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3D PRINTING AND ITS IMPLICATIONS ON COPYRIGHTS FROM A EUROPEAN UNION – UNITED STATES PERSPECTIVE

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TABLE OF CONTENTS

ABSTRACT

This research examines the interaction between 3D printing and intellectual property rights, however this research focuses on copyright law related issues, and the enforcement of rights. United States and European Union legislation concerning copyright law will be analyzed, as well international legislation applicable to both - US and EU.

The purpose of the research is to ascertain the possible violations and risks of 3D printing concerning the IP rights by analyzation of the US and EU legislation, as well examine the case law and offer solutions for the future legal developments related to 3D printing and copyright laws. The main research method for this thesis is the review of legal literature, in addition to that the case law of 3D printing are to be examined where the intellectual property rights holders rights have been violated, if there are no definite legal cases that could be precedents.

The author examines the legal implications of 3D printing in relation to copyrights as an example is brought from US and EU legislation and treaties which are applicable internationally, in order to understand how these can be contradictory. In addition, the thesis consists of comparative study between US and EU legislation concerning 3D printing and copyright laws, and the suggestions of possibilities how to reduce infringements of copyrights, whether the related laws are sufficient or need a review.

The main conclusions the author of this thesis arrived is that the legislation concerning the copyright and 3D printing is not currently sufficient from international perspecive, as well as EU and US legislations independently. The author discusses about possible analogous, however, the existing categories are not fully suitable for the entire 3D printing process. The author suggestes to add 3D printing into existing copyright laws by introducing a new subject of 3D printing technology or by categorizing and interpreting 3D printing elements into existing categories of copyrighted objects. However, the scholars have suggested to consider sui generis copyright-like protection for 3D objects

Keywords: 3D printing, Intellectual Property law, copyright, disruptive technology

LIST OF ABBREVIATIONS

BC	Berne Convention (1886)
CAD	Computer-aided design
IP	Intellectual Property
IPR	Intellectual Property Rights
P2P	Peer-to-peer
TRIPS	The Agreement on Trade-Related Aspects of Intellectual Property Rights (1994)
WCT	WIPO Copyright Treaty (1996)
WIPO	World Intellectual Property Organization

INTRODUCTION

3D printing, in other words the printers implementing additive layer manufacturing technology, has developed rapidly during the last decade, making the 3D printers more accessible for people because prices of 3D printers are decreasing. Businesses are combining 3D printing as part of their manufacturing methods. This, however, has arised concern of the patent, copyright, trademark and design holders because their rights can be easily violated. The author chose 3D printing and the intellectual property (IP) legal problems, more specifically the violation of copyright matters, because the author feels that in modern society, it is increasingly difficult to protect your original work from reproducing/copying, therefore, the laws must be in constant development to protect original works of the authors.

The aim of this thesis is to determine the interaction between 3D printing and copyright from a legal perspective. Its central focus is to compare European Union and US copyright systems, whether current copyright systems are in accordance with the implications of 3D printing. This thesis will be written using qualitative methods for more accurate overview of the topic. As is in common with such studies, this thesis is composed by analysing diferent legislative sources. Comparing to the EU, the US legislation related to 3D printing is more advanced, therefore, the US approach is takes as a model in order to compare certain aspects to the EU.

In the course of the research, the author will focus on three main research questions. Firstly, what is the relation between copyright law and 3D printing and how these two are in conflict? Secondly, what are copyright enforcement tools if they are violated in the context of 3D printing? Thirdly, is the existing copyright legislation on 3D printing is sufficient or needs to be examined?

The thesis will be divided into three separate chapters. The first chapter will examine the concept of 3D printing and its connection to copyrights. Besides that, it's analysed whether 3D printing can be considered as a disruptive technology. The second chapter will concentrate on the international legislation, which is applicable to both – EU and US concerning the copyright laws. The EU and US legislation will be examined separately, in order to draw conclusions whether current copyright systems are in accordance with 3D printing and its possible implications. The third chapter will analyse the future developments of 3D printing regulations.

The aim of this chapter is to provide possible solutions how the legislation concerning 3D printing and copyright should be advanced in the future. The last chapter will draw conclusions and will answer the research questions; and the author will reflect which results she arrived to.

1. CONCEPT OF 3D PRINTING

In order to begin this research it is needed to examine what is the concept, operation and status of 3D printing to fully understand the relation to IP law. Three-dimensional printing ("3D printing") is a process by which a three-dimensional item is created. Similar to traditional printers the toner is dropped onto paper, however, it is possible use liquid, powder, paper or sheet form, where the layers of material is deposited. Every layer can be minimum 0.003 mm, which allows to make the 3D object extraordinarily accurate even for the most complex designs. After the consecutive addition of ultra-thin layers, the object is fused by using laser or heat treatment. The process of adding layers and fusing will continue as long as the required 3D structure has been created.[1]

3D printing requires a certain software, which sends the details of the object to the printer informing how to build the physical object, the so-called computer-aided design (CAD) file. There are three ways to obtain a CAD file. Firstly, it can be developed from scratch by utilization of modelling software. Nowadays, there are possibilities obtainable online, which allow individuals with no previous experience to design their own models with some programs that offer pre-fused shapes. Secondly, the physical object can be shifted into a actual 3D model by the utilization of 3D scanner. 3D scanner is a equipment, which gathers a large amount of data from physical objects using lasers or x-rays, in order to multiply digital model ("3D Visualization") with a high resolution and preciseness. Thirdly, a effective alternative for 3D scanning is photogrammetry. In briefly it means that this photographic technique uses software tools to connect set of 2D photos, which are taken from different angles, to a 3D model.[2]

3D printing started developing from the 1970s and the first granted patent dates back to 1977.[3] It is clear that the 3D printing will have a greater impact on manufacturing techniques in the future as the factories will start "printing" their products rather than "manufacturing" them. As a result of using 3D printers in the manufacturing matters, it is predicted that several factories will return their business back to developed countries as there is no need for manual laborers,

