burned a copy of his draft card as part of a political protest, and was convicted and sentenced under the aforementioned law. While O'Brien argued that the burning of his card was a political protest, and thus protected speech under the First Amendment, the Supreme Court could not "accept the view that an apparently limitless variety of conduct can be labeled 'speech' whenever the person engaging in the conduct intends thereby to express an idea."[31]

The Court then laid out a test that would help determine whether the government's interest in regulating conduct outweighed the speech interest in situations where the line between

[30] United States v. O'Brien, 391 U.S. 367, 370 (1968).

[31] *Id.* at 376.

speech and conduct was unclear.[32] This test asks whether a regulation: (1) furthers an important or substantial governmental interest, (2) is unrelated to the suppression of free expression, and (3) is restricting First Amendment freedoms no more than is essential.[33]

The O'Brien test was refined and clarified by *Spence v. Washington*, where the Court held that a flag desecration statute was unconstitutional.[34] A student had been convicted for placing a duct-tape peace sign on a U.S. flag and hanging it upside down, and the Court relied on O'Brien in evaluating the situation. The Court asked whether Spence's conduct was "sufficiently imbued with elements of communication," and the test they decided on asked whether "a particularized message [was] present [within the conduct], and in the surrounding circumstances [was] the likelihood … great that the message would be understood by those who viewed it[?]"[35]

Later, *Texas v. Johnson* both upheld the Spence test and applied the O'Brien test, holding that the burning of an American flag was expressive conduct[36] and that the law criminalizing the act was content-based.[37] The governmental interest in protecting the flag did not outweigh the speech interest inherent in the act of burning the flag.[38]

These cases did not deal with computer code directly, but they are important in the cases that do so – because computer code straddles the line between pure speech and speech-like

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[32] *Id.* at 377.

[33] *Id.* at 376.

[34] Spence v. Washington, 418 U.S. 405 (1974).

[35] *Id.* at 411.

[36] Texas v. Johnson, 491 U.S. 397, 404 (1989).

[37] *Id.* at 420.

[38] *Id.*

conduct, and because it is often unclear to someone unfamiliar with computer code who the "speaker" or "listener" may be, some variation of the Spence test is often applied to decide whether computer code should receive First Amendment protection at all, and the O'Brien test is applied afterwards.[39]

CAD Files and Computer Code

The question of whether computer code, specifically, was protected by the First Amendment first appeared in the district courts in 1996, through a series of cases brought by Daniel Bernstein that involved the exportation of encryption code and the application of restrictive licensing requirements to that code.[40] This case, along with the question of whether computer code was protected speech, reached the circuit courts in 1999.[41] Both times, computer code was held to be protected First Amendment speech, and any restrictions were required to meet the same high standard that a prior restraint on traditional speech must meet. In the decision, the lower court described the code in question as "[s]peech that is potentially subject to the prior restraint of licensing[.]"[42] They found that this was a valid First Amendment claim, and in this case, code was not presumptively excluded from protection.[43]

Today, the protection afforded to most computer code is fairly clear, but a new technology has entered the ring, and is raising the same questions. Litigation related to computer

[39] *See* Junger v. Daley, 8 F. Supp. 2d 708, 717 (N.D. Ohio 1998).

[40] Bernstein v. United States Dept. of State, 922 F. Supp. 1426 (N.D. Cal. 1996).

[41] Bernstein v. United States Dept. of Justice, 192 F. 3d 1308 (1999).

[42] *Bernstein*, 922 F. Supp. at 1437.

[43] *Id.*

assisted design (CAD) files, the lines of code that instruct a 3-D printer to generate a physical object, has made it to the courts, and it is unclear what protections the code should receive.[44] The files themselves bear many similarities to computer code, but the purpose of the CAD file is to create an individual, disconnected physical product, while computer code cannot breach the boundaries of the computer it is placed on.[45] When computer code stops running, whatever task it performs ends as well – even the most infectious computer virus cannot reach into the physical world.[46] CAD files, on the other hand, are used to create something that can be completely separated from the file, and still function properly. The CAD file is the means to the end, while traditional computer code is the ends in itself.

Background and Technical Details

This section will consist of a brief history of 3-D printing, and some explanation about how CAD files relate to the final 3-D printed product. The specific details of the file format can vary, and certain file types are more suited to different types of modeling.[47] The term "CAD file" will be used to refer to all file formats that, when given to a 3-D printer, can produce a physical product.

3-D printing in its modern form has been around for nearly four decades. In 1981, Dr. Hideo Kodama invented a method for fabricating three-dimensional models made of photo-

[44] *See* Defense Distributed v. U.S. Dept. of State, 838 F.3d 451 (5th Cir. 2016).

[45] M.M.M. SARCAR ET AL., COMPUTER AIDED DESIGN AND MANUFACTURING (1st ed. 2008).

[46] *Id.*

[47] Dibya Chakravorty, *4 Most Common 3-D Printer File Formats in 2019*, All3-DP (February 10, 2019), https://all3dp.com/3d-printing-file-formats/.

sensitive plastic.[48] While techniques for constructing three-dimensional models had existed before this particular innovation, they were subtractive methods. What set his method apart was the additive nature of the process, where instead of cutting parts away from a larger whole, new material was introduced to a final product.

Additive manufacturing moved one step closer to its current iteration when Chuck Hull, co-founder of 3-D Systems Corporation, filed a patent for a stereolithography fabrication system – a method of layering and curing plastic to form 3-D models that is more similar to the method used by modern, consumer-oriented 3-D printers.[49] He also created the STL file format, a comparatively rudimentary format for creating CAD models without any color or texture.[50]

The method used by most 3-D printers today is fused deposition modeling, a technique developed in 1988 by S. Scott Crump.[51] Plastic is extruded from a moving nozzle and layered over and over, until it has formed a solid, three-dimensional object.

Twenty-five years after S. Scott Crump filed his patent, the United States Department of State demanded that a Computer Assisted Design ("CAD") file containing the digital schematics for a completely 3-D-printed gun be removed from the internet immediately.[52] The Court

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[48] Hideo Kodama, *Automatic Method for Fabricating a Three-dimensional Plastic Model with Photo-hardening Polymer*, 52 REVIEW OF SCIENTIFIC INSTRUMENTS 1770 (1981), https://aip.scitation.org/doi/10.1063/1.1136492.

[49] U.S. Patent No. 4575330A (Apparatus for production of three-dimensional objects by stereolithography, assigned to Charles W. Hull, first issued August 8, 1984).

[50] Chua Chee Kai et al., *Interface between CAD and Rapid Prototyping Systems. Part 1: A Study of Existing Interfaces*, 13 INT. J. ADV. MANUF. TECHNOL. 566 (1997).

[51] U.S. Patent No. 5121329A (Apparatus and method for creating three-dimensional objects, assigned to S. Scott Crump of Stratasys Inc, first issued October 30, 1992).

[52] Dan Nosowitz, *U.S. State Department Tells Defense Distributed to Take Down 3-D Printed Gun Plans*, POPULAR SCIENCE (2013), https://www.popsci.com/technology/article/2013-05/us-state-department-tells-defense-distributed-take-down-3-d-printed-gun-plans.

acknowledged the possibility of a First Amendment issue, but declined to explore the issue any further.

Broadly, 3-D printing is the process of using a 3-D printer to create parts and models using instructions from a computer file.[53] The file is created by using some form of Computer Assisted Design/Drafting ("CAD") software to create a virtual model of the final product, which is then converted into a text-based file format that can be read and understood by the 3-D printer. The final file is a set of directives that details the exact coordinates of each corner and plane of the final product, the unit of measurement, the color, and the material that the printer will be instructed to use.[54]

The progress of 3-D printing technology over the past few years mirrors the rise of another disruptive innovation – personal computers. This thesis will attempt to show that CAD files, the code that makes it possible to use a 3-D printer, are comparable to traditional computer code, the code that makes it possible to use a personal computer, and that the First Amendment should come into play when the government is restricting the spread of CAD files just as it would for a traditional piece of computer code.

Computer code consists of one of many programming languages arranged in such a manner as to instruct a piece of software or hardware to perform a certain task.[55] CAD files are similar in many aspects, but do contain some important differences. Mainly, the code contained within the CAD file could be considered an amalgamation of traditional computer code

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[53] Emanuel Sachs et al., *Three-Dimensional Printing: The Physics and Implications of Additive Manufacturing*, 42 CIRP ANNALS 257 (1993).

[54] Hod Lipson, *AMF Tutorial: The Basics (Part 1)*, 1 3-D PRINTING AND ADDITIVE MANUFACTURING 85 (2014).

[55] *See generally* Roy Harkow, *Computer and Programming Basics*, ESSENTIAL AUTOLISP®: WITH A QUICK REFERENCE CARD AND A DISKETTE 581 (1996).

(instructions) and pure imagery. The code, while visually similar to many types of computer code, is functionally similar to a paint-by-numbers product – the file contains the visual parameters of a physical product, including the color, the dimensions, and the material, all in a text-based format readable by a 3-D printer.[56]

This difference is fairly superficial on its face, but may actually provide a reason to apply First Amendment protections to CAD files in a few situations where computer code loses this protection.[57] Specifically, the inherently expressive nature of CAD files makes it easier for the wider public to understand what the file is "saying," circumventing the main argument courts have made against protecting computer code – that the functional nature of the code precludes it from receiving First Amendment protections. [58] A string of code that tells a computer to open a file might not appear speech-like to someone unfamiliar with the language, but a CAD file is describing the physical properties of the final object – color, size, and other parameters.[59] At first glance, CAD files appear to contain expressive elements that traditional computer code does not, and these elements weigh in favor of protecting CAD files as expressive speech.

The Value and Use of 3-D Printing Technology

This section will delve into some of the ways that modern 3-D printing technology is used, the many fields it is used in, and give some background as to why the CAD files that make these uses possible should be protected by the First Amendment.

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[56] Sachs et al., *supra* note 53.

[57] Bernstein v. U.S. Dept. of Justice, 176 F. 3d 1132 (Ninth Circuit Court of Appeals 1999).)

[58] *Id.*

[59] Chua Chee Kai et al., *Interface between CAD and Rapid Prototyping Systems. Part 1: A Study of Existing Interfaces*, 13 INT. J. ADV. MANUF. TECHNOL. 566, 573 (1997).

