TALLINN UNIVERSITY OF TECHNOLOGY
School of Business and Governance
Department of Law

Aleksi Yli-Houhala

THE EMERGENCE OF ADDITIVE MANUFACTURING (3D PRINTING) AND LEGAL PROBLEMS IN RELATION TO INTELLECTUAL PROPERTY LAW

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Supervisor: Pawan Dutt, LL.M.

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Aleksi Yli-Houhala .....

(signature, date)

Student code: 145413HAJB

Student e-mail address: aleksi.ylihouhala@gmail.com

Supervisor: Pawan Dutt, LL.M.:

The paper conforms to requirements in force

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(signature, date)

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.....

(name, signature, date)

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ABSTRACT

This research examines the relationship and legal problems between 3D printing and intellectual property rights, and the tools for enforcement of rights in the context of 3D printing. The aim of the research is to determine the potential infringements and threats of 3D printing's ecosystem upon Intellectual Property Law, analyse case law of the subject area, and produce a prediction of the future legal developments within the field. The author will focus on legal literature review as the main research method as well as examining cases where 3D printing has caused disruption among the IPR holders, in the absence of definite legal cases of the subject matter to act as precedents.

The author will analyse as main research questions the relation between 3D printing and intellectual property law, and how the two have conflicted as of yet. Additionally, what are the tools of enforcement of intellectual property rights when infringed upon in the context of 3D printing, and finally, whether the current legislation of intellectual property regulating 3D printing is sufficient or in need of revising.

The main conclusions arrived to were that of the different branches of IP, patents are most likely to face the most extensive degree of legal problems and infringements brought by 3D printing for infringing purposes. In order to avoid the negative experiences of the IPR holders in the field of entertainment industry in the turn of the millennia, the legislation of IP should anticipate and prepare to adapt for development of 3D printing, as should the IPR holders by adapting their business models for the arrival of personal manufacturing of products within the following decade.

Keywords: 3D printing, Intellectual Property Law, disruptive technology, enforcement of rights.

LIST OF ABBREVIATIONS

CAD	Computer-aided design
CPC	Community Patent Convention
CTM	Community Trade Mark
DMCA	Digital Millennium Copyright Act (1998)
DRM	Digital Rights Management
EC	European Commission
FDA	Food and Drug Administration
IP	Intellectual Property
IPR	Intellectual Property Rights
P2P	Peer-to-peer
TPM	Trusted Platform Module
TRIPS	The Agreement on Trade-Related Aspects of Intellectual Property Rights (1994)
VCR	Videocassette recorder
WCT	WIPO Copyright Treaty (1996)
WIPO	World Intellectual Property Organization

INTRODUCTION

The emergence of 3D printing, and more importantly the physical emergence of printers implementing additive layer manufacturing technology, commonly known as 3D printers, within the last decade into the more affordable consumer/enthusiast market has introduced a new technology to a wider public audience but has also led to situations where the rights of patent, copyright, trademark and design holders have been a concern. The author chose 3D printing and its legal problems in relation to intellectual property (IP) law to be the subject of research, as the author feels that 3D printing has the capability of revolutionizing not only various industries manufacturing tangible objects, but also to transform the purchasing behaviours of consumers within the next two decades.

The aim of the research is to determine the legal problems of 3D printing in the context of IP law. The aim is fulfilled by analysing different legal problems arising in different branches of intellectual property rights (IPR) and by addressing current legislation in the subject matter and analysing the further demands in the field. The research will consist of literature review, analysing information from legal publications and peer-reviewed articles of the subject, reviewing cases where the conflict of 3D printing and IPR has occurred, and the author´s personal hypotheses and opinions on the subject area.

In the course of the research, the author will focus on three main research questions. Firstly, **what is the relation between 3D printing and IP law, and how the two have conflicted as of yet?** Secondly, **what are the tools of enforcement of IPRs when infringed upon in the context of 3D printing**, and finally, **whether the current legislation of IP regulating 3D printing is sufficient or in need of revising.**

The research will be divided into six separate chapters. In the first chapter, the concept of 3D printing will be briefly examined. The second chapter will mark the beginning of the substantive part of the research, that being the 3D printing and it´s relation to the different branches of IP, starting by examining the branches of IP belonging to industrial property (patents, trademarks and

designs) and after that the IP of copyrights. In every respective chapter the author will examine the potential legal problems of 3D printing for the different branches of IP, as well as an analysis of the regulation and enforcement of the rights within the subject of the chapter at hand.

The second chapter will examine 3D printing and it´s problems in relation to patent law. The problems of 3D printing in relation to trademarks will be examined in the third chapter. The fourth chapter will analyse 3D printing and the legal problems in relation to designs, and the fifth chapter will focus on 3D printing the problems in relation to copyrights. The fifth chapter will mark the end of the substantive part of the research. After having examined the various branches of IPs, the problems, regulation and enforcement, the last chapter will be dedicated to conclusions, where the research questions will be answered thoroughly, and the author will reflect on the applicability of the results arrived to.

1. THE CONCEPT OF 3D PRINTING

In order to begin the research of the relation of 3D printing and IP, it is needed to examine the concept, operation, utilization and status of 3D printing. From an overly simplified perspective, a 3D printer is a mechanical device which is capable of producing tangible three-dimensional objects. The International Organization for Standardization has defined 3D printing as of following: "process of joining materials to make parts from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing and formative manufacturing methodologies".[1] Whereas a traditional printer can produce pages of paper or film including of text or photographs, a 3D printer is capable of producing tangible objects, with virtually any possible kind of shape within the physical, technical and material limits of the 3D printer itself. Whereas a modern printer can produce a readable, physical representation, for example of a text file commonly by using a computer´s text editor to create the file, a 3D printer requires a different set of "blueprints" to construct the object. A 3D printer requires a Computer Aided Design (CAD)-file, which essentially is the three-dimensional digital model of what the printer will use as instruction for the operation in the printing process.

The method of operation is what distinguishes the two; as a traditional printer sprays toner ink in various patterns on paper or film, a 3D printer utilizes an additive process, in which the object is constructed by adding thin layers of materials varying from liquid plastics, such as urethanes and resins, all the way to different types of metals in forms of sheets, wires, powders and fabrics in the more technically advanced and thus, expensive models.[2] The method of operation and the resulting accuracy is what makes 3D printers so versatile, as layers laid on top of each other in the 3D printing process can share an individual thickness of even 0.003mm, which in effect enables

[1] International Organization for Standardization (ISO). (2015). *ISO/ASTM 52900:2015(en)*, Accessible: https://www.iso.org/obp/ui/#iso:std:iso-astm:52900:ed-1:v1:en, 09.01.2018.
[2] Srivatsan, T. S., Manigandan, K., Sudarshan, T. S. (2016). Additive Manufacturing of Materials: Viable Techniques, Metals, Advances, Advantages, and Applications. – *Additive Manufacturing: Innovations, Advances, and Applications.* (Eds.) T. S., Srivatsan, T. S., Sudarshan. Boca Raton: CRC Press, p 5.