[1] Silverman, I. (2016); Optimising protection: IP rights in 3D printing; E.I.P.R. 2016, 38(1), p 5-10
[2] Elam, V. (2016); CAD Files and European Design Law; Journal of Intellectual Property, Information Technology and Electronic Commerce Law ,7, p 146-162
[3] Mendis, Dr D. (2013); The Rise of 3D Printing and its Implications for Intellectual Property Law—Learning Lessons from the Past?; E.I.P.R. 2013, 35(3), p 155-169

but rather a need for skilled employees, such as engineers, IT specialists, logistics experts and other specialists. The main reason why the business in the first place moved their factories to third world countries was because of the cheaper costs of wages to the employees, however, as the 3D printing is not requiring so much labour and can be done economically, there is a possibility to bring factories back to their native countries. The other reason why companies are preferring to choose 3D printing is the save up from the material costs, as 3D printing does not demand "flanges and brackets" for objects to be "handled, milled and moulded by machine tools" and does not require "surfaces for the parts to be bolted or welded together", it means that this reduces material waste, thus reducing material costs. 3D printing enables designers and engineers to communicate with each other around the world, in order to discuss about the product by sharing different ideas. This would lead to the establishment of "home office factories" because there is no need to leave the house.[4]

1.1 Analysis of 3D printing as a disruptive technology

This chapter will examine whether the 3D printing is considered disruptive technology. In order to do that, it is needed to specify the term "disruptive technology". The concept of "disruptive technology" was first widely introduced by Clayton Christensen when he published his book "The Innovator's Dilemma" in 1997.[5] Disruptive technologies can be explained as technologies which considerably change the way how organizations and industries operate. Frequently, the introduction of these technologies put companies in a position to reconsider the way they run their business and whether they are ready to risk losing or changing their market share. As an example can mention the disruptive technology, such as smartphones and e-commerce. Disruption is a approach in which small-scale business successfully challenges major companies or completely create new market. Since there is a possibility that large-scale companies only focus on customers who offer a greater value to the company, the disruptive companies aim to attract customers who are not involved to major company customers base, in order to get a foothold. Large enterprises can not promptly react to new threats and competition, therefore, disruptive companies ultimately get a larger position on the market and take over an increasing share of the customer base. Frequently the disruptive technologies are emerging

[4] Ibid

[5] Chen, J. (2018); Disruptive Technology, Accessible: https://www.investopedia.com/terms/d/disruptive-technology.asp. (assessed: 22.02.2019

quite unexpectedly or they do not have an economical purpose, therefore, the major companies do not have enough time to develop plan against the disruptive technologies.[6]

Before deciding whether 3D printing can be classified as a disruptive technology, it is vital to analyse in which ways 3D can disrupt other technology. As 3D printers has spread over the last decade among private and legal persons, the field of application has increased accompanied by legal matters. Due to the expansion of 3D printing, piracy has evolved both in the production of counterfeit copies of 3D printed products and in the use of 3D printing to copy products made using traditional production methods. In the case of copying products by using traditional manufacturing methods, the counterfeiters scan the item, in order to create a design file that can be customized if needed and used multiple times to print counterfeits. 3D printed products can be easily reproduced if the counterfeiters have a 3D print file in order to establish low-priced and similar copies.[7]

It is also necessary to examine the peer-to-peer file sharing as it has already caused damage for music and film industry, likewise it has a potential to cause problems for business who are using 3D printing method. Peer-to-peer ("P2P") technology allows file sharing via direct exchange between end-users' computers. P2P operates in a way that assured software is installed in user's computer as a server for shared files, which enables any computer equipped with software to act as a mini-server from which other P2P users can download files.[8]

It is already possible to print at no cost non-designer objects, for example accessories and glasses, the emerging problem that arises is when the custom-made products can also be easily printed. The design files for brand products can be obtained in two ways, either by hacking into designer computer or by buying and later scanning the brand product, thus making it into digital file. The well-known file sharing website The Pirate Bay has already created a category for 3D printer design files.[9]

[6] Ibid
[7] Silverman, I. (2016); p 5-10
[8] Bonadio, E. (2011): File sharing, copyright and freedom of speech; E.I.P.R. 2011, 33(10), p 619-631
[9] Silverman, I. (2016); p 5-10

2. EU AND US COPYRIGHT LAW RELATING TO 3D PRINTING

This chapter will examine the European Union and United States copyright law system and its effect to 3D printing. International regulations on copyright law have also been developed, some of them are binding to both – US and EU – therefore, the conventions are to be discussed hereinafter. In addition to international treaties this chapter will analyze US and EU copyright related legislations separately, in order to understand the differences and disadvantages of both jurisdiction. However, it is important to first understand the main idea of copyright and fundamental matters of US and EU legislation.

Copyright is obtained automatically assuming the work is stated and original. Copyright lasts for creator's life and 70 years after their death. According to the Copyright Act the term "originality" is assigned by the effort made by the author in order to create a copyrighted work, for instance expression of ideas. Copying of the original work is considered as copyright infringement, however, the copying does not have to be precise. The question that arises is that when making a "significant copying" whether a defendant had used a "significant part" of the skills, workforce and effort applied by the original creator.[10] The development of copyright and other IP rights (IPR) has been linked to throughout technological developments in history. Before the 14th century, the lack of reprographic technology enabled authors to prevent third parties form using their original works, in order to protect their businesses and other interest without necessity for legal intervention in the form of ownership. Even if the non-professional users did violate the rights of the authors, the damage caused was minimal. In the 14th century the exclusion of third parties from using author's original works was more difficult due to the printing technology development. By now the unauthorized copying was done by professional users. As a result there was a growing need for legal intervention in order to protect the interests of authors, printers and publishers, therefore, the statutory laws of copyright was introduced.[11] It is important to clarify the composition of EU and its Member States, regarding the applicable laws and regulations, because regulations and laws are on two different levels - national and EU. In EU the copyright laws are governed and protected by the national laws of each Member State, however, the EU has adopted some comprehensive regulations and laws which has an