Academic Usage

3-D-printing technology has multiple uses in various academic settings. In early education, the ability to generate educational aids that are adapted to the individual needs of each student is invaluable.[60] This holds true in more specialized education as well – custom adaptive devices can be created as-needed to ensure that students with specialized needs are not excluded from any given curriculum.[61] The cost of custom assistive devices can be astronomical, but access to a 3-D-printer makes it possible to cut that cost and create lightweight, usable tools at the moment they are needed.[62] For example, a wheelchair tablet mount can cost over $100.00 and only work for specific devices, but printing one costs pennies and allows for immediate customization and use.[63]

3-D-printing technology can play a valuable role in higher education as well. Currently, aerospace engineering students can use 3-D-printed aircraft models instead of metal ones in their final projects, allowing them to test their skills without the cost, waste, and margins of error of the metal model.[64]

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[60] Michael Eisenberg, *3-D Printing for Children: What to Build Next*, 1 INT. J. OF CHILD-COMPUTER INTERACTION 7 (2013).

[61] Erin Buehler et al., *ABC and 3-D: Opportunities and Obstacles to 3-D Printing in Special Education Environments*, PROCEEDINGS OF THE 16TH INTERNATIONAL ACM SIGACCESS CONFERENCE ON COMPUTERS & ACCESSIBILITY 107 (2014).

[62] *Id*. at 108.

[63] *Id.*

[64] Dror Artzi & Ehud Kroll, *Enhancing Aerospace Engineering Students' Learning with 3-D Printing Wind-tunnel Models*, 17 RAPID PROTOTYPING JOURNAL 393 (2011).

The technology can also be used to visually model mathematical concepts and proofs, making the field more accessible and understandable.[65] In *Visualizing Mathematics Using 3-D Printers*, the researchers used 3-D-printing technology to create a physical representation of Newton's Theorem of Sphere Packing, a theorem that shows that the maximum number of identical spheres that can touch a central sphere without overlapping is twelve.[66] The theorem is a complex one, and was only proved in 1953, but 3-D-printing technology allows the formula to be converted to a CAD file, represented visually, and printed.[67] For anyone, especially a visual learner, this is extremely valuable. To summarize, 3-D-printing technology and the CAD files that make it possible play a valuable role in the academic realm and have the potential to be even more useful in the future.

Medical Usage

In healthcare, 3-D-printing technology appears in an astonishing number of places, and is not limited to printing plastic or metallic objects.[68] To list a few ways that the technology has impacted the medical field – 3-D-printing has been used to create medical-grade orthopedic and cranial implants, surgical instruments, dental restorations such as crowns, and various external

[65] Oliver Knill & Elizabeth Slavkovsky, *Illustrating Mathematics Using 3-D Printers* (2013), https://arxiv.org/pdf/1306.5599.pdf.

[66] *Id*. at 2.

[67] *Id*.

[68] Helena N. Chia & Benjamin M. Wu, *Recent Advances in 3-D Printing of Biomaterials*, 9 JOURNAL OF BIOLOGICAL ENGINEERING 4 (2015); *see also* Philip Tack et al., *3-D-Printing Techniques in a Medical Setting: A Systematic Literature Review*, 15 BIOMEDICAL ENGINEERING ONLINE 115 (2016); *see also* Kolesky et al., *infra* note 95.

prosthetics.[69] 3-D-printed anatomical models are used by surgeons to study and prepare for complex surgeries.[70] Medical students are doing the same during their schooling.[71] This technology is becoming a valuable resource for the field and is changing the way we think about healthcare.[72]

In addition to these advances, this technology is making healthcare more accessible to people who truly need it.[73] A high-school student created and distributed a CAD file for a finger splint, printable in around 10 minutes and costing $.02 of plastic.[74] Designs for scalpel handles, forceps, and other medical equipment are free and available online.[75] In areas where medical

[69] *3-D Printing of Medical Devices*, U.S. Food & Drug Administration, https://www.fda.gov/medicaldevices/productsandmedicalprocedures/3dprintingofmedicaldevices/default.htm.

[70] Hammad H. Malik et al., *Three-Dimensional Printing in Surgery: A Review of Current Surgical Applications*, 199 JOURNAL OF SURGICAL RESEARCH 512 (2015).

[71] Kah Heng Alexander Lim et al., *Use of 3-D Printed Models in Medical Education: A Randomized Control Trial Comparing 3-D Prints versus Cadaveric Materials for Learning External Cardiac Anatomy*, 9 ANATOMICAL SCIENCES EDUCATION 213 (2016).

[72] *See How 3-D printing is revolutionizing healthcare as we know it*, TECHCRUNCH, http://social.techcrunch.com/2018/04/05/bioprinted-organs-skin-and-drugs-how-3d-printing-is-revolutionizing-healthcare-as-we-know-it/; *see also Medical 3-D Printing: Innovation in Healthcare*, CELLINK (Jun. 9, 2017), https://cellink.com/3d-printing-innovation-healthcare/; *see also* Tack et al., *supra* note 87; *see also* Nicholas A. Giovinco et al., *A Novel Combination of Printed 3-Dimensional Anatomic Templates and Computer-Assisted Surgical Simulation for Virtual Preoperative Planning in Charcot Foot Reconstruction*, 51 THE JOURNAL OF FOOT AND ANKLE SURGERY 387 (2012).

[73] Ahmed M.S. Ibrahim et al., *Three-Dimensional Printing in Developing Countries*, 3 PLAST. RECONSTR. SURG. GLOB. OPEN (2015), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4527617/pdf/gox-3-e443.pdf.)

[74] Michael Molitch-Hou, *High School Senior 3-D Prints Finger Splint*, 3-D PRINTING INDUSTRY (2013), https://3dprintingindustry.com/news/high-school-senior-3d-prints-finger-splint-12561/; *see also* Splint for injured finger (research only), Thingiverse.com (December 13, 2012), https://www.thingiverse.com/thing:37727.

[75] Ibrahim et al., *supra* note 73.

supplies are difficult to come by, and expensive to access, the ability to recycle unusable plastic into functional medical supplies is priceless.[76]

While obtaining the initial printer may present an obstacle, it is not as daunting as it seems. A complete, functional printer can be purchased for around $150.[77] One printer, and access to a set of open-source CAD files distributed by the 3-D-printing community, makes it a fairly simple task to print more 3-D-printers.[78] This potentially infinite replicability and the relative ease of use means that a single 3-D printer and the right CAD files could provide nearly limitless aid to areas that desperately need access to basic healthcare and first aid equipment, but currently do not receive it.

Biological Printing

The value of 3-D-printing technology does not end with the ability to print inorganic implants, surgical tools, prosthetics, and more 3-D-printers. Research into printing organic biocomponents is thriving, and scientists have successfully printed multiple pieces of organic

[76] *Four Ways 3-D Printing Is Improving Healthcare in Developing Countries*, ManufacturingTomorrow (September 7, 2018),, https://manufacturingtomorrow.com/news/2018/09/07/four-ways-3d-printing-is-improving-healthcare-in-developing-countries/12111/.

[77] *Monoprice Mini Delta 3-D Printer with Heated (110 x 110 x 120 mm) Build Plate, Auto Calibration, Fully Assembled for ABS & PLA + Free MicroSD Card Preloaded With Printable 3-D Models*, Amazon.com: Industrial & Scientific, https://www.amzn.com/B07CJQ3-D6L.

[78] Sells et al., *infra* note 110; *see also* Vasilis Kostakis & Marios Papachristou, *Commons-Based Peer Production and Digital Fabrication: The Case of a RepRap-Based, Lego-Built 3-D Printing-Milling Machine*, 31 TELEMATICS AND INFORMATICS 434 (2014).

material, including living skin and mouse organs.[79] Printed organic tissue, such as a trachea grown from a patient's own cells, are being used to treat patients.[80]

Bioprinting, the process of using 3-D-printing technology to create organic material, is a rapidly growing area of research.[81] There are bioprinting methods capable of fabricating 3-D tissue samples containing functional vasculature and multiple types of cells. [82] These samples are created by precisely printing and layering multiple materials, known as bioinks.[83]

Printed biological tissue opens up new possibilities for medical treatments, drug and cosmetic testing, and studies of wound healing.[84] In the long run, bioprinting technology has the potential to mitigate or solve the organ transplantation crisis.[85]

Artificial bones and bone augmentation implants are another area where 3-D-printing technology is playing a valuable role.[86] Artificial bone can be designed to perfectly match the skeletal structure of the patient, and once implanted, will either act as a functioning part of the skeleton or be converted to real bone by the patient. [87] Bone printing is a very promising area,

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[79] Léa J. Pourchet et al., *Human Skin 3-D Bioprinting Using Scaffold-Free Approach*, 6 ADVANCED HEALTHCARE MATERIALS 1601 (2017).

[80] Susan Young Rojahn, *Is 3-D Printing the Key to Artificial Organs?*, MIT TECHNOLOGY REVIEW, https://www.technologyreview.com/s/525161/artificial-organs-may-finally-get-a-blood-supply/.

[81] *3-D Bioprinting of Living Tissues*, WYSS INSTITUTE (2016), https://wyss.harvard.edu/technology/3d-bioprinting/.

[82] Kolesky et al., *infra* note 95.

[83] *Id.*

[84] Vijayavenkataraman et al., *infra* note 90.

[85] Vladimir Mironov et al., *Organ Printing: Computer-Aided Jet-Based 3-D Tissue Engineering*, 21 TRENDS IN BIOTECHNOLOGY 157 (2003).

[86] Hideto Saijo et al., *Maxillofacial Reconstruction Using Custom-Made Artificial Bones Fabricated by Inkjet Printing Technology*, 12 J ARTIF. ORGANS 200 (2009).

[87] *What happens depends on the material used to print the artificial bone*, XILLOC, https://www.xilloc.com/ct-bone/

and like bioprinting, it is only growing.[88] Large-scale bioprinting is not possible yet, but we are quickly moving towards that eventuality, and towards a world where organ donations become obsolete.[89]

The physical product produced through the use of a CAD file could be nearly anything: a piece of art, a body part,[90] another 3-D printer,[91] a medical device,[92] or a weapon.[93] Like the older computer code cases, restricting the distribution of a CAD file raises First Amendment concerns and threatens to chill progress and stifle speech within the communities that use and share these files, but CAD files are different enough from traditional computer code to warrant a closer look at the cases and theories that may influence how the court treats them in the future.

3-D printing is becoming easier, cheaper, and more convenient by the day. Many people utilize CAD files and 3-D printers on a regular basis. The potential inherent in this technology is immense. Suppressing communication among the groups of people to develop the files could be tantamount to chilling progress in a huge number of fields. We can print medical devices.[94] We

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[88] Natalja E. Fedorovich et al., *Organ Printing: The Future of Bone Regeneration?*, 29 TRENDS IN BIOTECHNOLOGY 601 (2011).

[89] Vladimir Mironov et al., *Organ Printing: From Bioprinter to Organ Biofabrication Line*, 22 CURRENT OPINION IN BIOTECHNOLOGY 667 (2011).