designers to create and print models' rich of details and features.[3] As the technology of 3D printing has developed significantly within the last decade, and in that time the introduction of the printers themselves to the consumer markets has occurred due to various companies producing them at an affordable price point, the technological concept itself is nothing new; the first patent was granted for a process implementing 3D printing technology in the United States in 1977.[4] It was not until the next decade, the 1980's, when the industry saw the large-scale introduction of computers which were capable of creating 3D models. This accelerated the implementation of 3D printing processes to the manufacturing industries, which has enabled the manufacturers to conduct rapid prototyping in cost-effective manner in their phases of research & development, all the way to implementing the 3D printing techniques to producing the most delicate and high-precision demanding objects such as jet-engine nozzles.[5] The advantage 3D printing provides to prototyping is that as opposed to creating the prototypes by means of casting from moulds, to which alterations in design would require physical replacement of the moulds in the manufacturing process, a CAD-file's design can be modified without expense.[6] In comparison to 3D printing, this can be expensive and time-consuming.[7] As of now, the 3D printing's status is a growing one. Within the past decade, 3D printers have erupted to the sphere of private use by consumers, and their commercial utilization has gained more ground, but does 3D printing's growing utilization possess any disadvantageous elements?

1.1. Analysis of 3D printing as a disruptive technology

This chapter will analyse whether 3D printing is a disruptive technology. In order to assess the factors involved, it is required to apprehend disruptive technology itself. The term was introduced by Clayton Christensen, a Harvard professor in his book "The Innovator's Dilemma" from 1997. Christensen divided emerging technologies to classes those of sustaining and of disrupting. Christensen defined new technologies where developments are made to already existing

[3] Silverman, I. (2016). Optimising protection: IP rights in 3D printing. – *European Intellectual Property Review,* Vol. 38, No. 1, 5-10.
[4] Daly, A. (2016). *Socio-legal aspects of the 3D printing revolution.* London: Palgrave Macmillan, p 5.
[5] Chua, C. K., Leong, K. F. (2015). *3D printing and additive manufacturing: principles and applications.* Hackensack: World Scientific, p 7.
[6] Van Overwalle, G., Leys, R. (2017). 3D printing and patent law: a disruptive technology disrupting patent law? – *International Review of Intellectual Property and Competition Law,* Vol. 48, No. 5, 504-537.
[7] Braun, V., Taylor, M. (2012). 3D printing. – *Computer and Telecommunications Law Review,* Vol. 18, No. 2, 54-55.

technologies as sustaining technologies, as they sustain the established patterns within the industries, whereas new technologies which differ from those established patterns due to their innovation and new approach as disruptive technologies.[8] Notwithstanding the novelty of the term itself, the phenomenon of disruptive technology is nothing new. Every once in a while, a type of technology or a company with a distinctive business model enters the industry raising opposition and concerns among its industries parties. Prime examples of disrupting technologies vary from email, which significantly reduced the correspondence by letters in mail, to personal computers and their text editor's which in effect caused the foreclosure of typewriter markets, the impact the emergence of refrigerators had for the providers and the market of delivered ice for preservation of food, and even in the context of printing an example can be found of disruptive innovation, that being the printing press introduced by Johannes Gutenberg in the 16th century, which disrupted the method of producing and copying of texts as the invention enabled texts to be copied by means of a machine, replacing the manual labour of handwritten copying.[9]

Analysing whether or not 3D printing is a disruptive as a technology or not, it is needed to analyse in which ways can it disrupt the established technologies and patterns of production in industries. It has been argued, that a fundamental change will occur to the manufacturing of products, where traditionally a manufacturer produces a product and distributes it to the consumers. The predicted change is that as in the future consumers acquire 3D printers in wide-scale manner, capable of producing the most accurate and versatile objects from varying materials, the manufacturing of products will be shifted to the consumers and the traditional role of manufacturers and their business models as supplier of the goods will be severely affected.[10] This prediction is futuristic, as of yet such phenomenon's have not yet occurred, but its hypothetical value for the companies in the manufacturing industries is important as in past a similar progress could be seen in the market of entertainment streaming services, which the traditional providers of movie rental services foresaw, tried to challenge and understate, but the disruptive nature and the widespread adoption of consumers of entertainment streaming services in the end amounted an almost complete foreclosure of the traditional entertainment rental services from their once predominant market status; a similar phenomenon occurred on the market for delivered ice as the product which

[8] Christensen, C. M. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Brighton: Harvard Business School Press, p 4.
[9] Van Overwalle, Leys (2017), *supra nota* 6, p 504-537.
[10] *Ibid*., p 504-537.

was commonly delivered to customers became void due to the cooling capabilities of refrigerators in consumer use.

The above presented example and the prediction of the decentralization in producing of products however, are not directly comparable due to their difference in adaptation and application, and the fact that in the case of entertainment streaming services the consumers already possessed the devices of which they could acquire the same entertainment content, circumventing the physical visit to the video-rental establishment, whereas in the case of 3D printing among consumers, it as of yet, has not become as mainstream of a platform of devices in household consumer use. The possible 3D printing-enabled fragmentation in the structural system of product manufacturing in the future without a doubt possesses potential violations and disruptions to not only different branches of IP, but also to product liability laws;[11] In scenarios where user-generated content in form of distributed CAD-files replaces e.g. the established market status of companies' registered designs and a consumer experiences an accident due to a fault in the CAD-files structural design, is the designer of the CAD-file responsible, the provider of the 3D printer itself, or the consumer themselves even in the absence of agreeing to replicate objects at one's own risk? The following chapters will analyse the problems of 3D printing in relation to the respective branches of IP, the direct and indirect infringements within the 3D printing's ecosystem, and in which areas of IPs could the effect of 3D printing's disruptive nature be seen.

[11] *Ibid.*, p 504-537.

2. 3D PRINTING AND LEGAL PROBLEMS IN RELATION TO PATENTS

In this chapter, the implications and effects of 3D printing to patent rights will be analysed. To begin the analysis of the relation of the two, it is required to examine the patent system itself, as well as the extensity of the protection enabled by the patent system for the proprietors of patents after grant. After having briefly addressed the requirements for patentability, the integral part of 3D printing's relation to patents will be analysed by examining the different phases, scenarios and factors of the 3D printing system where the intersection of 3D printing and patent rights occurs and the infringement of patent rights by it.