[10] Mendis, Dr D. (2013); p 155-169

[11] Pila, J.; Torremans, P. L.C. (2016), European Intellectual Property Law, United Kingdom: Oxford University Press; p 243-257

impact on Member States. The effects are to be discussed as follows. Under EU copyrights and property rights all authors' works, for instance original computer programs, photographs and databases, demand copyright protection. Such protection is considered as a fundamental right under Article 17 (2) of the Charter of Fundamental Rights of the European Union (CFR) in line with the Article 1 of Protocol 1 Convention for the Protection of Human Rights and Fundamental Freedoms (ECHR). In addition to that EU law determines the advantages of acquiring copyright, which also includes a closed list of exclusive economic rights, containing the right to reproduce a protected work in order to publish it to the public. It is also required that the copyright for the original work continue 70 years after the death of the author, however, the copyright must enter into force during that period according with the laws of individual Member States, which are in compliance with the principles of EU free movement and competition law. And lastly, in the case of exceptions and limitations, EU law sets out that copyright must be restricted in order to avoid third parties from producing temporary or incidental copies of the work required for a technological process, for instance internet browsing. Additional exceptions to copyright infringement govern third party that acts as reproducing and communicating parts of a work for the purpose of research, news reporting, or review etc.[12]

In the case of US the copyright law is mainly in the field of federal law, rather than subject to individual US states, however the states do have laws related to copyright.[13] State laws on intellectual property are not generally considered to be useful tools for implementing state policies in order to attract innovation and creativeness, especially with regard to copyright and patent laws, which are largely federal, designed by federal policies and are thus uncontrollable starting points for state innovation policies, which leaves limited leeway for the effects of state law. States statues on copyright are restricted by number of forces: at the federal level, the preemption doctrine and the dormant Commerce Clause limit the reach of state laws, and international law that binds the United States also shapes the space for state laws. The constitutional requirements arising from both the federal Constitution and the Constitution of the state, has an impact on the laws of the state. Copyright laws are part on US federal law under US Constitution IP Clause, which states that Congress in entitled to promote the development of science and the arts by providing the authors and inventors with exclusive right

[12] Ibid

[13] Trimble, M. (2017), U.S State Copyright Laws: Challenge and Potential, Stanford Technology Law Review, 21, p 67-73

to their respective writings and discoveries for a limited period of time. The Supremacy Clause states that federal law takes precedence over state law, and the preemption doctrine ensures the supremacy of federal law. Although copyright laws mainly due to federal law, courts have not established copyright law to subject to field preemption that would entirely exclude state law on copyright. Therefore, there is room for state legislation, though limited. However, it is often a difficult task to determine which federal law has left to the states to legislate.[14]

2.1 International legal framework

Since the last decade the possibilities of file sharing via Internet have developed rapidly, thus airising the violations of owner's rights. Therefore the international legislation was necessary because of the fact that a person can download anything from foreign state's artist. This thesis will examine the three most important international agreements on copyrights, which are the following: the Berne Convention[15], The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS)[16] and the WIPO Copyright Treaty (WCT)[17], however, TRIPS and WCT are in compliance with the Berne Convention, because they both indicate back to BC regarding the specified list of protected works.

The Berne Convention and most of the national copyright laws are based on the presumption of national treatment, i.e national copyright laws reach actions that take place within national borders and require equal treatment of both foreign authors and citizens. Interactive services such as the Internet, which now allow servers to be transferred and accessed in more than 90 countries, raises a number of concerns. The concern about the application of national copyright to act physically carried out in other countries and the problem of piracy paradise has been widely recognized.[18] The Berne Convention was concluded in 1886 on the protection of literary and artistic works, which makes it the oldest international copyright treaty open to all states. The treaty was originally signed by ten countries - Germany, Belgium, Spain, France, the United Kingdom, Haiti, Italy, Liberia, Switzerland, and Tunisia - and came into effect from

[14] Ibid

[15] Berne Convention for the Protection of Literary and Artistic Works of 9 September 1886. Paris Act of 24 July 1971, as amended on 28 September 1979. WIPO, Geneva

[16] The Agreement on Trade Related Aspects of Intellectual Property Rights. 15 April 1994, WTO, Marrakesh

[17] WIPO Copyright Treaty. 20 December 1996. WIPO, Geneva

[18] Dixon, A. N.; Hansen, M. F. (1996), The Berne Convention enters the digital age, E.I.P.R. 1996, 18(11), p 604-612

December 5, 1887. The colonial possessions of France, Germany, Italy, Belgium, Spain and the UK were also influenced by the convention.[19] The original 1886 Berne Convention purpose was to improve the protection of authors through adjusting minimum standards, the abolition of any formality for granting protection and attaining national treatment by eliminating discrimination between domestic and foreign authors. The Berne Convention also composed a non-exclusive list of protected works, including, the terms of copyright protection and the duration of protection was also defined. The Convention introduced the idea of exclusive rights of the author, including the right to translation, which was the first exclusive right established by the 1886 Convention. The Berne Convention imposed restrictions on the rights of the author in cases where the public has a necessity access to essential information. In such cases, the author's work may be reproduced without the author's approval. In addition, the Convention allowed states to develop exceptions to the use of literary or artistic works in scientific or educational publications. The justification for these exceptions is the distribution to the public of copyright works where the national legislator fears that the absence of these works may hinder the dissemination and development of knowledge. The Berne Convention does not give any formalities, however, each country may provide for formalities under its national law. Therefore, in the case of the authors first published their original works in the country where the formalities were necessary, then the Convention required them to comply with these formalities in order to obtain protection.When the authors first published a work in a country that does not require formalities, the Convention protected its works in all other countries without formalities.[20]