[90] *Bringing 3-D-Printed Prosthetic Hands to Third-World Countries*, PHYSICIAN'S WEEKLY, https://www.physiciansweekly.com/bringing-3d-printed-prosthetic-hands-to-third-world-countries/; *see also* S. Vijayavenkataraman et al., *3-D Bioprinting of Skin: A State-of-the-Art Review on Modelling, Materials, and Processes*, 8 BIOFABRICATION 032001 (2016).

[91] Ed Sells et al., *RepRap: The Replicating Rapid Prototyper: Maximizing Customizability by Breeding the Means of Production*, *in* HANDBOOK OF RESEARCH IN MASS CUSTOMIZATION AND PERSONALIZATION 568 (2009).

[92] Bas Wijnen et al., *Open-Source Syringe Pump Library*, 9 PLOS ONE e107216 (2014).

[93] Defense Distributed v. U.S. Dept. of State, 838 F. 3d 451 (2016).

[94] *The Ultimate List of What We Can 3-D Print in Medicine and Healthcare!*, THE MEDICAL FUTURIST (2017), https://medicalfuturist.com/3d-printing-in-medicine-and-healthcare.

can print tools, toys, and parts of the human body.[95] The technology is being integrated into multiple fields, and used in myriad ways, but the legal protections available to the actual code behind the product are still unclear.

The main problem stems from the fundamental nature of CAD files – they are computer code that become physical objects. The cases that have dealt with computer code in the past involved a product that began and ended as code, and did not stray beyond the confines of the device it was saved on. There are cases that have dealt with the output of code, specifically, the search engine cases, but those do not discuss the code itself. This gap is where CAD files seem to fit, and the goal of this thesis is to understand how.

Another goal of this thesis is to determine whether CAD files should be considered protected speech under the First Amendment at all, and if so, what theories and case law support this. While there are a number of scholarly works examining the impact 3-D printing may have on various intellectual property laws, and the impact those laws will have on the 3-D printing community, there is a gap in the literature when it comes to the question of whether CAD files warrant First Amendment protection at all.

Literature Review

The First Amendment protects speech.[96] Courts have, on multiple occasions, held that computer code is speech and is protectable as such.[97] This section first reviews the existing scholarship on protected speech and how it applies to computer code. Subsequent sections focus

[95] David B. Kolesky et al., *3-D Bioprinting of Vascularized, Heterogeneous Cell-Laden Tissue Constructs*, 26 ADVANCED MATERIALS 3124 (2014).

[96] U.S. CONST. AMEND. I.

[97] Brown v. Entm't Merch. Ass'n, 131 S. Ct. 2729 (2011).

on the legal issues surrounding 3-D printing and CAD files and on how scholars have written about the subject.

Computer code as speech

The question of whether computer code is speech under the First Amendment, and whether it should therefore be constitutionally protected, is one that has generated a fair amount of scholarly literature on every side. While court cases consistently find that computer code is protected speech, some argue that the analysis the courts are performing is flawed. Others argue that the courts are not extending enough protection to computer codes, permitting restriction far more often than they do in other cases.

One of the more common arguments against protecting computer code under the First Amendment has to do with the nature of code. Computer code is, as mentioned above, a set of instructions that must be read by a machine to have any effect. The functional nature of computer code is sometimes used to argue that it does not deserve the same protections as other types of speech.

Jorge R. Roig, a professor of Law at Charleston School of Law, believes that this doesn't matter. In his article, *Decoding First Amendment Coverage of Computer Source Code in the Age of YouTube, Facebook, and the Arab Spring*, Professor Roig argues that the functional nature of computer code should have nothing to do with the protection it receives.[98] He analyzes the benefits and drawbacks of this protection, and concludes that the core values inherent in the First

[98] Jorge R. Roig, *Decoding First Amendment Coverage of Computer Source Code in the Age of YouTube, Facebook, and the Arab Spring*, 68 NYU ANN. SURV. AM. L. 319, 338 (2012).

Amendment are all furthered by extending First Amendment protections to computer code, and even if all other reasons were ignored, this would be enough to warrant protection.[99]

Arguing along a similar vein in her article, *Is Data Speech?*, Jane Bambauer believes that freedom of speech necessarily includes the right to create knowledge, and suppression of that knowledge should be treated as an infringement on a person's constitutional rights.[100] Treating data as pure information, and analyzing it through multiple theories of the First Amendment, she concludes that, among other reasons, data should be protected when it is furthering a right to learn new things.[101]

Lee Tien, a prominent First Amendment scholar, takes another view here, focusing on algorithms, software, and their relation to natural speech conventions.[102] In *Publishing Software as a Speech Act*, Tien conceptualizes language as "sets of conventions" that bind a community through a shared method of expressing themselves.[103] This definition allows speechless, expressive actions to fall under the term "speech," and allows for coverage of acts that aren't generally considered language, like the burning of a draft card.[104] The social context, the shared meaning, the community understanding of the implications of some expressive action, that makes a language, and the language makes speech possible.[105]

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[99] *Id.* at 395.

[100] Jane Bambauer, *Is Data Speech?*, 66 STAN. L. REV. 57, 61 (2014).

[101] *Id.* at 77.

[102] Lee Tien, *Publishing Software as a Speech Act*, 15 BERK. TECH. LJ 629, 629 (2000).

[103] *Id.* at 643.

[104] *Id.* at 644.

[105] *Id.*

This idea leads to a very interesting logical conclusion – that communities like researchers, computer scientists, and artists speak through their work, and that work should be protected like speech. If one programmer expresses herself by creating and distributing a unique CAD file online, and another sees, understands, and is affected by that file, the code contained within should be treated like the verbal utterance or the non-verbal, but expressive burning of a flag.[106] In this article, Lee Tien also makes the distinction between First Amendment "coverage" and "protection."[107]

Another aspect of this debate is whether this protection, however it may work, applies to the output of a piece of computer code. While a piece of written code could be considered analogous to a piece of written literature, the output of that code is more difficult to classify. A video game, the direct result of millions of lines of computer code executing at the right moment, is protected under the First Amendment.[108] Would the chat-log generated by a basic chat-bot be given the same protection? Would algorithmic art be protected as expressive speech? Would the output of a 3-D printer get these same First Amendment protections?

Professor Stewart Benjamin addresses similar questions in his article, *Algorithms and Speech*.[109] He focuses on the effects of allowing the Free Speech Clause to protect decisions outsourced to algorithms, and concludes that any line drawn to exclude algorithms and their output from protection would be "unjustifiably arbitrary" and unnecessary.[110]

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[106] *Id.* at 711.

[107] Lee Tien, *Publishing Software as a Speech Act*, 15 BERK. TECH. LJ 629, 629 (2000).

[108] Brown v. Entm't Merch. Ass'n, 131 S. Ct. 2729 (2011).

[109] Stuart Minor Benjamin, *Algorithms and Speech*, 161 U. PA. L. REV. 1445 (2013).

[110] *Id.* at 1493.

Research Questions

The goal of this thesis is to determine whether Computer Assisted Design (CAD) files should be considered protected speech under the First Amendment, and if so, what theories and case law support this? To accomplish this, the following research questions will be addressed:

i. In cases where courts have recognized that computer code is protected speech, do they articulate a reason for this protection?
    1. Would that reason be applicable to CAD files? Why, or why not?
ii. Do accepted theories of free speech provide a clear justification for treating CAD files as speech?
iii. Based on the findings to the above questions, what does this suggest about the protection of CAD files under the First Amendment?
    1. Are there any clear reasons to exclude CAD files from protection?

Method/Procedure

The first research question will be answered by analyzing the major cases that have addressed computer code as speech, starting with the landmark case that established this precedent, *Bernstein v. Dep't of Justice*.[111] Other cases that will be analyzed to answer this question include: *Junger v. Daley*,[112] *Universal City Studios, Inc. v. Corley*,[113] and *Universal City Studios, Inc. v. Reimerdes*.[114] These cases were selected because they revolved around the

[111] Bernstein v. United States, 192 F.3d 1308 (9th Cir. 1999).

[112] Junger v. Daley, 209 F. 3d 481 (6th Cir. 2000).)

[113] Universal City Studios, Inc. v. Corley, 273 F.3d 429 (2d Cir. 2001).

[114] Universal City Studios, Inc. v. Reimerdes, 111 F. Supp.2d 294 (S.D.N.Y. 2000).

question of whether computer code, in various forms, received First Amendment protections. The circumstances of each case differed, but this core question is present in each one.

The second research question will be answered by reviewing the scholarship on the major theories of free speech. By analyzing the reasoning behind the protection of certain categories of speech and applying that reasoning to the features and uses of a CAD file, it should become apparent whether a CAD file can justifiably fall into the category of "protected speech."

The third research question will be answered by expanding on the analysis done for RQ1 and RQ2.

To gather cases and secondary legal sources, a progressively narrowing Westlaw search was performed, starting with just the term "computer code" and a Boolean modifier that allowed for variations of the term. After going through the first four pages of secondary sources and collecting those that appeared relevant, the search was changed to "algorithm" and "speech," modified in the same way. The cases and secondary sources that, at first glance, appeared to be the most significant were read, and terms from those sources were searched. This method was repeated for combinations of the terms "computer language," "code," "first amendment," "liability," "damage," "protection," "algorithmic output," "code as speech," "machine speech," "algorithmic speech," "artificial speech," "non-human speech," "computer assisted design file," "CAD file," and "3d printing."

This series of search terms was put through the UNC – Chapel Hill library website as well. The terms were also searched on Google Scholar, LexisNexis, and Bloomberg Law, IEEE Xplore and ProQuest Computing. The results from this search were more technical, but still very valuable. A search was also done on ArXiv, although that yielded results that ventured too far into the engineering side of the research.

Once all of these sources were gathered and reviewed, the primary footnotes were searched for any case law, as well as any other relevant articles that might have been missed. Most of the cases discussed in this paper came from this method, and from checking for cases that cited these cases. A Westlaw search of the terms mentioned above yielded no additional results.

Limitations

This thesis has one major limitation. There is, as of now, no case law addressing the treatment of CAD files under the First Amendment. Because this technology is relatively new, there are no cases directly on point. This limitation will be overcome by analogizing to older, similar cases, which dealt with technology that was as unfamiliar to the courts then as CAD files used for 3-D printing is today. While the courts haven't dealt with this specific type of file outside of the Defense Distributed case, they have had to address uses of computer code that were new at the time, and the methods they used to address that code should be universally applicable.

Chapter Breakdown

This thesis will be arranged such that each subsequent chapter addresses one research question, in the order in which they appear. The final chapter will summarize the findings of the previous chapters and conclude with some observations about what these findings may suggest for the future.