In essence, patents protect inventions. This is not to say that every invention possesses the required attributes to be subject for a grant of patent.[12] The World Trade Organization's The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) Article 27(1) provides that in order for an invention be patentable, it has to have novelty, contain an inventive step, have industrial applicability and be licit.[13] In essence, patents are proprietary rights which confer exclusive rights to exploitation by the proprietor, even in cases where the proprietor is not allowed to utilize the patent, but the right conferred enables him to prevent other parties from doing so.[14] Analysing the infringement of patent holder´s right by acts by 3D printing, it is needed to examine the specific features of the patent holder´s rights which can be infringed upon; as provided by Article 28 of the TRIPS Agreement, grant of a patent confers certain exclusive rights to the proprietor, which enable him the enforceable legal right of, in the case of product patents, "to prevent third parties from making, using, offering for sale, selling, or importing that product without the patent owner´s consent".[15] In the case of process patents, the owner has the right to prevent others from "using

[12] Jacob, R., Alexander, D., Fisher, M. (2013). *Guidebook to Intellectual Property*. 6th ed. Oxford and Portland: Hart Publishing, p 36.
[13] World Trade Organization (WTO), The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), art 27.
[14] *Ibid.*, art 28(1)(a)(b).
[15] *Ibid.*, art 28(1)(a).

the process, as well as using, offering for sale, selling, or importing for these purposes at least the product obtained directly by that process".[16] Infringing upon any of these rights during the time period of the patent's protection would amount to a direct infringement. Article 30 of the Community Patent Convention (CPC) provides that in order to amount to indirect infringement, any of the following acts would have to occur: "supplying or offering to supply – with means relating to an essential element of that invention, for putting it into effect therein, when the third party knows, or it is obvious in the circumstances, that these means are suitable and intended for putting that invention into effect."[17]

The patent system in a way can be seen facing problems as it functions relatively similarly as a century ago, whereas the digitalization in other branches of IPR has been notable, which is why the author attempts to find whether or not 3D printing will prove to be a similar or harder challenge for IPR's than online piracy was copyrights. The first sub-chapter will analyse the always necessary CAD-files, what are the scenarios when they can infringe upon patent rights, in their respective phases of creation and distribution, as well as the limitations to such practices. The second sub-chapter will analyse the physical process of 3D printing itself, the liability of the parties and the infringements that can occur. During these sub-chapters, the author will analyse the potential infringements from the perspective of the rights conferred to patent owner´s as well as the technical aspects of which of the practices and activities within the 3D printing society have potential for infringement.

2.1. CAD-files

As a preface, the role of CAD-files is of importance to the 3D printing process, as in order for a 3D printer to print out objects, the machine needs commands to follow upon, them being the CAD-files which contain the digital blueprints. CAD-files themselves are not solely means of the infringement, as they are used in industries varying from architecture to aviation designing but can certainly be utilized in ways which would amount to direct patent infringement, as without a CAD-file, a product created by a 3D printer cannot be realised.[18]

[16] *Ibid.*, art 28(1)(b).
[17] European Economic Community (EEC), 76/76/EEC of 26 January 1976 Convention for the European Patent for the Common Market, L 17/2, art 30.
[18] Mendis, D. (2013). "The clone wars": episode 1 – the rise of 3D printing and its implications for intellectual property law – learning lessons from the past? – *European Intellectual Property Review,* Vol. 35, No. 3, 155-169.

2.1.1. Creation of a CAD-file

"A man who has a habit for smoking cigarettes, has grown very keen on a particular brand of a lighter, that brand being Zippo.[19] He wonders whether it would be possible to make an accurate replication of it by a computer's 3D modelling program. He then proceeds to do so, and ends up creating an almost perfect replication as a CAD-file of the Zippo-lighter."

In the example scenario above, the average potential infringer of patents is imagined in their initial phase. In the example, it was assumed that the man wanted to create the CAD-file himself by a 3D modelling software, however this is not the only way to create a CAD-file of an existing object; the man could have also utilised a 3D scanner to arrive at the same result.[20] The example's CAD-file, modelled with the aim of replicating the original product, such a CAD-file can infringe upon the lighter's patent rights depending on the subsequent acts; if the man of the example was not to advance further and distribute the file or realise the digital design into a physical replication of the Zippo-lighter and possibly sell it, he would not be further infringing the right of the patent holder by supplying and it is unlikely that he would be sued for infringement if such modelling is done solely for the purpose of private enjoyment as a hobby, even though in the unlikely event of the patent holder suing a person for acts similar to the example, the patent holder could argue that by an act of reverse-engineering the plaintiff has created a copy device by the CAD-file.[21] On the basis of the conditions of direct and indirect infringement of patent rights, the above presented acts hardly would amount to infringement of the patented article.

2.1.2. Distribution of CAD-files

"After having finessed the design of the CAD-file as close to the patented article, he thinks other like-minded individuals could like his creation too and decides to upload it onto an online platform used to distribute files of such kind."

This sub-chapter will analyse the distribution of CAD-files intended for 3D printing, and the liabilities of the different parties involved. The status and contribution of CAD-files has faced controversy due to whether or not CAD-files infringing patent rights belong to the process of

[19] *List of various patents of Zippo-brand lighter*, Zippo Manufacturing Company. Accessible: https://cdn.shopify.com/s/files/1/1295/7985/files/Windproof_Patent.pdf?467049124388331634, 21.3.2018.
[20] Van Overwalle, Leys (2017), *supra nota* 6, p 504-537.
[21] European Commission - Overview of 3D printing & intellectual property law (2016), Under the contract with the Directorate General Internal Market, Industry, Entrepreneurship and SMEs (MARKT2014/083/D), Annex 3, p 15.

manufacturing and thus amount to direct infringement. It can be argued that the distribution of CAD-files modelled from patent protected articles will most likely result in the realisation of those CAD-files designs in the 3D printing's ecosystem, and therefore constitute as indirect infringement of supplying the means for infringing patent right, and thus being to some extent, almost the same as the tangible object itself. This approach however is problematic in the context of patents, as in order for a patent to be infringed, a third party would have to commit the act of making it without the user's consent, as is in the case and analysis of the following sub-chapter, but in the context of mere CAD-files of patent infringing digital blueprints, the digital files of the patented article do not fulfil the conditions of direct infringement, as would be in the case of digital files of copyrights, but due to the nature of CAD-files and their imminent closeness to the creation of a tangible object could possibly require adaptation of legislation, to establish digital patent infringements in the future.[22] As of now, the mere creation and possession of a patent infringing CAD-file does not constitute infringing the patent holder's rights. It is required then to examine the distribution of patent infringing CAD-files, and the liability of the parties involved in the process.

As imagined in the example, the Zippo-replicating 3D-model of the lighter has entered circulation to an online platform. In the article by O. Owoeye and M. Adewale, the authors emphasize the liability of the online platform provider's as a possibility for enforcing patent holder's rights in the context of distribution of CAD-files infringing patent holder's rights.[23] By application of such theory to the paradigm of enforcement of patent rights, the patent holder could enforce their patent right by claiming damages from the providers of online platforms where CAD-files infringing patent holder's rights are distributed, as has been the common policy in cases of copyright infringing peer-to-peer (P2P) distributing online platforms.[24] This approach of shifting liability to intermediaries as providing means of infringing patent protected articles to owners of 3D printers would however be problematic, as it would have to be demonstrated that the intermediaries actively promoted the distribution of patent infringing CAD-files. The extent of interpretation is up to the Courts until definitive legislation is established. The author speculates, that in some cases if the providers of online platforms were to be found of promoting the distributed CAD-files for

[22] Holdbrook, T. (2016). *How 3D Printing Threatens Our Patent System*. Accessible: https://www.scientificamerican.com/article/how-3-d-printing-threatens-our-patent-system1/, 21.3.2018.
[23] Owoeye, O., Adewale, M. (2016). 3D printing and patent law: a balance of rights and obligations. – *European Intellectual Property Review*, Vol. 38, No. 11, 697-702.
[24] *Ibid.*, p 697-702.

the intention of infringing patent protected articles, they could be prosecuted for contributory infringement.[25]

2.2. 3D Printing

2.2.1. Direct infringement

"The man decides to print the CAD-file of the Zippo-lighter by utilising a 3D printer capable of printing the materials required for the construction of the metal-bodied lighter. The end result is an almost exact physical copy of the original Zippo-lighter."