The TRIPS Agreement was concluded in 1994, under the General Agreement on Tariffs and Trades (GATT) system. The aim of the TRIPS Agreement was to enact the members of World Trade Organisation (WTO) to consent with the Berne Convention, however, with the exemption of the provision, which established the authors' moral rights. The TRIPS agreement states the computer programs are to be protected as "literary works" within the meaning of Berne Convention.[21] TRIPS agreement article 10 is the first provision in any multilateral instrument which assures the protection of computer programs by copyright, however, starting from 1990 many countries had added computer programs in the list of protected works under their national

[19] Goldstein, P; Hugenholtz, P.Bernt (2013). International Copyright: Principles, Law and Practice. United States of America: Oxford University Press, p 34-42

[20] Malkawi, B. H. (2013), A long "TRIP" home: how the Berne Convention, TRIPS Agreement, and other instruments complement the international copyright system, E.I.P.R. 2013, 35(2), p 93-107

[21] Tritton, G. (2008). Intellectual property in Europe. 3rd ed. London, Sweet & Maxwell, p 469

laws, the extent of the protection was vague. Article 10 sets out the form of expression in which the computer program is published and which is in the form of source code or object code.[22]

The WIPO Copyright Treaty (WCT) was adopted in 1996, as there was a rapid development of technology during 1970-1980, including the growth of the importance of computer programs and databases, the new special agreement was necessary. The main purpose of WCT was to permit computer programs protection as literary works, despite of their mode or form of expression, in the meaning of Berne Convention Article 2(1). Article 20 of BC allows member of the convention to enter into special agreements with each other in order to give the authors more extensive rights than those granted with the Convention, or to contain other provisions that are not contrary to the provisions of the BC. Therefore, the WCT is connected only to the Berne Convention.[23]

Recent literature and opinions of scholars have suggested to consider the legal status of three-dimensional models and 3D design files (CAD) and their protection as the intellectual property law matter.[24] In more particular the CAD files should be protected as literary works, because the CAD files should be considered as computer programs and, therefore, should be equivalent. The Berne Convention did not include nothing about 3D printing technology and its consequences, because the 3D technology started developing in the late 1970s. However, it is possible to find a appropriate definition for 3D printed objects and CAD files from the article 2 of BC, which contains a non-limitative list of copyrighted works. Should be taken into account that the technology is continuously evolving and changing, the non-limiting list is rather illustrative and incomplete, and the inexhaustibility of protected works allows us to interpret different types of new mediums and forms of publishing on a copyrighted subject. As mentioned above that BC does not even mention CAD files nor 3D printed objects, the article 2(1) may provide analogous to CAD files or 3D printed objects as the article 2(1) includes works such as: “drawing, painting, architecture, sculpture, engraving and lithography; or illustrations, maps, plans, sketches, and three-dimensional works relative to geography, topography, architecture or science”. Even though the list includes the term “three-

[22] Gervais, D. J. (1999), The TRIPs Agreement: interpretation and implementation, E.I.P.R. 1999, 21(3), p 156-162

[23] World Intellectual Property Organization (2004). WIPO Intellectual Property Handbook: Policy, Law and Use. p 262

[24] Mendis, Dr D. (2018); In pursuit of clarity: the conundrum of CAD and copyright - seeking direction through case law; E.I.P.R. 2018, 40(11), p 694-705

dimensional", it has no direct connection to 3D printed works, however, for instance the scientists and architects use 3D printers as their working tool to create CAD models and later 3D print them, which are connected to geography, architecture or science, then the 3D printed object is usually covered under Berne Convention. The sculptures can be also classified as 3D printed objects. Since the BC does not provide a specific definition of the sculpture as well, the process of achieving the end result can be dissimilar and might include 3D printing. Though many forms of expression are explicitly mentioned in article 2(1) of the Berne Convention, the form of expression is not appropriate, where the work includes any original literary, scientific or artistic field.[25]

3D printing and CAD files has been given lately a lot of attention and the subject is made priority probably because using 3D printing method has developed in manufacturing physical products. Several researches and policy reports have been discussing the topic, but it can be generally concluded as follows: "there needs to be clearer guidance on defining whether a CAD file is capable of copyright protection. The territorial nature of copyright law, coupled with the pervasive nature of online platforms and CAD files shared therein could lead to uncertainty and complex issues in the future".[26] It could be rational to modify the BC by adding a new category under the non-exclusive list of protected works or to adopt a completely new agreement about 3D printing and its related issues under the meaning of Article 20 of BC, like was done with computer programs.

2.2 United States approach

The United States Copyright Act has been modified in recent years, first with the changes that the US needed to comply with the Berne Convention for the Protection of Literary and Artistic Works in 1989, and later with a number of amendments made at the end of 1990. The BC introduced a change of the US treatment of 'foreign works', which according to the Copyright Act refers to works originating in countries other than the US, and modified copyright notices and other formalities into optional provisions, before they had been mandatory features of the US copyright system.[27] Besides the Copyright Act, there is also Digital Millennium Copyright

[25] World Intellectual Property Organization. (2004), p 262
[26] Mendis, Dr Dinusha (2018), p 694-705
[27] Tanenbaum, W. A. (1991), US copyright law after the Berne, moral rights and 1990 amendments, E.I.P.R. 1991, 13(12), p 449-465

Act (DMCA), which also plays a major role in US copyright laws. The DMCA was adopted in 1998.[28] However, 3D printing is not mentioned in the Copyright Act nor in the Digital Millennium Copyright Act.