CHAPTER II: THE DEVELOPMENT OF COMPUTER CODE AS PROTECTED SPEECH IN THE COURT SYSTEM

The First Amendment guarantees freedom of speech.[115] The term "speech" is not defined within the amendment, but multiple U.S. Supreme Court cases have made it clear that "speech" is not limited to verbal utterances or written prose.[116] It is an expansive definition that the Court has found to include the wearing of a black armband as a form of protest,[117] electronic communication via the internet,[118] video games,[119] and the expressive act of burning a flag.[120]

There are also situations where governmental regulation of speech has been permitted, despite an impact on the First Amendment rights of the speaker. Speech that injures another, such as defamatory speech, can lose protection.[121] Speech with negligible social value, such as obscene speech, is unprotected. [122] Criminal conduct that takes the form of speech does not receive protection.[123] Speech that incites another person to commit a criminal act can cause the

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[115] U.S. CONST. AMEND. I ("Congress shall make no law … abridging the freedom of speech.").

[116] *See* Spence v. Washington, 418 U.S. 405, 411 (1974) (holding that certain actions imbued with sufficient elements of communication are protected speech.).

[117] Tinker v. Des Moines Indep. Cmty. School Dist., 393 U.S. 503 (1969)

[118] Reno v. American Civil Liberties Union, 521 U.S. 844, 851 (1997) ("Taken together, these tools constitute a unique medium-known to its users as 'cyberspace'-located in no particular geographical location but available to anyone, anywhere in the world, with access to the Internet.").

[119] Brown v. Entm't Merch. Ass'n, 131 S. Ct. 2729, 2733 (2011).

[120] Texas v. Johnson, 491 U.S. 397 (1989).

[121] N.Y. Times Co. v. Sullivan, 376 U.S. 254, 279-80 (1964).

[122] *See, e.g.,* Miller v. California, 413 U.S. 15 (1973).

[123] *See* Brown v. Hartlage, 456 U.S. 45, 55 (1982) (stating that the First Amendment does not immunize an individual from liability for criminal solicitation just because that solicitation was accomplished through pure speech); Giboney v. Empire Storage & Ice Co., 336 U.S. 490, 498 (1949) (stating that criminal conduct is still criminal, even if the conduct was accomplished through pure speech).

speaker to be held liable for incitement to "imminent lawless action."[124] Categorizing something as speech does not immunize the "speaker" from being held liable when the speech ventures too close to criminal conduct.

The most relevant case law can be divided into two distinct categories: First, cases that involved computer code directly, and second, cases that involved the output of computer code. The first category is included because CAD files are a form of computer code, and understanding how various courts have treated other pieces of computer code in the past makes it possible to predict how they may treat CAD files in the future. The majority of these cases involve encryption code.

The second category is included because CAD files create instructions for 3-D printers, producing an output by compiling and following the instructions in the file. While the cases included in this section involve search engines and video games, the way the court treated them offers insight into how CAD files and what they print may be treated in the future. To take everything into account, both the code and the output of a CAD file are important – this is why this chapter will include cases dealing with both the code and the output.

This chapter also reviews two additional areas of caselaw. First, a comparison is drawn between CAD files and instruction manuals, and cases dealing with First Amendment protection of instruction manuals are reviewed. Second, a case dealing with protected speech losing protection due to national security concerns is reviewed.

This chapter will not focus on issues outside the domain of the First Amendment. While many of these cases involved challenges to specific regulations, Second Amendment issues, and

[124] Brandenburg v. Ohio, 395 U.S. 444, 447 (1969).

various unrelated complaints, this chapter will only look at the court's treatment of code or its output under the First Amendment.

Encryption Source Code Cases

The question of whether computer code was protected by the First Amendment first appeared in the district courts in 1996, through a case involving the exportation of encryption code. It reached the circuit courts in 1999. At both the state and federal level, computer code has consistently been held to be protected First Amendment speech, and any restrictions were required to meet the same high standard that a restriction on traditional speech must meet.

These decisions contain some very valuable information. These courts analyzed the code in question, comparing it to other protected speech, and their reasons are very applicable to CAD files.

Bernstein v. Dep't of Justice

The Bernstein cases are a series of cases beginning in 1996, and brought by Professor Daniel J. Bernstein, who was a graduate student at the time of the first case. Professor Bernstein was challenging a set of restrictions that placed encryption source code, including the system he had created as a graduate student, on the United States Munitions List.[125] This list is meant to control the import and export of defense articles and weaponry, and if an item was on this list, anybody who wished to leave the country with it had to get permission from the State

[125] Bernstein v. U.S Dep't of Justice, 922 F. Supp. 1426 (N.D. Cal. 1996); *see also* Bernstein v. United States Dep't of Justice, 192 F. 3d 1308 (1999).

Department before they could do so.[126] When Professor Bernstein requested that his code be permitted to leave the country, he was denied.[127]

Professor Bernstein's first request covered his encryption system, called "Snuffle," in two formats: as part of an academic paper, and as "source code" written in the "C" programming language.[128] The State Department determined that both formats were "defense articles" under ITAR and subject to the same stringent licensing requirements that would be required of other items on the list, such as flamethrowers and bombs.[129] Professor Bernstein submitted a request for a second determination in order to clarify whether the academic paper fell under this classification, and in this request, he asked for a decision on five items total: "1) the paper, "The Snuffle Encryption System," 2) Snuffle.c, 3) Unsnuffle.c, 4) a description in English of how to use Snuffle, and 5) instructions in English for programming a computer to use Snuffle."[130] All were determined to be defense articles subject to the licensing requirements of ITAR, and Professor Bernstein challenged this treatment as a restraint on his speech, and a violation of his rights under the First Amendment.[131] After he brought suit, the second determination was narrowed to only include Snuffle and Unsnuffle.c – the actual encryption and decryption code –

[126] *Id*.

[127] Bernstein v. U.S Dep't of Justice, 922 F. Supp. 1426, 1428 (N.D. Cal. 1996).

[128] *Id*.

[129] *Id*. at 1430.

[130] *Id*.

[131] *Id*.

and so the court exclusively focuses on the code in the opinion, rather than the academic paper or the description of the code.[132]

The Bernstein court "conclude[d] that encryption software, in its source code form and as employed by those in the field of cryptography, must be viewed as expressive for First Amendment purposes, and thus is entitled to the protections of the prior restraint doctrine."[133] The government's argument, that source code is different from other protected, expressive speech because it "can be used to control directly the operation of a computer without conveying information to the user," was rejected. They also argued that the functional nature of the code precluded it from protection – this argument was rejected as well.

The district court stated that "the functionality of a language does not make it any less like speech." [134] They went on to say that "[i]nstructions, do-it-yourself manuals, recipes, even technical information about hydrogen bomb construction are often purely functional; they are also speech."[135]

Junger v. Daley

In this series of cases, also beginning in 1996, Professor Peter Junger challenged the same restrictions that were at issue in the Bernstein cases.[136] Unlike Professor Bernstein, Professor Junger was not attempting to physically take his code out of the country. He was planning to

[132] *Id*.

[133] Bernstein v. United States, 192 F.3d 1308, 1141 (9th Cir. 1999).

[134] *Bernstein*, 922 F.Supp.2d at 1426.

[135] *Id.* at 1435.

[136] Junger v. Daley, 8 F.Supp.2d 708 (1998).

teach a class on computer law that covered encryption software, and planned to post portions of his course materials online for students to access. Because this would involve publishing actual encryption code, and because the Regulations defined "export" to include unrestricted online publication, Professor Junger requested a determination as to whether the restrictions applied to this code.[137] He also requested the same determination for the textbook he was planning to use.[138]

The State Department determined that four of the five pieces of encryption software he had presented were subject to the regulations, but that the first chapter of the physical text book containing written copies of the same code was an allowable unlicensed export.[139] Posting the book in an electronic format, however, would require a license because the text contained the restricted code.[140] Professor Junger brought suit in the District Court for the Northern District of Ohio, claiming that these restrictions violated his rights under the First Amendment, and sought injunctive relief from governmental enforcement of these restrictions.[141]

The lower court sided with the government, stating that encryption source code was not communicative enough to warrant protection under the First Amendment.[142] The court compared encryption code to other types of software, and said that while "certain software is inherently

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[137] *Id*. at 714.

[138] *Id*.

[139] *Id*.

[140] Junger v. Daley, 209 F.3d 481, 483 (6th Cir. 2000).

[141] *Supra* note 112 at 711.

[142] *Id*. at 718.

expressive[,]" encryption software was "especially functional rather than expressive."[143] It was designed to "transfer functions, not to communicate ideas."[144]

Junger appealed this decision, and the Sixth Circuit Court of Appeals reversed the decision of the district court, concluding that the First Amendment did protect source code.[145] The Court went on to say that "[w]e recognize that national security interests can outweigh the interests of protected speech and require the regulation of speech."[146]

The Court applied standards from *Spence v. Washington,*[147] *Texas v. Johnson,*[148] and *Tinker v. Des Moines,*[149] asking whether or not this conduct was "sufficiently imbued with elements of communication."[150] The Court reversed and remanded the lower court's decision, and explicitly described computer code as "an expressive means for the exchange of information and ideas about computer programming."[151]

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[143] *Id*. at 716.

[144] *Supra* note 116.

[145] *Id*.

[146] *Id.*

[147] Spence v. Washington, 418 U.S. 405 (1974).

[148] Texas v. Johnson, 491 U.S. 397 (1989).

[149] Tinker v. Des Moines Independent Community School Dist., 393 U.S. 503 (1969).

[150] Spence v. Washington, 418 U.S. at 409 (1989).)

[151] *Id.* at 485.

Karn v. Dep't of State[152]

In *Karn*, the issue was the actual exportation of a disk containing source code for encryption software. [153] Philip Karn, like Professors Junger and Bernstein, had requested a determination of whether the code he wished to export fell under ITAR's restrictions. The code was in two formats – 1) a physical textbook, entitled *Applied Cryptography* and containing printed code, but no "machine-readable media," and 2) a disk containing source code that was also printed within parts of the textbook.[154]

Karn submitted a separate request for each format, and the book was determined to fall outside the restrictions.[155] However, this determination explicitly stated that "[it] did not extend to the two diskettes referenced in the book and available from the author."[156] While the code was approved in its printed form, it was designated a "defense article" in its disc form, and could not be exported.[157] Karn brought suit, alleging that the regulation of the disk was a restraint on his free speech and a violation of his First Amendment rights, but the court dismissed the claim as "meritless."[158]

[152] Karn v. U.S. Dep't of State, 925 F. Supp. 1 (D.C. Cir. 1996).

[153] *Id*.

[154] *Id*. at 4.

[155] *Id*.

[156] *Id*.