This sub-chapter will analyse the substantial act of 3D printing itself, and the infringements upon patent law following. The conditions of acts amounting to direct infringement of patents are, as noted earlier, making, using, offering for sale, selling, or importing that product without the patent owner´s consent.[26] After having physically replicated the patent protected object, the man has committed a direct infringement upon Zippo-lighter's patent holders by making the patented article. This alone is not sufficient to bring the man of the example into criminal proceedings; as analysed by Daly, citing Weinberg's article, the problem of the relation between 3D printing and patents are the dissimilarities to copyrights, as noted, that copyright explicitly prohibits copying of the work which most people know to be copyright infringing and refrain from doing so, as where in patents it is notably more cumbersome for an individual to be aware of all the objects that are patent protected, and thus could yield increasing amounts of "innocent" infringers of patents.[27] It is the subsequent acts decided to pursue by the man of the example, that will determine the extent of his liability, as certain renowned limitations and exceptions do exist to the prohibited acts in the context of patents.

Within the European context, the limitations and exceptions of the CPC, harmonized to national legislations, provide that "acts done privately and for non-commercial purposes; acts done for

[25] 35 U.S.C. § 271(b) Infringement of patent, U.S. Patent Act.
[26] World Trade Organization (WTO), The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), art. 28(1)(a).
[27] Weinberg, M. (2010*). It Will be Awesome If They Don´t Screw It Up: 3D Printing, Intellectual Property, and the Fight Over the Next Great Disruptive Technology*. Public Knowledge, referenced in Daly (Daly (2016), *supra nota* 4, p 30).

experimental purposes relating to subject matter of the invention (experimental use)"[28] shall be exempted from the exclusive right of the patent holder after grant and confer of patent rights, thus escaping the scope of direct infringement.[29] If the man of the example were not to pursue commercial gain from the 3D Zippo-lighter, he wouldn't be liable for patent infringement. The extent of patent protection of an object also comes to play when consumers utilise 3D printing for purposes of spare or replacement parts to an already existing patent protected object.

In various cases regarding the patentability of replacement parts, a common case in automotive industry, the approach taken by many manufacturers have been to apply for design patent protection for their respective brand replacement parts. Although in various cases the manufacturers have tried to enforce their rights to deter market loss of replacement parts manufactured by third parties, the recurring pattern in the decisions given by Courts in EU and US has been that the individual elements of a product cannot be patented, with certain case-specific conditions. In the case of *Schütz v Werit*, the UK Supreme Court held that the constructive nature and approach of the patented article and the replacement part desired to create for it dictates the applicability of "manufacturing" the patent protected article in an infringing manner, as if a part desired to be made a replacement for is removed from the patented article and the article still remains as the main component and contains the claimed invention, then it cannot be claimed that replicating a replacement "subsidiary" part for the larger patented article would constitute as infringing act if the replacement part doesn't consist of the patented innovation claimed.[30] In effect, in the context of 3D printing within Europe, the consumers would be able to print replacement parts for their owned patent protected objects without fear of patent or design infringement accusations, given that such manufacturing of replacement parts was conducted for personal use, or as noted earlier, "acts done for experimental purposes relating to subject matter of the invention (experimental use)".[31]

The acts of 3D printing patent protected objects that fall outside the limitations provided have an increased likelihood of being caught by the attention of the patent right holder's, especially if the act(s) are conducted in a commercial manner. Next the author will speculate certain scenarios,

[28] European Economic Community (EEC), 89/695/EEC of 15 December 1989 Agreement Relating to Community Patents, L 401, Luxembourg, art 27(a)(b).
[29] Kur, A., Dreier, T. (2013). *European intellectual property law: text, cases and materials.* Northampton: Edward Elgar, p 118.
[30] Supreme Court of the United Kingdom, [2013] UKSC 16, *Schütz Limited. v. Werit Limited.*
[31] European Economic Community (EEC), *supra nota* 28, art 27(a)(b).

where the commercial utilisation of 3D printers could yield patent infringements and legal proceedings. Firstly, the vast development of 3D printers themselves as well as the materials of which they are capable of producing tangible objects has expanded rapidly within the last decade. The shift from plastic resins all the way to fabrics, metals, tissue and even consumables has created new market segments for manufacturers to utilise 3D printing in, but in effect has also created opposition claiming regulatory acts.[32] One such example was seen in 2015, when the US departments of Food and Drug Administration (FDA) approved the first medicine capsule for consumer market distribution that was manufactured utilising a 3D printer.[33]

The author speculates that this trend of 3D printing drugs could lead to emerging companies challenging and copying patent protected recipes of their competitors established drugs, which as themselves could be much more dated than the general 20-year longevity of the patent's protection, but which continue to be protected by patents due to the evergreening of patents. Even though such strategic patent planning practices of making minor alterations to the details and technicalities of the patent claims and filing them shortly before the expiry date of the original patent have been contested due to their exploitation of the patent system, they are however legal in most cases. The author predicts that within the next decade various drug patent infringement cases involving utilisation of 3D printing will be seen globally.

Even more controversial topic of patentability has been the field of genetic patents, as was seen in the case of Harvard University's Onco-Mouse case in 1980's, where a patent application claim consisted of a laboratory mouse which had been exposed to a specific gene which increased the likelihood of the mouse to develop cancer. [34] In effect, and as approved in 2004 by the European Patent Office, this was suitable for research of cancer of humans, which outweighed the ethical aspect of animal suffering.[35] This is notable, as by granting a patent in the Onco-Mouse case, the path for future biotechnological innovations to be granted patent protection was laid in the European context, which is crucial for the further development of the field of bioprinters and their

[32] Nissan, A. M. (2016). Regulating the Three-Dimensional Future: How the FDA Should Structure a Regulatory Mechanism for Additive Manufacturing (3D Printing) – *Boston University Journal of Science and Technology,* Vol. 22, 267-298.
[33] *Spritam, the first 3D printed drug to be approved by the FDA,* Aprecia Pharmaceuticals LLC. Accessible: https://www.spritam.com/#/patient, 21.3.2018.
[34] Kur, Dreier (2013), *supra nota* 29, p 129.
[35] World Intellectual Property Organization. (2006). Bioethics and Patent Law: The Case of The Oncomouse – *WIPO Magazine*, No. 3, 16-17.