The main problem with copyright law concerning the CAD files is that the CAD files offer both functional and creative value. Copyright protects original works, but not articles that provide utilitarian function, and as with CAD files, if the original work is not separated from the useful article, copyright protection is not applied. It is clear that MP3 and MP4 media files consist copyrighted material, CAD files are in a much more uncertain position and generally copyright law does not protect functional objects, in other word does not apply for objects that are designed for a physical purpose. However, there are a limited number of complex areas in the Copyright Act where CAD files may fall into the rule of functional objects.[29]

2.2.1 Legal protection of 3D printing

While 3D printing is now commonly used by the manufactures and natural persons, it is only a matter of time when it becomes widespread as the prices of 3D printers continue to decrease.[30] Personalized 3D printing is currently in the development phase, with universities and Internet user communities leading a great deal of innovation in home printing. The 3D printing community emphasizes the "open source" system, whereby ownership and design are shared between all those who contribute to design and implementation. In the case of an open-source model, such as copyright, the ownership of the design belongs to the person who owns it for the first time; that is, the person who fixes the design in a tangible medium.[31] Even though no one has filed a lawsuit yet, the parties have initiated a difficult discussion. The holders of copyrights have submitted a takedown notice for the Digital Millennium Copyright Act to websites that permit users to download 3D computer-aided design files. Copyright issues related to 3D printing include the following: whether CAD files are protected by copyright; whether CAD files and 3D-printed objects are considered as derivative works which are

[28] The Digital Millennium Copyright Act of 1998
[29] Twomey, P. (2014) A New Dimension to Intellectual Property Infringement: An Evaluation of the Intellectual Property Issues Associated with 3D Printing. Trinity College Law Review,17, p 33
[30] Dolinsky, K. (2014), CAD's Cradle: Untangling Copyrightability, Derivative Works, and Fair Use in 3D Printing, Washington and Lee Law Review, 71, p 594-597
[31] Rideout, B. (2011), Printing the Impossible Triangle: The Copyright Implications of Three-Dimensional Printing, Journal of Business, Entrepreneurship & the Law, 1 , p. 161-178

protected by copyrights on already-existing works; and whether courts can fairly use protection in cases where defendants have CAD files of copyrighted works or 3D printed objects. Copyrightability issues concerning the 3D printing focus on the copyrightability of CAD files. 3D printed objects belong to the category of "pictorial, graphical, and sculptural works", which are protected by copyright, and courts will probably identify the copyrightability of such objects in existent case law. By contrast, CAD files do not fit properly into one of the categories explicitly listed in the Copyright Act.[32]

2.2.2 Originality criteria

Since the copyright law only protects the "original works of the author", the originality is the target of the US Copyright Act. In order for the work to be "original" the Supreme Court has determined that it must be: 1) independently created; and 2) include creativity. According to the Feist case "independently" means that the author did not copy from other author's work. On the other hand, for instance, if someone really did not have access to Shakespeare's sonnet, but happened with a great coincidence to write exactly the same words independently, the work can be protected by copyright laws.

There are two possibilities to create CAD files: 1) someone can create a three-dimensional object image in a CAD program and; 2) someone can just scan an object using a 3D scanner to create a CAD file on one's computer. According to the first method, there can be referred to an analogous of drawing an object in a CAD program may indicate to painting a picture of the object on a canvas. However, according to the Justice Holmes, a drawing or CAD file would probably be "independently" created, because of the fact that the person drawing the object will give it at least a personality. The second method may not qualify as an independent creation because the scanner is not considered as a human, therefore, the scanner does all the work. Assuming that all legal requirements are met, the same can be said about photography, however, most photos are copyrightable because the photographer decides when to press the camera button, therefore, creates a picture "independently". Likewise, can be said that the scanning may be done "independently" by the person who initiates the 3D scan. Therefore, there is an opportunity that even three-dimensional scanning can qualify as "independent" creation. [33]

[32] Dolinsky, K. (2014), p 594- 597

[33] Osborn, L. S. (2014), Of PhDs, Pirates, and the Public: Three-Dimensional Printing Technology and the Arts, Texas A&M Law Review, 4 , p 811-836

The research reveales that the copyrightability of works which are analogous to CAD files, such as architectural plans, computer software and other technical drawings, and comparing these works to CAD files, puts a CAD file copyrightability for a test. Prescribed that CAD files are frequently described as blueprints, it is rational to start by examining whether this is the right comparison. The Architectural Works Copyright Protection Act of 1990 (AWCPA) amended Article 102 of the Copyright Act of 1976 to explicitly include architectural works as copyrighted works. The change was also included in the definition of architectural work "the design of a building as embodied in any tangible medium of expression, including a building, architectural plans, or drawings". Since the architectural work itself are in the plans, a copyright in the project extends not only to the plans but also to the physical structure, even if it is not yet built. Even though architectural plans seem to be logical analog to CAD files, significant differences makes the comparison not applicable. CAD files and blueprints are both imaginary images of 3D structures that may ultimately be built, resulting in a comparison of the two news articles explaining how 3D printing works. If the CAD files were given the same protection as the architectural drawings, then the CAD designer would get copyright protection not only for the CAD file itself, but for any 3D-printed versions that might finally exist.[34]

2.2.3 Copyright limitations

Even if some physical objects are protected by copyright, patent or trademark, they still are exception to the rule. The sculpture clause of the Copyright Act provides a broad category of "pictorial, graphic, or sculptural works" qualified for copyright protection, provided that such works comply with the Act's other requirements. However, the Act excludes from copyright any "useful article". "Useful article" is defined as "an article having an intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information".[35] This limitation is consistent with the notion that functional objects are not suitable for the relatively long-term protection of copyright, which is contrary to the temporary rights set forth in the Patent Act. Congress tried to determine the lines between copyrightable works of applied art and uncopyrightable works of industrial design by limiting the definition of sculptural works eligible for copyright protection as follows: "Such works shall include works of artistic craftsmanship insofar as their form but not their mechanical or utilitarian aspects are concerned;

[34] Dolinsky, K. (2014), p 594- 597
[35] Rideout, B. (2011), p 161-178

the design of a useful article, as a pictorial, graphic or sculptural work only if, and only to the extent that, such design incorporates pictorial, graphic, or sculptural features that can be identified separately from and are capable of existing independently of, the utilitarian aspects of the article.". Thus, while "useful articles" as a whole are not eligible for copyright protection, individual design elements including these items may, in their own right, meet the requirements of Copyright Act. In particular, if a useful article contains a design element that is physically or conceptually separable from the base material, the element is entitled to copyright protection.
Since 3D printers can theoretically create 3D objects at any time, intellectual property owners, including artists, inventors, are concerned with their legal protection against what they would probably perceive as a threat to their intellectual property. There are several forms of intellectual property protection that are potentially available for 3D printed designs, but it is thought that this "ragged quilt of protection" does not adequately protect designers. Intellectual property owners have the opportunity to increase their legal protection by trying to control either 3D CAD files or expanding the protection of the intellectual property of 3D objects. Intellectual property owners could also try to extend their intellectual property protection by gaining sui generis copyright protection for their utilitarian objects.[36]

2.3 European Union approach

In this paragraph will be discussed the European Union approach to 3D printing, bringing examples from EU regulations and case law, further on continuing with originality criteria. The idea was to study the same categories of copyrighted works, which are analogous to 3D printing as represented under the United States approach, however, among EU Member States several submitted categories are lacking of harmonised approach, for example recipes.