[157] *Id.*

[158] *Id.*

While the court did not side with Karn in its decision, it assumed that the code in question was speech, and would be protected by the First Amendment in most situations.[159] Even if the software itself was speech, the court found that the exportation restrictions were content neutral and narrowly tailored enough to be permissible in these circumstances. So, the national security interest outweighed the First Amendment interests.

Summary: The Encryption Cases

Junger used the phrase "expressive means for the exchange of information and ideas" to describe protected computer code, and that description seems to apply to CAD files fairly cleanly. While the information and ideas may not be about computer programming, distributing CAD files is, in itself, spreading information and ideas about things to make and potential methods of making them. The 3-D printing community is a very collaborative one, and the free exchange of ideas is a core aspect of that community.

Bernstein made it clear that a functional nature did not preclude code from protection. There, the code was protected despite its functional nature, and the court's rationale can very easily be applied to CAD files. If instruction manuals, and "technical information about hydrogen bomb construction" are protectable, then the CAD file that instructs a 3-D printer to produce an object should be just as protectable, if not more so.[160] CAD files have a potential to create any number of things, including protected artistic expression, while encryption code can only perform one specific function.

[159] *Id*. at 10.

[160] Bernstein v. U.S Dep't of Justice, 922 F.Supp.2d at 1434.

Karn wraps the trio up with the takeaway that while code is presumptively speech, it is still subject to the rules and regulations that govern traditional speech.[161] In the right situation, a narrowly tailored, content neutral restriction would probably be permissible if one were applied to CAD files, just as it was in the *Karn* case. [162]

Decryption Cases

Like the encryption code cases, the decryption cases concerned a regulation that impacted the ability to share a piece of code – the Digital Millennium Copyright Act ("DMCA"). The code in question was a program called DeCSS, and it was able to bypass the encryption used to prevent copying of DVDs. With this software, a user could copy and store the movies locked behind the Content Scrambling System ("CSS").

Universal City Studios v. Reimerdes and Universal City Studios v. Corley

The two cases reviewed in this section, *Universal City Studios v. Reimerdes* and *Universal City Studios v. Corley* are connected.[163] Because the facts of these cases are virtually identical at the onset, this section combines them. The defendants, Eric Corley and Shawn Reimerdes, created and published DeCSS together, and along with Roman Kazan, who owned the company that hosted the website containing DeCSS, were sued together. This lawsuit accused the defendants of "trafficking in circumvention devices" by publishing DeCSS online,

[161] Karn v. U.S. Dep't of State, 925 F. Supp. 1 (D.C. Cir. 1996).

[162] *Id.*

[163] Universal City Studios, Inc. v. Reimerdes, 111 F.Supp. 2d 294 (S.D.N.Y. 2000) aff'd 273 F.3d 429 (2d Cir. 2001).

an act which violates the DMCA.[164] The defendants argued that publishing the program did not violate the DMCA, and that the DMCA itself, as applied to computer code, violated the First Amendment.[165]

The court issued a preliminary injunction, barring the defendants from continuing to publish or host the code while the case was in progress. After this, Reimerdes and Kazan entered into consent agreements that barred them from posting the code for DeCSS and from linking to any other sites doing so, and were dropped from the suit afterwards.[166] Corley did not enter into an agreement, and in an "act of electronic civil disobedience," continued to host links to other websites that allowed a user to download DeCSS, becoming the sole defendant at the close of the case.[167]

The court found in favor of the movie studios, and issued a permanent injunction barring Corley from distributing DeCSS online.[168] *Universal City Studios v. Corley* is an appeal of this decision, challenging the constitutionality of the DMCA and alleging that applying it to computer code is a violation of the First Amendment right to speech.[169] The Second Circuit Court of Appeals did not overturn the judgement of the lower court, and Corley was still barred from distributing DeCSS online.[170]

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[164] *Id*. at 304.

[165] *Id*.

[166] *Id*. at 312.

[167] *Id*. at 313.

[168] *Id*. at 345.

[169] Universal City Studios, Inc. v. Corley, 273 F.3d 429 (2d Cir. 2001).

[170] *Id*. at 459.

While these cases did not resolve in the most favorable manner for the computer code at issue, they do provide extremely useful information regarding the First Amendment protections afforded to computer code. This is why these cases are included, and this is expanded on in the following section.

Summary: The Decryption cases

While the code was protected, the way it was being used was not.[171] The court made it clear that "protection" did not mean immunity from regulation.[172] Rather, "to say that a particular form of expression is "protected" by the First Amendment means that the constitutionality of any regulation of it must be measured by reference to the First Amendment."[173] The regulations in the DMCA withstood this test, and were permitted.

The code in this case was actively used to break laws, and bypass measures that allowed companies to protect their products from unauthorized redistribution. Despite that, the code itself was not considered to be outside the scope of First Amendment protection. As the Second Circuit Court of Appeals stated, "[c]ommunication does not lose constitutional protection as "speech" simply because it is expressed in the language of computer code."[174] Applying this logic to CAD files, it seems to indicate that they would be within the scope of First Amendment protection, assuming they were not being used to break laws.

[171] Universal City Studios, Inc. v. Reimerdes, 111 F.Supp. 2d 294 (S.D.N.Y. 2000) aff'd 273 F.3d 429 (2d Cir. 2001).

[172] *Id.* at 325.

[173] *Id.* at 326.

[174] Universal City Studios, Inc. v. Corley, 273 F.3d 429, 445 (2d Cir. 2001).

Output of Code Cases

The cases in this section are not as on-point as the preceding ones. Despite that, the cases do provide valuable insight into how the courts view the First Amendment as applied to new technology. While video games and the results of an online search are different from the three-dimensional product created by using a CAD file, both are examples of computer code that produces a final product that bears no resemblance to the code itself, and as such, warrant a cursory review in this section.

Brown v. Entertainment Merchants Ass'n[175]

Brown v. Entertainment Merchants Ass'n is a landmark U.S. Supreme Court case from 2005 that struck down a California law that banned the sale of violent video games to children without their parents supervising.[176] The Court held that video games were protected speech under the First Amendment, and could not be restricted without the same affordances that a restriction on traditional speech would require.[177]

In the opinion, the Court stated that "the basic principles of freedom of speech … do not vary with a new and different communication medium.[178] This is one of the valuable parts of this case, at least in terms of its application to the question of First Amendment protections for CAD files. The Court explicitly states that a change in the method of communication should not

[175] Brown v. Entm't Merch. Ass'n, 131 S. Ct. 2729 (2011).

[176] *Id*.

[177] *Id*.

[178] *Id*. at 2730.

impact the principles of freedom of speech. It would stand to reason that computer code, even in a CAD format, should not lose protection just because of that format.

Jian Zhang v. Baidu.com [179]

This case concerned the leading search engine in China, Baidu.com. The plaintiffs, who were residents of New York, had published materials online about the democracy movement in China, alleged that baidu.com had excluded these and other similar materials from search results, effectively censoring them.

The court rejected this argument, instead finding that the First Amendment protected Baidu's search results. Specifically, the court stated:

> there is a strong argument to be made that the First Amendment fully immunizes search-engine results from most, if not all, kinds of civil liability and government regulation … The central purpose of a search engine is to retrieve relevant information from the vast universe of data on the Internet and to organize it in a way that would be most helpful to the searcher. In doing so, search engines inevitably make editorial judgments about what information (or kinds of information) to include in the results and how and where to display that information (for example, on the first page of the search results or later).[180]

The court also states that "the First Amendment's protections apply whether or not a speaker articulates, or even has, a coherent or precise message, and whether or not the speaker generated the underlying content in the first place."[181] This seems to draw difficult to understand subjects like computer code and CAD files under this umbrella of protection. If the precise message doesn't matter, and the coherency of the message doesn't matter, then a page of code

[179] Jian Zhang v. Baidu. com Inc., 10 F. Supp. 3d 433 (S.D.N.Y. 2014).

[180] *Id.* at 438.

[181] *Id.* at 437.

that produces a sculpted object seems very protectable, even if some people would be confused about what the code itself is saying.

Instruction Manuals

If we look for a way to compare CAD files to something that we already consider "speech," there is a valid argument to be made that CAD files are analogous to instruction manuals – a text-based series of directives that, if followed, end in the same result every time. The manual would require a human actor to physically follow the instructions, while the CAD file would provide instructions meant for a 3-D printer to follow, but aside from the intended reader, the analogy fits fairly well. If CAD files can be considered a type of instruction manual, it stands to reason that cases dealing with the limits of First Amendment protection for instruction manuals would provide valuable insight. This section reviews some of the major cases that dealt with First Amendment protection of instruction manuals.

In one of the more well-known cases in this category, *Rice v. Paladin Enterprises, Inc.*, the publisher of an instruction manual that taught the reader how to commit murder without being caught was held liable for assisting in a murder when a reader committed the act while following the instructions from the book.[182] While the First Amendment protects most speech, and the criminal conduct in this case was literal text, the *Rice* court observed that speech may be punished when it is intended to facilitate unlawful conduct, and such conduct is likely to occur.[183]

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[182] Rice v. Paladin Enterprises, 128 F.3d 233, 239 (4th Cir. 1997).

[183] *See id.* at 248 (quoting DEPARTMENT OF JUSTICE, REPORT ON THE AVAILABILITY OF BOMBMAKING INFORMATION, THE EXTENT TO WHICH ITS DISSEMINATION IS CONTROLLED BY FEDERAL LAW, AND THE EXTENT TO WHICH SUCH DISSEMINATION MAY BE SUBJECT TO

The speech at issue in this case, the book entitled *Hit Man: A Technical Manual for Independent Contractors*, portrayed itself as a literal guide to starting a career as a paid murderer.[184] Paid murderers took this at face value and followed the guide while committing murders.[185] When the publishing company was sued by the families of those who had been killed by someone who used the book as a guide, the Fourth Circuit Court of Appeals ruled that the book was not protected by the First Amendment and that the publishing company could be held liable for the murders committed by the reader.[186]

Another case in this category, *Winter v. Putnam*, looked at the question of publisher liability for information contained in a book from a different angle.[187] *Winter v. Putnam* is a products liability case that revolved around a book entitled The Encyclopedia of Mushrooms. This book was intended to instruct the reader about which wild mushrooms were edible and non-poisonous, and which ones were to be avoided. The book was presented as a factual guide, containing true and correct information that could be trusted. Unfortunately, there were errors in some of the entries, and one of these errors incorrectly labeled a poisonous mushroom as nonpoisonous. The plaintiffs relied on this information and ate the mushrooms, becoming extremely ill as a result.[188]

REGULATION CONSISTENT WITH THE FIRST AMENDMENT OF THE UNITED STATES CONSTITUTION 42-43 (1997).

[184] *See supra* note 201 at 235-39 (referencing and quoting the book entitled HIT MAN: A TECHNICAL MANUAL FOR INDEPENDENT CONTRACTORS).