relation to patents.[36] The intersection of the example above and 3D printing is that in the future, as complete case law to serve as a precedent of the subject area have not yet occurred, the author speculates that also within the next decade, biotechnical patents, genetic patents and stem cell patenting will be subject of patent infringement cases, if biotechnical companies challenge patents of their competitors utilising 3D bioprinters for printing of human cells, which was already proved possible in US in the year 2004 when the first patent for ink-jet printing of viable human cells was granted.[37]

2.2.2. Indirect infringement

As noted earlier, Art. 30 CPC provides that "supplying or offering to supply – with means relating to an essential element of that invention, for putting it into effect therein, when the third party knows, or it is obvious in the circumstances, that these means are suitable and intended for putting that invention into effect"[38] amount to an indirect patent infringement. The idea of the intersection of indirect patent infringement and 3D printing becomes fathomable, if one considers the providers of 3D printers and the respectively the providers of the materials required for 3D printing to be the "essential means", intended for the physical creation of the patented article. Drawing an analogy to earlier cases where the utilisation of a new product was questioned in the context of IPR, as was in the case of *Sony Corp. of America v. Universal City Studios, Inc.*, where, even though being a copyright and not a patent case, the utilisation of video cassette recorders (VCR's) was questioned.[39] The Sony case will be analysed in depth later on in the chapter of copyrights. The approach taken by the U.S. Supreme Court in the case of *Global Tech Appliances v. SEB* could yield manufacturers of 3D printers and parties hosting CAD-file distribution platforms liable for indirect infringement if it could be shown be the claimants that the plaintiffs had knowledge of a said patent's existence and that they facilitated or acted in a way which infringed upon that patent.[40] This must have been recognised as a potential legal pitfall by the parties, as they display visibly that they are not liable for any of the acts their products or services users engage them

[36] Stazi, A. (2015). *Biotechnological Inventions and Patentability of Life: The US and European Experience*. Cheltenham: Edward Elgar Publishing Limited, p 219.
[37] *Patent for ink-jet printing of viable cells, US2004237822 (A1)*, European Patent Office (EPO). Accessible: https://worldwide.espacenet.com/publicationDetails/biblio?FT=D&date=20041202&DB=&locale=en_EP&CC=US&NR=2004237822A1&KC=A1&ND=1, 21.3.2018.
[38] European Economic Community (EEC), *supra nota* 28, art 26.
[39] Supreme Court of the United States, 464 U.S. 417 (1984), *Sony Corporation of America et al. v. Universal City Studios, Inc., et al.*
[40] Supreme Court of the United States, 563 U.S. 754 (2011), *Global-Tech Appliances, Inc. v. SEB S.A.*

into.[41] The author contemplates, that such proceedings could however occur, if it could be proven that the providers of the printers and materials actively promoted the use of their products for patent infringing purposes, or if following a future regulation of the 3D printer technology and surveillance of production, failed to implement a sort of manufacturing control system into their products, similar to a digital rights management (DRM)-access technology.[42]

2.3. Regulation of 3D printing in the context of patent law

The digitisation of the entertainment industry notably affected the copyright legislation, but digitisation of objects or innovations subject to patent protection have not had the same experience due to their tangible, and thus not digital nature.[43] The regulation of 3D printing in the context of patent law is as of yet non-existent, and no cases have occurred where patent owners have sued providers of sharing platforms for contributory infringement.

2.3.1. Enforcement of rights

In the European context, European patent law excludes private- and non-commercial use from the infringement of a patent, whereas in the U.S. no such exception exists.[44] For this reason, the author predicts that most of the future cases of infringement of patent rights by utilization of 3D printing may emanate from U.S. jurisdictions. In the context of 3D printing, and generally as well the enforcement of patent rights in infringement cases makes them problematic when compared for example, to copyrights as in patents, the patent holder has the responsibility of proving that the plaintiff carried out a prohibited act, that the prohibited act was done only after the publication of the patent application, that the prohibited act was done in country where the patent has effect due to grant, and lastly that the prohibited act was in relation to a product or a process within the scope of the patent claims in order to establish a patent infringement.[45] It has been argued that for this reason in enforceability of patent rights, a majority of the 3D printer hobbyists would evade patent

[41] Van Overwalle, Leys (2017), *supra nota* 6, p 13.
[42] Mendis (2013), *supra nota* 18, p 155-169.
[43] Ballardini, R. M., Norrgård, M. (2016). Digitising patent law: challenges from 3D printing technologies. – *European Intellectual Property Review,* Vol. 38, No. 8, 519-521.
[44] Bechtold, S. (2016). 3D printing, intellectual property and innovation policy. – *International Review of Intellectual Property and Competition Law,* Vol. 47, No. 5, 517-536.
[45] World Intellectual Property Organization. (2004). *WIPO Intellectual Property Handbook: Policy, Law and Use*. 2nd ed, p 29.

infringement proceedings due to the lack of capacity of monitoring such events, as well as to the unprofitable nature of suing each one individually.[46] For patent owners enforcing their rights against intermediaries for contributory infringement, the principle of "Staple commercial product" comes into play as discussed by Overwalle and Leys in their article.[47] Essentially the manufacturers of 3D printers and the parties hosting the CAD-file sharing platforms would be exempt from liability for contributory infringement if their equipment and services would have a majority of legal users and use-bases. The author concurs that this is the scenario for the time being, but the adaptation of legislation of IP will without a doubt examine the problem collectively and possibly implement a sort of "Digital Millennium Copyright Act (DMCA) for patents" as a tool for enforcement of patent rights in order to adapt to the current and the future demands brought along by breakthrough of low-cost 3D printing amongst consumers and the growth of 3D printing services.[48]

[46] Daly (2016), *supra nota* 4, p 30.
[47] Van Overwalle, Leys (2017), *supra nota* 6, p 12.
[48] Desai, D., Magliocca, G. (2013). Patents, Meet Napster: 3D Printing and the Digitization of Things. – *Indiana University Robert H. McKinney School of Law Research Paper No. 2013-37; Thomas Jefferson School of Law Research Paper No. 2338067*, referenced in Daly (Daly (2016), *supra nota* 4, p 31).

3. 3D PRINTING AND LEGAL PROBLEMS IN RELATION TO TRADE MARKS

In this chapter, the implications of 3D printing to Trade Mark Law will be analysed from a perspective of reflecting the future's potential legal problems brought by 3D printing to the existing legal problems of trade mark law. As a preface, a trade mark is a badge of origin, be it in the physical form of a sign, including words, personal names, logos, pictures, three-dimensional shapes and the shape of the goods as well the packaging their contained in, a colour or a combination of colours or a scent, which as a requirement must be capable of distinguishing one trader's goods from those of another, have the capability of being graphically represented, be licit and available for use, hence not infringing an existing trade mark. The relatively-modern inclusion of scents,[49] colours, two- and three-dimensional shapes, have opened new frontiers for trade mark proprietors to identify their brand from those of others, but the inclusion of shapes as subjects for trade mark protection can have a problematic future due to 3D printing.