In European Union there have been obstacles in the harmonizations of laws. At international level, globalization has undoubtedly led to fragmentation and hence to fragmented laws. It seems to be correct even at the European level, despite harmonization efforts. Differences at national level indicate that, despite the objectives of European harmonization, national interpretations tend to follow their historical trends. This requires an evolutionary understanding of the legal development. Copyright-related legal traditions appear to be strongly

[36] Ibid

path-dependent. The path-dependence of the state's legal system can be explained, inter alia, by its links to the state's technological, economic and cultural heritage.[37]

2.3.1 Originality criteria

The concept of originality appeared quite late in French case law. It was first developed in the doctrine, as is often the case in civil law systems. The European Union has adopted several directives on the purpose of regulating various aspects of copyright policy. In order to adopt legislation, which is addressed to an individual EU member states asking them to improve their legislation to comply with the directive, so called "transposition", EU legislators, both Commissioners and member of the European Parliament, are obliged to reckon with the interests of all 27 Member States. Concerning the copyright matters, this includes common law jurisdictions also, for instance United Kingdom and Ireland. Three copyright directives should be mentioned: Directive on the Legal Protection of Databases, the Directive on the Legal Protection of Computer Programs, and the Directive on the Term of Protection of Copyright.[38]

The Computer Programs Directive claims that a computer program "shall be protected if it is original in the sense that it is the author's own intellectual creation. No other criteria shall be applied to determine its eligibility for protection". The Database Directive is using incorporating language closer to Article 2(5) of the Berne Convention that "databases which, by reason of the selection or arrangement of their contents, constitute the author's own intellectual creation shall be protected as such by copyright. No other criteria shall be applied to determine their eligibility for that protection". Lastly, the Term Directive states that photographs "[w]hich are original in the sense that they are the author's own intellectual creation shall be protected in accordance with Article 1. No other criteria shall be applied to determine their eligibility for protection. Member States may provide for the protection of other photographs." According to these directives two significant conclusions can be made. Firstly, originality is the only criterion that 27 EU Member States may apply to determine whether content that matches one category of copyrighted material is protected. Secondly, originality,

[37] Mylly, U. M. (2010). Harmonizing copyright rules for computer program interface protection. University of Louisville Law Review, 48, p 878-888

[38] Judge, E. F., Gervais, D. (2009). Of Silos and Constellations: Comparing Notions of Originality in Copyright Law. Cardozo Arts and Entertainment Law Journal, 27, p 375-384

at least for computer programs, databases, and photographs, exists when the work is the author's own intellectual creation.[39]

Determining originality in a computer programm is evaluated without qualitative or aesthetic qualities of the program without applying the originality test.[40] The originality requirement of the CAD files would be filled when the file was created from scratch. Nearly every object, whether it is copyrighted or not, can be converted into a CAD file.[41] The harmonisation of EU originality criteria originates from the infamous Infopaq case,[42] which main question was the interpretation of the two concepts contained in the Infosoc Directive. The Infopaq case was a preliminary ruling, which was forwarded to Court of Justice of the European Union by the Danish court. The Danish court's first aim was to find an answer to the interpretation of the concept of "reproduction in part", which is defined in Article 2 and whether it could be permitted to use without the approval of the right holder. Infopaq is a company that compiles summaries of Danish newspaper articles through a 'data capture process'. Danske Dagblades Forening is an organization of Danish newspaper publishers that helps its members with copyright issues. Infopaq recorded the data without the consent of the right holders using a data storage method that separates 11 words before and after the search term. Court of Justice of the European Union first found what can be regarded as "work" within the meaning of the InfoSoc Directive and originality criteria prescribed in the Computer Programs Directive and Database Directive, it is the same, which means that the work is original when it is the author's own intellectual creation.[43] Words and phrases are not protected by copyright, but the court has ruled that even 11 words may be copyrighted within the meaning of the InfoSoc Directive if they are an expression of the author's intellectual creation. As mentioned above, several CAD programs are simplified to the extent that the user simply selects the previously designed objects and reorganizes them according to his necessity, however, it can be debated whether such activity involves an element of originality,[44] since pre-designed block libraries usually provide original shapes for designer to make reorganizations and basic shapes are usually not copyright

[39] Ibid
[40] 2009/24/EC, supra nota 97, recital (8)
[41] Swanson, S., 3D Printing: A Lesson in History: How to Mold the World of Copyright, Southwestern Law Review, 43, p 484-489
[42] Rosati, E., Originality in a Work, or a Work of Originality: The Effects of the Infopaq Decision,Journal of the Copyright Society of the USA, 58, p 795
[43] C-5/08, Infopaq, supra nota 120, section 37
[44] Osborn, L. S. (2014), p 812-814

protected, similar to words and phrases.[45] According to the results of the Infopaq case and the analogy of block shapes to words, it can be inferred that even the shape of such block may contain originality.[46]