[185] *Id*.

[186] *Id*. at 239.

[187] See Winter v. G. P. Putnam's Sons, 938 F.2d 1033, 1035 (9th Cir. 1991).

[188] *Id*. at 1034 (stating that both plaintiffs required liver transplants as a result of eating the mushrooms.)

The plaintiffs brought suit against the publisher, alleging liability based on product liability, breach of warranty, negligent misrepresentation, and false representations. The publisher moved for summary judgement, arguing that the claim failed for multiple reasons. The products liability claim failed because information within a book is not an actual product for the purposes of strict liability under products liability law.[189] All other claims failed because, according to the court, a publisher does not have a duty to investigate the accuracy of the text publishes."[190]

The *Winter* court agreed, and granted summary judgement for the defendant, refusing to hold the publisher liable for the inaccurate descriptions. Their reasoning can be summed up as follows: The blame for any harm suffered by the plaintiffs would fall to the ideas contained within the book, not to the book itself, and because ideas are not tangible products, they do not fall under the purview of products liability law.

The court goes into detail about the dangers of imposing strict liability on intangible ideas and expression – specifically, the chilling effect that would loom over potential authors who wish to write about potentially dangerous topics. Quoting *Walter v. Bauer*, a case involving a student who was injured by following instructions for a science project in his textbook, the court asks "would any author wish to be exposed . . . for writing on a topic which might result in physical injury? e.g. How to cut trees; How to keep bees?"[191] The court even acknowledges that

[189] *Id.*

[190] *Id.*

[191] *Id.* at 1035 (quoting Walter v. Bauer, 109 Misc. 2d 189, 191, 439 N.Y.S.2d 821, 823 (1981))

strict liability applied to tangible products can inhibit innovation, but we are willing to tolerate that loss – we are not willing to risk being "deprived of the latest ideas and theories."[192]

The plaintiffs also asserted that The Encyclopedia of Mushrooms could be analogized to something that was a "product" as defined by products liability law – aeronautical charts, which depict the relevant geographical features of the land, and which are intended to be used by pilots. The plaintiffs suggested that both Encyclopedia and chart contain "representations of natural features and…are intended to be used while engaging in a hazardous activity."[193] This was not enough to convince the court, and the plaintiffs were ultimately unsuccessful.[194]

Rice hinged on the fact that the speech in the manual was not just advocating "abstract ideas about how to commit murder," but was actively encouraging the reader to follow the instructions within and commit an illegal act.[195] *Winter* turned on the fact that the court was unwilling to impose strict liability on ideas contained within the pages of a book.[196]

The Counterpoint: National Security

Even if CAD files were presumptively given full First Amendment protection, certain regulations could still survive scrutiny under the First Amendment. There are situations where certain national security concerns have the potential to override the protection of the First

[192] *Id.* at 1035.

[193] *Id.* at 1035-1036.

[194] *Id.*

[195] *Rice*, 940 F. Supp. at 849.

[196] *Winter*, 938 F.2d at 1035.

Amendment, and this section reviews a seminal case in this area, *Holder v. Humanitarian Law Project*.

Holder v. Humanitarian Law Project, a Supreme Court case from 2010, is the most prominent recent example of a restriction on certain speech surviving First Amendment scrutiny because of a national security interest.[197] In *Holder,* plaintiffs challenged a section of the USA PATRIOT Act that prohibited providing material support to foreign terrorist organizations.[198] The plaintiffs, which included the Humanitarian Law Project, stated that they wish to support only the "lawful, nonviolent activities" of two groups that have been designated foreign terrorist organizations by the Secretary of State – Partiya Karkeran Kurdistan (PKK) and the Liberation Tigers of Tamil Eelam (LTTE). Both groups are committed to establishing independent states in Turkey and Sri Lanka, respectively.[199] To that end, they both engage in various "political and humanitarian activities," but have also "committed numerous terrorist attacks, some of which have harmed American citizens.[200]

The plaintiffs argued that the PATRIOT ACT was unconstitutional, and violated their First Amendment rights to freedom of speech and association.[201] Specifically, they challenged the Act's prohibition on providing material support of terroristic organizations in the form of "training," "expert advice or assistance," "service," and "personnel," asserting that the

[197] Holder v. Humanitarian Law Project, 561 U.S. 1 (2010).

[198] 18 U.S.C. § 2339(B) (2012).

[199] *Holder*, 561 U.S. at 2 (showing how the PKK aims to establish an independent state for Kurds in Turkey, and the LTTE aims to do the same for Tamils in Sri Lanka).

[200] *Id*.

[201] *Id*. at 2.

prohibition was unconstitutionally vague and invalid to the extent that it prohibited them from activities such as "training PKK members to use international law to resolve disputes peacefully" and "teaching PKK members to petition the United Nations and other representative bodies for relief."[202] The Court disagreed, and held that the material support statute was constitutional as applied in this situation.[203]

Holder hinged partially on the fact that "material support" is a term that is understood to exclude independent advocacy – as long as it did not involve advocacy under the direction of, or in coordination with a terrorist organization, the plaintiffs could "say anything they wished on any topic."[204] Furthermore, the Court rejected the idea that the plaintiffs would only work to further the legitimate goals of the groups, stating that the "taint of their violent activities is so great that any that working in coordination with them or at their command legitimizes and furthers their terrorist means."[205]

While *Holder* reinforces the fact that speech, even protected political speech, can be restricted when it clashes with a significant enough national security interest, it seems very unlikely that the holding, or the relevant provisions of the PATRIOT Act, could apply to most situations involving a CAD file – even one containing schematics for a gun. The plaintiffs in *Holder* wish to actively interact with groups that they knew were labeled as foreign terrorist

[202] *Id*.

[203] *Id*. at 6 (highlighting how the Court stated that this holding only applies to this specific scenario, and does not indicate whether any future challenges to the Act would survive First Amendment scrutiny).

[204] *Id*. at 4.

[205] *Id*.

organizations.[206] This knowledge is a stated requirement of violating the Act, and *Holder* was clear that without this factor, a violation would not occur.[207] Distributing a file online, without intending to provide it to anyone, much less a known terrorist organization, would seem to fall outside of this requirement.

More broadly, *Holder* would imply that a sufficiently narrow, carefully defined, and targeted statute prohibiting the distribution of CAD files to a group or individual that the distributor knows to be associated with a terrorist organization would pass scrutiny under the First Amendment.[208] This does not clash with the idea that CAD file should be presumptively considered protected speech – it simply supports the idea that even protected speech can lose protection in certain situations, which this thesis does not argue against.

[206] *Id*. at 1.

[207] *Holder*, 561 U.S. at 16-17 ("'To violate this paragraph, a person must have knowledge that the organization is a designated terrorist organization . . . that the organization has engaged or engages in terrorist activity . . ., or that the organization has engaged or engages in terrorism . . .' Congress plainly spoke to the necessary mental state for a violation of § 2339B, and it chose knowledge about the organization's connection to terrorism, not specific intent to further the organization's terrorist activities.") (citing 18 U.S.C. § 2339B(a)(1)).)

[208] *Id*. at 21 (stating that the parameters of what was covered by the Act were defined extremely clearly, and clarifications were added over time, as needed.).

CHAPTER III: FOUNDATIONAL THEORIES OF THE FIRST AMENDMENT AND THEIR APPLICATION TO CAD FILES

To decide which theories should be analyzed, a review of the literature was done and the most prominent, influential theories will be used. These theories have influenced the courts and inform the rationale they use when deciding whether or not something is protected speech. As discussed below, each theory assumes and argues for an objective of the First Amendment, and gives reasons for why certain speech deserves protection while other speech may not.

Marketplace of Ideas

The marketplace of ideas, often referred to as "marketplace theory," refers to the idea that the First Amendment is meant to protect a thriving, competitive exchange of ideas. The underlying assumption is that the best ideas should always rise to the top, assuming all ideas are given ample opportunity to fight it out. As Justice White said in *Red Lion Broadcasting Co. v. FCC*, "[i]t is the purpose of the First Amendment to preserve an uninhibited marketplace of ideas in which truth will ultimately prevail."[209]

This is one of the oldest theories of the First Amendment to appear in American jurisprudence. In the 1919 case, *Abrams v. United States*, Justice Holmes argued that "the best test of truth is the power of the thought to get itself accepted in the competition of the market."[210] This rationale can be traced back further this, however. In 1644, the marketplace metaphor

[209] Red Lion Broadcasting Co. v. FCC, 395 U.S. 367, 390 (1969).

[210] Abrams v. United States, 250 U.S. 616, 630 (1919).

appeared in the Areopagitica, a work by John Milton opposing licensing requirements and censorship in England.[211]

Marketplace theory presents the broadest approach, bringing nearly all ideas under the scope of "freedom of speech."[212] This theory also works particularly well when applied to scientific research and technological advancements.[213] After all, at its core, science is a never-ending search for the truth – free and open speech and debate among scientists furthers progress in general. Stifling scientific speech, on the other hand, limits the search for truth and restricts progress in general.

Applying this principle to computer code makes perfect sense, and courts have done so. In *Junger*, the court explicitly stated that "[b]ecause computer source code is an expressive means for the exchange of information and ideas about computer programming, we hold that it is protected by the First Amendment."[214] If the purpose of First Amendment protection is to facilitate the spread, interaction, and eventual triumph of good ideas and valuable information, posting computer code clearly fulfills this purpose.

Applying this principle to CAD files presents no clear reason to exclude them from protection. If anything, it places them even more squarely under the coverage of the First Amendment. The majority of the communities that use and distribute CAD files do so openly,

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[211] JOHN MILTON, AREOPAGITICA: A SPEECH FOR THE LIBERTY OF UNLICENSED PRINTING TO THE PARLIAMENT OF ENGLAND (1644) ("Let [Truth] and falsehood grapple; who ever knew Truth put to the worse in a free and open encounter?").

[212] Stuart Minor Benjamin, *Transmitting, Editing, and Communicating: Determining What "The Freedom of Speech" Encompasses*, 60 DUKE L.J. 1673, 1694 (2011).

[213] E. John Park, *Protecting the Core Values of the First Amendment in an Age of New Technologies: Scientific Expression vs. National Security*, 2 VA. J.L. & TECH. 1, 47 (1997).

[214] Junger v. Daley, 209 F. 3d 481, 484–85 (6th Cir. 2000).

sharing them with everybody at no cost.[215] CAD files containing the information necessary to print additional 3-D printers exist and are freely distributed.[216] The online communities that create and distribute files are embodying the most basic principle behind the marketplace of ideas – that letting ideas battle it out will ensure that the best survives.