In the European context, rights conferred by a Community Trade Mark (CTM) enable the proprietor to prevent third parties from using the mark in use of commerce without the proprietor's consent, meaning any sign which is identical with CTM in relation to goods or services for which the CTM is registered, or a sign which is identical or similar mark for identical or similar products if it results a likelihood of confusion among consumers, and use of identical or similar mark for goods or services which are not similar to the goods or services of which the CTM is registered to, but have reputation and third parties' use of the proprietors mark takes unfair advantage or is detrimental to the proprietor's mark.[50] The criteria in order for determining infringement of trade mark are, that the entity accused of infringement must have made active use of the sign, in a commercial manner, the use has been in relation to the goods or services of which the proprietor's mark is registered, and that the accused entity's use has jeopardised the trade mark's functions by being detrimental to the proprietor's revenue derived from the utilisation of their respective

[49] Burgett, J. M. (2009). Hmm... What's That Smell? Scent Trademarks – A United States Perspective – *INTA Bulletin*, Vol. 64, No. 5.
[50] Council Regulation (EC) No 207/2009 of 26 February 2009 on Community Trade Mark, art 9(1)(a)(b)(c).

mark.[51] As in the chapter of patents, the essential actors, elements and processes of the 3D printing's ecosystem need to be examined to determine potential legal problems in relation to trade marks to find out which acts would constitute infringement of trade marks.

3.1. Creation, distribution and hosting of CAD-files

The situation regarding CAD-files and their role as potential tools for infringing IPR of trade marks is in certain ways similar to those discussed in the earlier chapter of patents. When analysing an individual who creates a CAD-file with embedded trade mark signs, names or logos, one could consider that as a using of trade mark without the proprietor's consent, however solely the creation of such a model containing identical or similar marks to the one registered does not amount to infringement as the individual creating the CAD-file has not involved themselves in use that would qualify as commercial in any way pursuant to Art. 9 CTM.[52] The distribution of such files however could yield legal liabilities of trade mark dilution, trade dress infringement and trade mark tarnishment for the party involving in such activities as discussed below in the chapter of enforcement of rights.

3.2. 3D printing of trade mark protected objects

To understand the intersection of 3D printing, their role in relation to trade marks and the possible issues resulting, one can visualize the process of replicating an object by means of a 3D printer containing embedded marks, e.g. a smart-phone cover with Apple-logo, or in the context of 3D shapes, a physical 3D model representing a 3D trademark such as Coca-Cola glass-bottle, Toblerone chocolate-bar and its packaging, or other designs protected by trade marks.[53] To establish infringement, direct or indirect, it is needed to analyse the extent, utilisation and nature of such processes of 3D printing.

[51] Kur, Dreier (2013), *supra nota* 29, p 195.
[52] Council Regulation, *supra nota* 50, art 9(1)(a)(b)(c).
[53] Froemming, J., Day, J. (2017). 3D Printing: Key Legal Issues and Options for Change. – *INTA Bulletin*, Vol. 72, No. 20.

3.2.1. Private use

Trademark protection enables the proprietor of the mark to use the mark as to distinguish their products from those of others and enable them to stop others from doing so. If an individual utilises a 3D printer to print e.g. a single coffee mug for their personal use with a Coca-Cola logo embedded on it, then the situation is similar to the creation of the CAD-file of which the printed coffee mug originates. In such a situation, the existence of confusion among consumers is non-existent, and the use of trade mark by the individual is not use in the context of commercial trade. As in the earlier case of patents and utilisation of 3D printers, it is the subsequent actions taken by users of 3D printers that may amount to infringement of IPR rights.

3.2.2. Commercial use

As of now, one of the most notable problems decreasing revenue and with potential to decrease brand-image of a registered trade mark is the widespread counterfeiting of trade mark protected goods on a global scale. In essence, the counterfeit goods bear the trade mark sign and are sold without being licensed to do so, which in effect misleads the consumers and decreases the revenue of the trade mark protected goods. It can be speculated that the introduction of 3D printing to the product markets could lead to situations where certain parties with aim of infringing existing trade marks would utilise 3D printing to purposes of manufacturing enhanced counterfeit goods without the expense of manufacturing them traditionally by a physical factory in a costly manner. In the market for trading in the EU, as of now majority of the trade mark infringing products are manufactured outside EU, and then imported into EU markets. The geographical shift of manufacturing of the counterfeit goods from an off-shore factory to within the borders of EU would most likely increase the flow of counterfeit goods as they wouldn't be as susceptible for the customs located on the outer-rim of EU.[54] The dilution of trade marks due to counterfeit goods was at question in *LVMH v eBay*, where the French commercial court held eBay liable for secondary trade mark dilution for providing the means to sell counterfeit goods of Louis Vuitton.[55] Even though the providers of the platform were not aware of such infringing acts, they could not rely onto it, and would be held liable under wilful blindness.[56] A similar approach taken by the French Court in the context of enforcement of trade mark law with 3D printed objects and CAD-

[54] Silverman (2016), *supra nota* 3, p 3.
[55] Sun, H. (2014). Reforming anti-dilution protection in the globalization of luxury brands. – *Georgetown Journal of International Law*, Vol. 45, p 784.
[56] Tribunal de commerce, [2010] ETMR 10, *LVMH v eBay.*

files could render intermediaries such as Thingiverse and Shapeways responsible for trade mark dilution and contributory trademark infringement.

3.3. Regulation of 3D printing in the context of trade mark law

The regulation of 3D printing in the context of trade mark law, and more specifically the enforcement of the proprietor's rights in this context are examined, as the author feels that as commonly known precedents and case law involving 3D printing and trade mark law have not emerged yet, it is crucial to examine the enforcement of the rights in order to depict the future developments within the field and also to reflect on past case law and events on CAD-file sharing platforms with DMCA takedown-notices, where an analogy could be drawn from. As of yet, legislation of trade marks does not have separate clauses dedicated for regulating 3D printing, as the acts committed within the ecosystem of 3D printing with potential to infringe upon trade mark rights of their proprietors are similar to the already existent enemies of the mark's proprietors including the similarity of competing manufacturer's marks in the same product market with potential of causing confusion amongst consumers and the above mentioned market of counterfeiting of widely known trade mark's products. In the UK, the Trade Marks Act of 1994 contains the legal basis for rights of the trade mark owners.[57] As discussed below in the chapter of enforcement of rights, the U.S. basis for acts of dilution and tarnishment are found in the Federal Trademark Dilution Act.[58] Use-based trade mark rights is not harmonized in EU, thus subject to national IP laws of each respective Member State. Registered trade marks are harmonized, and thus stronger in their enforceability and uniform nature due to harmonization. In the US context, sanctions for intentionally producing and trafficking counterfeit goods is provided in the 1984 Trademark Counterfeiting Act.[59]

3.3.1. Enforcement of rights

The enforcement of rights of the trade mark proprietors' is in a way different than those of copyrights, as the companies and individual proprietors of the marks have for a long time enforced their right to the use of their respective mark due to widespread counterfeiting for several decades.