2.3.2 Legal protection

In order to start an EU approach to law enforcement in 3D printing, one of the most promising analogues for CAD files and 3D-printed objects, which was also analyzed under the US approach, continues to be computer programs. The first form of originality was given to computer programs in 1991 (now modified 2009/24/EC). This Direcitve made it more difficult to harmonize the criterion of originality between Member States, since the purpose of the Directive was only to define the criteria for computer programs by dividing the general originality criteria for computer programs and other works. The term "computer program" is defined in the Directive as follows "shall include programs in any form, including those which are incorporated into hardware. This term also includes preparatory design work leading to the development of a computer program provided that the nature of the preparatory work is such that a computer program can result from it at a later stage."[47] The widespread definition of computer programs was an unambiguous decision by the EU Commission in the aim of avoiding termination of this term. In addition to the expression of the source code or object code resulting from the TRIPs Agreement Article 10(1), the Court has also claimed in the case of Bezpečnostní Softwarová Asociace (BSA), that under the software directive, any object in any form of a computer program that allows it to be reproduced in different computer languages, such as source code and object code, is a protected object.[48]

Computer program interfaces are specified in the Software directive as elements of the program that ensure the interconnection of software and hardware elements.[49] Theoretically, CAD files could be deemed as interfaces, because it is the basis for using 3D printer software to create a 3D-printed end result. Under the Software Directive the interfaces are explicitly excluded from copyright protection. The BSA case concerned the protection of a graphical user interface, a

[45] Dasari, H., Assessing Copyright Protection and Infringement Issues Involved with 3D Printing and Scanning, AIPLA Quarterly Journal, 41, p 293-295
[46] Ibid
[47] 2009/24/EC, supra nota 97, recital (7)
[48] C-393/09, Bezpečnostní softwarová asociace (BSA), sections 33-35
[49] 2009/24/EC, supra nota 97, recital (10)

visual medium by which a user communicates with a computer program.[50] The main question referred to the European Court of Justice during the preliminary ruling procedure was whether the graphical user interface could be protected as an expression of a computer program protected as literary works. The Court stated that the graphical user interface is not suitable for the expression of a computer program because it does not allow the computer program to be reproduced and is simply one element of the program that allows users to communicate with the program.[51] However, the court provided that such an interface may be protected under the Infosoc Directive if it corresponds to the originality demand of the author's own intellectual creation.[52] Another important case to mention is In the SAS Institute Inc. v. World Programming Limited (SAS v. WPL)[53], where The Court examined the possibility of protecting the functions of a computer program, such as a programming language or file formats used to store data within the meaning of a software program. ECJ held that such functions are not capable of acquiring copyright protection as an expression of a computer program.[54] If there is a possibility to protect CAD files as computer programs and the SAS Institute case conclusion that the computer program functions are not protected, they can be applied to CAD files so that the CAD file functions would not be protected - would it be possible to extend the term "functions" to CAD interface that interacts with a 3D printer or contains physical 3D-printed objects that contain functional aspects.[55]

[50] C- 393/09, BSA, supra nota 105, section 41
[51] Ibid
[52] Ibid, section 51
[53] C-406/10, SAS Institute (SAS)
[54] Ibid, section 46
[55] Although the functional aspects are not protected by copyright, it is covered in section 3.2. to be able to create a sui generis right to even protect such useful 3D printed items

3. FUTURE DEVELOPMENTS OF 3D PRINTING REGULATION

3D printing makes possible to create very complex objects without mechanical processing and can potentially interfere with the main aspects of production, making it safe to say that 3D printing continues to evolve widely. It is clear that there will be a solution for the intellectual property issues in the future as the industries have a strong benefits from the 3D printing, therefore, probably demanding an accelerating legal process New legal framework would be important for designers, 3D printer manufacturers, online platforms for sharing 3D design, and printing service providers in order to protect them from violation of their rights.[56]

There are different approaches among the scholars on how the 3D printing should be handled. Some believe that the jurisdiction concerning the 3D printing and copyright law should be updated, on the other hand, others claim that the issues concerning 3D printing should be dealt as to the music industry. It is possible to compare the introduction of CAD files and consumer-level 3D printers, and the development on MP3 files, which evolved less than twenty years ago. The creation of consumer goods in the music industry is becoming from a basic rivalrous model to something that is quasi-non-rivalrous. While the end product - the three dimensional object - is rivalrous, the means of printing that object, the CAD file, is non-rivalrous. Like the music industry before the appearance of MP3 files, producers of consumer goods are now relying on the fact that the costs of infringing the intellectual property rights of individuals are extremely high. If 3D printing really rises at consumer level, the current legal framework for the protection of producers will become increasingly inadequate.[57] One of the main concerns, which arisis is that the courts will state CAD files and 3D printed objects as new fixed medium, such as CDs, however, a better way would be to classify them as a new copyrighted form and give 3D printed objects their own category.[58] Therefore, this chapter outlines the main options that could fully or partially resolve copyright issues at the regulatory level.

[56] VIIDE: Ealey, D. (2015) How to Avoid 3D Printing a Legal Landmine. Available at: http://www.eurekamagazine.co.uk/design-engineering-features/ip-advice/how-to-avoid-3d-printing-a-legallandmine/75838/ (accessed 05.05.2019)
[57] Twomey, P. (2014), p 15-16
[58] Swanson, S. (2014), p 489

3.1 Regulation under copyright law

There are two possible ways to include 3D printing into existing copyright legislations: firstly by introducing a new subject of 3D printing technology; or secondly by categorizing and interpreting 3D printing elements into existing categories of copyrighted objects.[59] Since the 3D printing is quite recently developed, the knowledge and experience of the courts in this field might be inadequate which may lead to strict and narrow interpretation by the courts. These interpretations may be excessively restrictive and not in line with the opinions of producers and users. The possibility that the field of 3D printing will be unregulated for an unspecified time is not excluded, however, it would be in the interest of the manufacturers to regulate the industry industry in a way they would find it most reasonable.[60]