Democratic Self-Governance

Democratic self-governance is a theory that ties the value of free speech to its ability to facilitate democracy.[217] Under the rationale of this theory, the purpose of the First Amendment would be to protect the ability to disseminate and receive information needed to ensure that citizens are fully informed and knowledgeable enough to vote in their own best interests.[218] Debate and lively discussion are encouraged, but more as a means to an end – suppressing speech that is not furthering the end goal of democratic self-governance would be permissible under the reasoning of this theory.

To that end, it seems difficult to find a place for either computer code or CAD files within this theory. Code in itself does not play a direct role in political decision-making, and it is unlikely that Meiklejohn considered CAD files as a possible method of furthering democratic self-governance. Scholars have made the argument that governmental use of code to perform

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[215] Dana Beldiman, *From Bits to Atoms: Does the Open Source Software Model Translate to Open Source Hardware*, 35 SANTA CLARA HIGH TECH. L. J. 23 (2018); *see also* Eli Greenbaum, *Three-Dimensional Printing and Open Source Hardware*, 2 NYU J. INTELL. PROP. & ENT. L. 257 (2012); *see also* Chelsea Schelly et al., *Open-Source 3-D Printing Technologies for Education: Bringing Additive Manufacturing to the Classroom*, 28 JOURNAL OF VISUAL LANGUAGES & COMPUTING 226 (2015).

[216] *See* RepRap, https://reprap.org/wiki/RepRap; *see also* Kostakis & Papachristou, *supra* note 14.

[217] *See generally* ALEXANDER MEIKLEJOHN, POLITICAL FREEDOM: THE CONSTITUTIONAL POWERS OF THE PEOPLE (1965).

[218] Robert Post, *Reconciling Theory and Doctrine in First Amendment Jurisprudence Symposium of the Law in the Twentieth Century*, 88 CALIF. L. REV. 2353, 2367 (2000).

political functions places various types of code under the purview of democratic self-governance.[219] The government uses code to encrypt their databases, perform financial analyses, and maintain digital weapons systems – the public has an interest in understanding governmental use of that code, and taking it into account in their political decision-making.[220] Still, it is not a perfect comparison, and CAD files do not find a justification here. However, this theory also fails to provide any clear reason to exclude CAD files.

Self-Realization/Self Fulfillment

The theory of Self-Realization/Self-Fulfillment ties the value of speech to its ability to facilitate the expression of one's self.[221] The content of the speech doesn't matter, nor does the medium – this theory places self-expression above all and the method does not matter. Under this rationale, there is value in art and other creative expression, whereas a different theory, such as democratic self-governance, might find that particular form of expression to be less valuable.

While computer code is not the first thing most people consider when they think of an expressive method of communication, many programmers treat the creation and eventual refinement of their code as a type of art. They distribute it to a community of other programmers for feedback, suggestions, and incorporate that advice into their work. If this theory would find a work of art to be expressive and protectable, it should also find that computer code is expressive and protectable.

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[219] Steven E. Halpern, *Harmonizing the Convergence of Medium, Expression, and Functionality: A Study of the Speech Interest in Computer Software*, 14 HARV. J.L. & TECH. 139, 157 (2000).

[220] *Id.*

[221] THOMAS IRWIN EMERSON, THE SYSTEM OF FREEDOM OF EXPRESSION (1970).

CAD files, being code with the potential to become physical, tangible art, find an even more secure place under this theory. Very often, they are used as a means of expressing one's creativity, and the most widespread use of CAD files is as a method of art creation.[222]

[222] Ihor Brahin, *Who Really Uses 3-D Printing and Why*, ZMORPH BLOG (Nov. 2016), http://blog.zmorph3d.com/really-uses-3d-printing/

CHAPTER IV: CAD FILES AS PROTECTED SPEECH UNDER THE FIRST AMENDMENT

This chapter assesses whether information gathered in the previous chapters provides a solid foundation for protecting CAD files. Part I discusses whether and how the case law that was analyzed in Chapter II can be applied to the current and future uses of CAD files. This discussion will build on the analysis from Chapter II, and attempt to ground it in real world uses of CAD files. Part II discusses the analysis done in Chapter III, and reviews whether CAD files fulfill the theoretical goals of the First Amendment.

Review of Case Law Analysis

Chapter II discussed the current state of the law surrounding computer code and the output of computer. One limitation of the analysis done in this chapter is the lack of cases where the output of the code was a physical product. The vast majority of the cases focus on the law as it applies to the code itself, or on how the law applies to various treatments of the code – exporting it, distributing it online, and other actions of the sort.

This limitation was mitigated by including cases that dealt with the output of code in a nonphysical format, and this section will analogize as needed to apply the findings of those cases to the physical product created by CAD files. The cases in this category dealt with the output of search engine algorithms – specifically, the results that are shown to the user when they search for a specific term.

To answer RQ1, seven cases were analyzed for elements that appeared multiple times and played a part in their decision to protect, or decline to protect, the code. Two factors seemed to

truly matter in the court's final decisions – the expressive behavior displayed by the code at issue, and the words the court used to describe it.

Reasons to protect CAD files

The purpose of reviewing and analyzing the cases included in Chapter II was to understand whether there was a reason articulated within the caselaw to protect CAD files under the First Amendment. The most common justification can be summed up as: most of the time, computer code, no matter the purpose, form, readability or functionality, is protected speech, and any attempt to limit that speech must be content neutral and narrowly tailored. Certain types of code are excluded, the same way that certain types of traditional speech do not receive First Amendment protections, but in general, code is speech.

Reviewing these cases revealed some common elements that most courts took into consideration when deciding whether code was speech. After distilling these elements down to their basic components, this section will apply those elements to CAD files. First, according to the Court of Appeals in *Universal City Studios, Inc. v. Corley*,[223] code of every complexity would be protected speech under the First Amendment, and the fact that it is written in "an obscure language"[224] would change nothing. The code is protected because, as the court puts it, "[c]ommunication does not lose constitutional protection as "speech" simply because it is expressed in the language of computer code."[225]

[223] Universal City Studios, Inc. v. Corley, 273 F.3d 429 (2001).

[224] *Id.* at 446.

[225] *Id.* at 447.

The communicative nature of code is the relevant element here. The Court explicitly states that "it is the conveying of information that renders instructions "speech" for purposes of the First Amendment."[226] The court described the code in question as "expressive activity," although it is in the context of permitting a higher level of regulation to be implemented on it.[227] In the end, code is decided to be a combination of speech and non-speech, with communicative elements weighting the decision towards "speech" and functional elements weighting it towards "non-speech."[228] So, this case defined protected First Amendment speech, included code at its most basic and most complex under this protection, but then used functionality as a method of reducing the protections.

Junger v. Daley consisted of two cases, one brought in 1998[229] and the other in 2000.[230] *Junger* (I) asked whether encryption software source code was expressive enough to merit First Amendment protection and found that while it might be expressive in some situations, it was not enough to merit protection. The court went on to implement a functionality test, deciding that encryption software was especially functional, and more like hardware than like an expressive piece of software. [231]

[226] *Id.* at 449.

[227] *Id.* at 429.

[228] *Id.* at 451.

[229] Junger v. Daley, 8 F. Supp. 2d 708 (N.D. Ohio 1998).

[230] Junger v. Daley, 209 F. 3d 481 (6th Cir. 2000).

[231] *Id.*

Junger (II) arrived at an opposite conclusion. [232] *Junger* (II) held that computer source code was expressive by its nature, and therefore did merit First Amendment protection.[233] However, the functionality language remained, and was still be when analyzing the government's interest in regulating this speech.[234]

Bernstein follows a similar line of reasoning, drawing comparisons between general legal protection of "expressions" and possible First Amendment protection for an encryption program "expressed in source code."[235] Almost immediately after this statement, the court mentions functionality, but denies that functionality has any negative effect on the expressive qualities of the code.[236]

These cases make it clear that courts put a lot of value on the expressive nature of the code,[237] and the potential for the code to communicate some form of information to another person.[238] The presence of these factors made it more likely that the court would protect the

[232] *Id.*

[233] *Id.*

[234] *Id.*

[235] Bernstein v. U.S. Dept. of State, 922 F. Supp. 1426, 1436 (N.D. Cal. 1996).

[236] *Id.* at 1437.

[237] Universal City Studios, Inc. v. Corley, 273 F. 3d 429 (2d Cir. 2001); *see also* Bernstein v. U.S Dep't of Justice, 922 F. Supp. 1426 (N.D. Cal. 1996); *see also* Universal City Studios, Inc. v. Reimerdes, 111 F. Supp. 2d 294 (S.D.N.Y. 2000).)

[238] *Corley*, 273 F. 3d at 429.

code. These cases also present some factors that are detrimental to potential protection, such as excessive functionality[239] and technical language.[240]

Jian Zhang v. Baidu.com, Inc. features the court extending First Amendment protections to a Chinese search engine that blocked specific topics from appearing in their results.[241] The court holds that creating and disseminating information is protected speech under the First Amendment, and that interfering with their control over their results amounted to government interference with a constitutional right.[242] The expressive, informational nature of the output was the key to the court's protection, and reinforces the reasoning used by the courts in the other cases.

Overall, the relevant elements that tend to contribute to a court protecting the code can be summarized as follows: an expressive nature, a communicative function, the potential to distribute information, and creative elements. These elements were mentioned in some manner in each of the reviewed cases, and used as the justification for protecting computer code. If the code exhibited some or all of these elements, the courts were more likely to consider it protected speech under the First Amendment. That does not mean that the code was immune to regulation, and in many of the reviewed cases, a restriction was permitted – it just had to meet the same standards that a restriction on traditional speech would.[243]

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[239] Bernstein v. U.S. Dep't of Justice, 922 F. Supp. 1426 (1998); *see also*; Universal City Studios, Inc. v. Reimerdes, 111 F. Supp. 2d 294 (2000); *see also*; Junger v. Daley, 8 F. Supp. 2d 708 (N.D. Ohio 1998); *see also* Universal City Studios, Inc. v. Corley, 273 F. 3d 429 (2000).

[240] Junger v. Daley, 8 F. Supp. 2d 708, 209 F. 3d 481 (N.D. Ohio 1998); *see also* Universal City Studios, Inc. v. Reimerdes, 111 F. Supp. 2d 294 (2000).

[241] Jian Zhang v. Baidu. com Inc., 10 F. Supp. 3d 433 (S.D.N.Y. 2014) (discussing results that were pro-democracy as one topic).

[242] *Id.* at 438.

[243] Universal City Studios, Inc. v. Corley, 273 F.3d 429 (2001).