[57] Silverman (2016), *supra nota* 3, p 3.
[58] 15 U.S.C. § 1125 False designations of origin, false descriptions, and dilution forbidden, Federal Trademark Dilution Act.
[59] Manta, I. (2011). The Puzzle of Criminal Sanctions for Intellectual Property Infringement. – *Harvard Journal of Law and Technology*, Vol. 24, No. 2, p 485.

For that reason, the author speculates that the impact of 3D printing as a whole for the IPR of trade marks will be less severe than that of the digital copyrights of the entertainment industry in the turn of the millennia. An example scenario of enforcing proprietors' rights in the context of 3D printing was seen as a CAD-file replicating the physical features of Tintin's moon rocket was distributed on the CAD-file platform called Thingiverse. The case had mostly aspects of copyright infringement, as discussed later in the respective chapter of copyrights, but also featured aspects of trade dress infringement for acts of unauthorised association with the actual mark's owner.[60]

The intersection of 3D printing and trade mark law is a bit different from the scenario of patents and copyrights due to their difference in what they protect. At the current state of 3D printing and its utilisation in a commercial manner producing counterfeit products of trade mark protected products, the likelihood of consumer confusion regarding the authenticity of the product is almost non-existent, as 3D printers generally are incapable of replicating the most intricate shapes of said trade mark protected products. The author speculates that due to this, the most potential factor of infringement of Trade Mark Law from 3D printing is the use of proprietor's trademark by a third party without the proprietor's consent by creating or distributing a CAD-file or directly 3D print it, which has the potential to dilute the goodwill of the mark and decrease the brand-image, due to its use in a field in which for the proprietor's trade mark is not registered to.[61] An example of such "tarnishing" act of a trade mark's goodwill in the context of 3D printing could be similar to the conduct of the defendants' in the case of *Pfizer Inc. v Sachs*, where Pfizer's mark of VIAGRA was used without the proprietor's consent in sexual content with a vulgar approach to presentation.[62] In the 3D printing context, such act could be that of a trade dress infringement, essentially the creation and distribution of a CAD-file, or 3D printing and selling a syringe with Coca Cola Company's "Coke" embedded into it.

[60] Daly (2016), *supra nota* 4, p 41.
[61] Rimock, M. (2015). An Introduction to the Intellectual Property Law Implications of 3D Printing. – *Canadian Journal of Law and Technology,* Vol. 13, p 16.
[62] United States District Court, S.D., New York, 652 F. Supp 2d 512 (S.D.N.Y. 2009), *Pfizer Inc. v. Sachs*.

4. 3D PRINTING AND LEGAL PROBLEMS IN RELATION TO DESIGNS

In this chapter, the potential legal problems of 3D printing in the context of design law will be analysed. As a preface, unlike patents, designs protect the aesthetic qualities of an object unlike in patents, where those objects as a requirement for their patentability, must contain a functional feature. According to EU law, the unregistered and registered Community designs comprise of "the appearance of the whole or part of product resulting from the features of, in particular, the lines, contours, colours, shape, texture and/or materials of the product itself and/or its ornamentation".[63] A good example of a design without a utility or a functionality itself is a figurine, or the shape of perfume bottle.[64] Design rights can be divided to registered and to unregistered. Unregistered design rights automatically confer rights, similar to that of copyright protection, although their scope of protection is narrower than those of registered designs.[65] The rights conferred by a registered design enable the owner the exclusive right of use of the design and the right to prevent third parties from doing so without consent. The similar use covers, as in the rights conferred by patents, "the making, offering, putting on the market, importing, exporting" of the product which implements the design.[66] Additionally, the same rights as mentioned above are conferred to the owner of an unregistered design, if it can be shown that the defendant's use was enabled directly by copying.[67] As the name implies, no registration is required for an unregistered design and the protection is effective for three years from the publication of a product implementing that design. Registered design confers stronger protection for a maximum of 25 years from the date of registration.

3D printing's implications towards IP and more specifically designs, are not solely negative, as parties with the desire to produce products for commercial uses utilising 3D printing can gain the protection of design rights before acquiring trade mark protection for their products. The

[63] Council Regulation (EC) No 6/20220 of 12 December 2001 on Community Designs, art 3(a).
[64] Rimock (2015), *supra nota* 61, p 17.
[65] Daly (2016), *supra nota* 4, p 34.
[66] Council Regulation, *supra nota* 63, art 19(1).
[67] *Ibid.*, art 19(2).

intersection of 3D printing and designs arises from the replication by means of 3D printing of designs which enjoy the protection of industrial design, registered or unregistered design rights or a Community design in the various jurisdictions with the respective differences between them. To analyse the potential infringements the utilisation of 3D printing can have upon design rights, it is needed to examine which acts in the ecosystem of 3D printing processes amount to infringement of design rights.

4.1. Creation, distribution and hosting of CAD-files

Firstly, it is needed to examine whether or not the creation a CAD-file of a registered or unregistered design infringes the design owners' rights. The intentions and subsequent actions taken of the CAD-files creator are at key importance, as the Community Designs Regulation contains limitations to the rights of the design's owner. Pursuant to Article 20(1)(a) of the Community Designs Regulation, acts conducted in the private sphere, for non-commercial purposes, do not infringe the design owners' rights.[68] The definition of a product however complicates the application of infringement to acts of creating CAD-files of the designs, as, similar to patents, the immaterial property of design is inseparable from the tangible object of a product which use the right protects. Article 3(a) of the Community Designs Regulation defines product as an "any industrial or handicrafted item", which at first glance would exclude the potential for infringement of CAD-files as they do not physically represent the product implementing the design.[69]

However as noted by Mendis, in the analysis of the 2010 UK Court of Appeal case *Grimme Landmaschinenfabrik GmBH v Scott*, a 3D printed product cannot be realised in the absence of a CAD-file.[70] This follows the approach introduced in the earlier chapters, that a CAD-file must be considered to be nearly the same as the tangible object itself due to its nature. In light of an approach stretching the definition of products to incorporate CAD-files too, the limitation of use for non-commercial purposes in the private sphere is still applicable. However, if the CAD-file whom creation is direct result of copying an existing design and that CAD-file is used for commercial purposes, then the digital replication without the owner's consent will amount to a

[68] *Ibid.*, art 20(1)(a).
[69] *Ibid.*, art 3(a).
[70] Mendis (2013), *supra nota* 18, p 155-169.

design infringement.[71] However the exception for personal use of the design is exempted if such conduct is done in a non-commercial manner. The role of the intermediaries, providing the platform of hosting and distributing CAD-files of which some may contain designs, not authorised for free distribution by their respective owner, may be held legally responsible for indirect infringement if it can be proven that they generate profit from the service they provide, as was ruled in 2010 in the case of *Twentieth Century Fox Film Corp. and others v Newzbin Ltd*.[72] Similar to the earlier chapters, the role of intermediaries sharing CAD-files is up to the analysis criteria of indirect infringement and their role and extent of promoting distribution for infringing uses.