Author Brian Rideout offers possible guidelines for extending copyright laws, which are the following: either extended protection of CAD files or the extended protection of 3D objects in the form of a sui generis right.[61] 3D scanning technology allows its users to create CAD files in no time that include the digital representation of the physical object, therefore, it would be essential to disable the 3D scanning for commercial purposes or by criminalizing the scanning of physical objects for digital purposes, and consider it to be illegal.[62] In this case the copyright holder should then confirm that the physical copying through the 3D printer occurred because the CAD file itself is simply an object presentation, not a copy. However, there is a risk of hampering the future innovation in this area, because an excessive development of intellectual property rights can lead to open-source development and existing design platforms.[63]

3.2 Sui generis right

As discussed in previous chapters the CAD files and 3D printed object does not yet completely fall within the existing copyrightable categories, and because of their complexity, new problems and questions arise about the copyright protection in relation to CAD files functionality and 3D

[59] Swanson, S. (2014), p 489
[60] Ibid
[61] Brian Rideout (2011), p 161-178
[62] Ibid
[63] Santoso, S. M., Wicker, S. B. (2014). The future of three-dimensional printing: Intellectual property or intellectual confinement? New Media & Society, 1-18, p 14.

printed object end result. Therefore, the scholars have suggested to consider sui generis copyright-like protection for 3D objects, because when a new technology starts to develop with its economic benefits, policymakers need to consider appropriate legal framework, as the protection of such works has an influence on technological development.[64] Among EU the sui generis protection can be found in the Database Directive.[65] Databases that do not comply with traditional copyright protection are the exceptions under EU Copyright law to which the sui generis protection is provided, therefore, the scholars have advised that the computer programs also have to be protected by sui generis right.[66] As the Berne Convention provides protection to computer programs as literary works, it may be considered as application of sui generis right as traditional copyright rules have been extended and amended to reflect the distinctive technological characteristics of computer programs.[67]

Sui generis right for 3D printed objects also raises some technical questions. First question that should be considered is: what would be the objectives of setting sui generis right for 3D printed objects. Second problem is whether 3D printed objects get copyright protection more easily than other types of work due to the sui generis right. The discussion of possible sui generis protection for computer programs was due to the lack of adequate and appropriate IP protection. This may be the case with 3D printed objects, as there is currently no suitable analogue in the copyright law. However, since computer programs were protected by copyright without creating a separate sui generis right, it is also possible to conclude that copyright can cover a wide variety of works, including works of digital creation. The introduction of legislative changes related to 3D printing technology should be postponed as long as possible so that revolutionary technology can develop and evolve.[68]

[64] Mylly, supra nota 101, p 880
[65] Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases OJ L 077 , 27.03.1996.
[66] Toeniskoetter, S. B. (2005). Protection of software intellectual property in Europe: An alternative sui generis approach. Intellectual Property Law Bulletin, 10, p 76
[67] Mylly, supra nota 101, p 880
[68] Susson, M. A. (2013). Watch the World'Burn': Copyright, Micropatent and the Emergence of 3D Printing. Micropatent and the Emergence of 3D Printing, forthcoming. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2253109 (accessed: 05.05.2019), p 48.)

CONCLUSION

The aim of this thesis was to thoroughly investigate the potential legal issues that 3D printing may have in the context of intellectual property rights, and in more specific regarding to copyright issues. The fact that 3D printing will have legal implications is unavoidable, Since 3D printers have been widespread in the last ten years among private and legal entities, the scope has increased with legal issues. The legal issues involve the production of counterfeit copies of 3D printed products and the use of 3D printing in order to copy products made using traditional production methods, which has a potential to violate copyright laws.

The key of granting the copyright protection is the requirement of originality. According to the law of US a two-step test must be carried out to determine originality in the work. This test requires that the work must be independently created and created with creativity, however, the test may not adequately analyze originality in digital creations. In the EU, originality is clearly defined for computer programs, databases, and photos, and has recently been harmonized with other work done with the Infopaq case, and the originality criteria must be "the author's own intellectual creation."

Recent literature and researchers' opinions have suggested considering the legal status of three-dimensional models and 3D design files (CAD) and their protection as the intellectual property rights. Specifically, CAD files should be protected as literary works, as CAD files should be considered as computer programs and should therefore be equivalent. The Berne Convention sets out that computer programs were protected as literary works, but the downside of that is the definition of a computer program was not very specific in the aim of avoiding termination of the term and allow the law to follow the rapid development of technology.

The United States Copyright Act has been amended in recent years, first with the changes that the United States had to follow in 1989 under the Berne Convention for the Protection of Literary and Artistic Works, and later with several amendments made at the end of 1990. In addition to Copyright Act, there is also a digital Millennium Copyright Act (DMCA) that plays an important role in US copyright law. The DMCA was adopted in 1998. However, 3D printing is not mentioned in the Copyright Act nor Digital Millennium Copyright Act. There have been obstacles to the harmonization of laws in the European Union. Differences at national level show that, despite the objectives of European harmonization, national interpretations tend to

follow their historical trends. Dependence on the state legal system can be explained, inter alia, by its links with the country's technological, economic and cultural heritage. Therefore, among EU the emphasis is on the international directives concerning the copyright law and 3D printing. This thesis also deals with potential analogous arising from the directives for 3D printing technology and copyright issues, however, the analysis led to conclusion that none of them is really relevant to 3D printing technology aspects. Since the 3D printing technology is complex in its nature, and the different steps of the CAD file to the actual 3D printing process, it would be indicative to regulate the already existing laws or to create a legal framework. The regulation of 3D printing could be created by a new directive aimed at protecting 3D printed objects, covering both the protection of CAD files and the protection of physical 3D printed objects.

As the main conclusions can be said that the legislation concerning the copyright and 3D printing is not currently sufficient from international perspecive, as well as EU and US legislations independently. There is a discussion about possible analogous, however, the existing categories are not fully suitable for the entire 3D printing process. The author suggestes to add 3D printing into existing copyright laws by introducing a new subject of 3D printing technology or by categorizing and interpreting 3D printing elements into existing categories of copyrighted objects. However, the scholars have suggested to consider sui generis copyright-like protection for 3D objects

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