The first element, an expressive nature, is as present in CAD files as it is in computer code. Not every page of code is expressive, and neither is every CAD file, but both have the potential to be expressive works. Depending on how expressiveness is defined, CAD files could be considered more expressive than most computer code – the format of a CAD file, while meant to be read by a 3-D printer, is more understandable to a layperson than a page of Python script would be. While computer code requires at least some basic knowledge of a programming language to understand the code itself, CAD files are at least partially written in plain language describing the colors, physical parameters, and other aspects of the final 3-D printer product.

When converted to a graphical representation of the instructions contained within the CAD file, the file becomes even more expressive and understandable to a layperson. While code can be deciphered given enough time and the correct knowledge, an actual image of the final printed product needs no deciphering. Most of the time, whatever is being expressed in an image is immediately visible and understandable.

The second element, a communicative aspect, is similarly present – CAD files as code communicate information about the final product, and the output of CAD files can be as communicative as any other form of art. This does not mean that every CAD file is communicative, the same way that not every piece of code is communicative.

The third element, the potential to distribute information, is again present in both CAD files and computer code. The communities that create and share CAD files tend to attract users who value collaborative thinking, and share their work openly for others to learn from and

improve upon it.[244] Information distribution is one of the main purposes of distributing CAD files, and so this element is fulfilled in most situations.

The final element, which can be summed up as "creative potential," also applies to CAD files. Creative potential, as applied to computer code, is the potential for a piece of code to have a non-pragmatic use. In other words, can it be used frivolously? Does it serve a purpose that is not a purely practical one?

For example, a piece of computer code with a single function – to convert binary-coded decimals into pure binary numerals – is not considered to be performing a creative act.[245] However, a piece of computer code that, when executed, allows the user to play a game – that would be considered a creative use.[246] Like computer code, CAD files have many possible uses, and while some are purely pragmatic, many of these uses are extremely creative. The "creative potential" of CAD files is only limited by the imagination of the creator.

Overall, CAD files meet the major criteria used by prior courts when deciding whether computer code warranted First Amendment protection. While CAD files are different from the types of computer code discussed in the cases reviewed in this thesis, computer code as a category covers a vast array of different types, languages, uses, and formats of code, and if these criteria would apply to all these different iterations of traditional computer code, it makes sense to apply them to CAD files in the same manner.

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[244] *See* Kostakis & Papachristou, *supra* note 14; *see also DSpace: An Open Source Dynamic Digital Repository* (2003); *see also* Eric von Hippel & Georg von Krogh, *Open Source Software and the "Private-Collective" Innovation Model: Issues for Organization Science*, 14 ORGANIZATION SCIENCE 209 (2003); *see generally* Jarkko Moilanen & Tere Vadén, *3-D Printing Community and Emerging Practices of Peer Production*, 18 FIRST MONDAY (2013).

[245] *See* Gottschalk v. Benson, 409 U.S. 63 (1972).

[246] *See* Atari, Inc. v. Amusement World, Inc., 547 F. Supp. 222 (D. Md. 1981); *see also* Brown v. Entm't Merch. Ass'n, 131 S. Ct. 2729 (2011).

Reviewing the Theory Analysis

Chapter III discussed some of the most prominent theories of the First Amendment and how they may apply to current uses and forms of CAD files. The theories reviewed included the marketplace of ideas, democratic self-governance, and self-expression/self-realization. Each theory offered a reason for why the First Amendment protects what it protects, and why some speech and speech like conduct can justifiably be excluded from First Amendment protection.

While CAD files did not find clear support within every theory, the files also should not receive outright rejection. The marketplace of ideas theory justifies protecting speech by arguing that allowing speech to "battle it out" in a hypothetical marketplace of ideas will increase the likelihood of the truth emerging. Applied to computer code, or to CAD files, the internet would be the marketplace and the ability to freely distribute the code or file would ensure that the quality of what is out there becomes better and better as the market chooses what deserves to remain and what should be allowed to disappear.

The theory of democratic self-governance did not provide much support for either code or CAD files, but self-fulfillment theory offered a fair amount. Self-fulfillment treats the expression and the eventual fulfillment of oneself as the ultimate purpose of free speech. As applied to computer code or CAD files, self-fulfillment would find that the artistic and expressive value inherent in both to be enough justification to protect them as strongly as any other speech. Justification for protecting the purely functional uses of code or CAD files is not found in this theory.

Overall, the theoretical foundations of the First Amendment provide more arguments in favor of protecting CAD files as speech than they do against it. While theoretical reasoning does

not bind the courts, it has informed their decisions in the past and will likely be considered in the future.[247]

[247] *See* Abrams v. United States, 250 U.S. 616 (1919).

CHAPTER V: CONCLUSION

CAD files are already a valuable tool for innovation, and have the potential to solve many problems that burden society today. They also have the potential to put untraceable weapons in the hands of people who currently cannot purchase standard, traceable weapons.[248] Moreover, they hold the potential to move the current form of Internet piracy from the purely digital realm into the physical world.

Prior chapters have focused on the protection of CAD files under the First Amendment, and have asked whether CAD files would receive that protection based on the criteria courts have used in older cases. This chapter will summarize the findings of the previous chapters, and then present the arguments against extending these protections to CAD files. This is to ensure that this thesis acknowledges both sides of this debate, and addresses any valid points against protecting CAD files in the same manner that computer code is protected.

Arguments Against Protecting Individual Files

Chapter II consisted of a case analysis that resulted in a set of elements that, when applied to computer code, has been treated by multiple courts as a point in favor of First Amendment protection. In essence, these elements can be summed up as an expressive nature, a communicative function, the potential to distribute information, and creative elements. Thus far,

[248] *See* Defense Distributed v. U.S. Dept. of State, 838 F.3d 451 (5th Cir. 2016).

this thesis has argued that these elements are present in CAD files, and sometimes are more present than they are in much traditional computer code.

However, it could be argued that if these elements are the factors that contribute to a finding of First Amendment protection, an overabundance of opposing elements should be considered a negative mark – that is to say, if a CAD file can be described as non-expressive, noncommunicative, lacking the potential to distribute information, or noncreative, it should not receive First Amendment protection.

If an expressive nature, as applied to CAD files, can be described as the ability of the file to convey a message via the code itself or the output to a nonexpert, a file with a non-expressive nature would be indecipherable to the vast majority of people who looked at it, or contain no message whatsoever. While most CAD files are written in a format that is readable by both machines and human beings, there is no requirement that this holds true for all CAD files.[249] A file written in a language that is only machine-readable might be considered non-expressive, although that is not a guarantee.

Besides an inability to communicate anything through the code itself, a CAD file that produces a purely functional product could be considered non-expressive – the final product would contain no semblance of communication and no message at all. A file that prints a basic screw, for example, might fall into this category. It would be difficult to find any message or expressive elements in a single screw.

The description of a non-expressive nature applies to a noncommunicative nature, as well. The third anti-element, a lack of potential to distribute information, is difficult to describe.

[249] David L. Bourell et al., *A Brief History of Additive Manufacturing and the 2009 Roadmap for Additive Manufacturing: Looking Back and Looking Ahead*, PROCEEDINGS OF RAPIDTECH 24 (2009); *see also* Kodama, *supra* note 48; *see also* Charles W. Hull, *Method for production of three-dimensional objects by stereolithography* (1998).

Since the information distribution aspect applies to the community that shares the files, the opposite would be something along the lines of a community that decries the open-source movement and does not share what they create. However, that group would probably not be considered a community at all, and because the open source elements of CAD files have been so deeply ingrained in the current community, there is no group with the opposing viewpoint currently in existence.

Non-creativity is more self-explanatory – if no creative input went into the creation of the file, it is difficult to argue that there is any creativity present. CAD files, especially the ones that generate a piece of art, are not created by writing the code line by line – rather, they are created via one of two methods.[250] Either they are hand drawn in a CAD program and converted into the code afterwards, or a physical object is scanned and the machine converts that image into the final file.[251] The former is undisputedly a creative action, but it is very difficult to find a creative aspect in the latter method. The screw example works in this situation as well, and the fact that the latter method tends to be used when creating functional products contributes to the possibility that a CAD file created in this manner would not be considered creative.

Arguments Against Protecting an Entire Category of Files

There is also an argument to be made that certain types of CAD files should be presumptively barred from First Amendment protection, or at least restricted from free distribution. This section will attempt to lay out those arguments, as they do have some merit.

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[250] Sachs et al., *supra* note 53.

[251] *See* A.W.L. Yao, *Applications of 3-D Scanning and Reverse Engineering Techniques for Quality Control of Quick Response Products*, 26 INT J ADV MANUF TECHNOL 1284 (2005); *See generally* ReCap | Reality Capture And 3-D Scanning Software | Autodesk, https://www.autodesk.com/products/recap/overview; *Reverse Engineering 101: Guide to Creating CAD from 3-D Scans*, Polyga, https://www.polyga.com/reverse-engineering-101-scan-to-cad/; *Scan to CAD*, 3-D Systems, /applications/scan-cad.

An extremely high potential for criminal use is the reason that appears most often in arguments against the free distribution of CAD files. CAD files can be used to print virtually anything, including weapons. 3-D printing guns are already a reality, and while they are not very powerful right now, that is likely to change as the technology progresses. Even in their current form, which is a plastic, single use weapon that melts after a single discharge, they would be very valuable to an enterprising criminal – a weapon that is undetectable by scanners and that self-destructs after it served its purpose would find many uses in the criminal world.

Add in the fact that this would allow criminals to bypass the background checks typically required to purchase a weapon, and you have a recipe for a weapon that cannot be traced back to any individual, will provide no fingerprints or other biometric information to law-enforcement, and is extremely cheap to produce. This possibility is a fairly valid reason to argue against First Amendment protection for CAD files that contain the information needed to print certain weapons. Even though a book that teaches you how to make bombs or handcraft a metal-free gun would receive those protections, there is one crucial difference between those instruction books and the CAD file of a weapon – the former require some work on the part of the creator, while the latter requires little more than access to a 3-D printer. The ease of creation is what takes this from mildly concerning to potentially extremely dangerous.

The above explanation also applies to the argument that CAD files should not be protected because of the high national security risks. A 3-D printed gun is undetectable by the scanners required at airports and high-security locations, and would render that particular protection functionally useless. Distributing files that allow anyone to print a weapon also undermines the government's ability to protect its citizens by keeping guns out of the hands of

known offenders – as mentioned above, it would allow anyone to bypass the background checks currently required to own a gun.

Overall, when it comes to First Amendment protections, CAD files should be treated like any other speech – receiving protection that can be stripped away in the right situations. As it is, we do not protect all speech equally, and we should not protect CAD files equally, but we should also not reject them altogether. While there are reasons for specific types of CAD files to lose protection, and there are definitely some risks involved with the open distribution of CAD files, none of these risks warrant excluding all CAD files from protection, nor does it warrant applying protection selectively.

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