4.2. 3D printing of designs

A similar economic threat to that of the trade marks, counterfeiting and dilution of the consumers is also present in one of the possible scenarios where design rights could be infringed upon by utilizing 3D printing. This scenario becomes fathomable in the market of designer furniture, where the potential customers invest in the object implementing the designers original vision, but also to their monetary value which in comparison to regular more affordable furniture will most likely remain their monetary value for the decades to come. The introduction of 3D printing to the equation introduces a potential threat for owners of design rights over designer furniture or sculptures, as by utilizing 3D printing technology the market for counterfeit could rapidly expand. The similar exemption for the end-user for 3D printing in a private, non-commercial manner as in patents and trade marks, is also present in design rights. If an item implementing design rights, unregistered or registered are manufactured by a third-party for commercial purposes without the right owner's consent, they will be illegal even if the third party in the role of manufacturer was unaware of the infringement. This was noted in the European Commission's (EC) review on industrial design protection, stating that within the following decade as 3D printers have not become mainstream products in the reach of the mainstream consumer, a third-party 3D printing service provider could face design right infringement claims if its client orders design right implementing objects such as figurines for commercial aims.[73]

[71] European Commission, *supra nota* 21, p 15.
[72] High Court of Justice of England and Wales, [2010] EWHC 608 Ch, *Twentieth Century Fox Film Corporation and others v Newzbin Limited*.
[73] European Commission, *supra* nota 21, p 22.

4.3. Regulation of 3D printing in the context of design law

As in other chapters, the initiative for regulation of IPR's in the context of 3D printing is in its early stages. Acts committed in the eco-system of 3D printing with infringements upon design rights can be enforced by their right holders if the alleged use by the plaintiffs is considered use in commercial manner.

4.3.1. Enforcement of rights

The enforcement of rights in infringement cases involving 3D printing and CAD-files are very similar to the other branches of IPR with the exceptions for personal, non-commercial use at least. In a realistic scenario, an individual creating CAD-files implementing copied designs of registered design protected figurines and 3D printing them at their home will as of now escape the scope of detection of the IPR holders as no DRM- or Trusted Platform Module (TPM)-technologies haven't been implemented into the 3D printers, and as such is a niche economic threat for the companies owning the rights due to the low volume of hobbyist consumers involving themselves in such activity. In the course of time within the next decade the development of low-cost 3D printing at home or using a 3D printing service can however have notable implications towards design rights, be it unregistered or registered design rights. In such cases, the owners of registered design rights would have more legal tools and "leverage" as the extent of protection between registered design rights and unregistered design rights differs. In potential infringement cases where the plaintiff would have created a CAD-file or 3D printed a tangible object allegedly implementing design elements copied from an UDR, the claimant would have the burden of proof, in essence to evident that notable amount of their UDR had been copied upon, as similarity in itself would not amount to infringement.[74]

The longevity of the design protection also plays a major role determining the possible legal implications of 3D printing for designs and the validity of infringements as design right protection generally lasts only from one to three decades in maximum, whereas copyright protection lasts significantly longer. To produce a forecast of the legal proceedings and court cases involving 3D printing and design rights, an analysis on similar cases where the longevity of protection of objects' exclusivity was disputed as well as the legal definition and consideration of said objects, as was

[74] European Commission, *supra nota* 21, p 12.

seen in the 2011 case of United Kingdom's Supreme Court in the case of *Lucasfilm Ltd v Ainsworth*.[75] Mr. Ainsworth had manually laboured the original Stormtrooper helmets in the production for the first Star Wars movie in 1976. After having found one of helmets in the early 2000's, Mr. Ainsworth proceeded to produce exact copies of the original helmet seen in the movies, which had notable monetary value and profitable gain to himself due to the vast fanbase and collectors of the series collectibles. The judgement given by Supreme Court of UK refuted the claim of copyright infringement by the plaintiff, as it was decided that the helmet of the Storm Trooper was not a sculpture under the meaning of the Copyright, Designs and Patents Act 1988, but a functional prop of which the longevity of its design protection had expired ten years prior to the case.[76]

The importance of this judgement is that the reproduction of objects seen in works under copyright protection do not always fall within the scope of copyright protection based on the criteria of their nature of utilitarian as opposed to a work of artistic sculpture, and thus their replication by means of 3D printer may not be infringing in the restraints of the design protections longevity.[77]

[75] Supreme Court of the United Kingdom, [2011] UKSC 39, *Lucasfilm Limited and others v Ainsworth and another*.
[76] United Kingdom Parliament, Copyright, Designs and Patents Act 1988, Section 4(1)(a).
[77] Mendis (2013), *supra nota* 18, p 12.

5. 3D PRINTING AND LEGAL PROBLEMS IN RELATION TO COPYRIGHTS

Copyrights automatically confer exclusive rights to their owner, and enable to prevent others from using, selling or distributing their copyrighted original works without the owner's consent. In the European context, the criteria for a work to gain copyright protection requires it must be original, thus not infringing upon earlier copyright protected works by others. One of the most important and applicable conventions governing copyrights is the 1886 Berne Convention for the Protection of Literary and Artistic Works, as well as the World Intellectual Property Organization (WIPO) Copyright Treaty (WCT).[78] The Berne convention established that copyright protection is given for the nationals of the member state to the Convention with the application of the respective national copyright laws of that member state, the extent of harmonization provides that subject to copyright protection are most notably, the literary and artistic works.[79] From these, the progress of the analysis can be made by recognising CAD-files as works in which copyright can arise from upon original creation.

The intersection of 3D printing and copyright law is interesting and different from the other IPR's in a way, as in the process of creating an original CAD-file, an actor in the ecosystem of 3D printing gains automatically copyrights for the work, though this has been interpreted varyingly by different jurisdictions and scholars.[80] The scope expands even more, due to subjective merging of the different intellectual properties; from an theoretical perspective, a creation of a CAD-file may attract copyright protection due to the innovation invested by the file's creator, the aesthetic attributions of the file may attract design protection as an artistic work, but still the role and utilisation of CAD files is that of patentable nature itself. The field of copyright law has known digital copyrights for a long time, but by the arrival of 3D printing, also physical objects can attract

[78] Pila, J., Torremans, P. L. C. (2016). *European intellectual property law.* Oxford: Oxford University Press, p 32.
[79] World Intellectual Property Organization (WIPO), Berne Convention for the Protection of Literary and Artistic Works of 9 September 1886, amended on 28 September 1979, art 3.
[80] Daly (2016), *supra nota* 4, p 25.

copyright protection. Therefore, the three formerly distant intellectual properties of copyrights, designs and patents are subject to intertwining which each other, which as later analysed in more depth, may call for reform of IP law of the subject area.[81] In the following sub-chapters, the author will subject to analysis the CAD-files and processes involving them, the IP arising from them with limitations, the potential of 3D printing for infringing upon copyright law, a brief case analysis of past copyright cases of the same subject matter, and finally the sub-chapter examining the regulation of 3D printing in the copyright law context and the enforcement of the copyright owner's rights in the 3D printing context. The author draws the analogy to older copyright cases, since 3D printing as a technical phenomenon shares some of the similar characteristics as digitisation of music in the end of 1990's; the aspect of ease for users to conduct copyright infringement by copying protected works is existent, and the relative ease of doing so even more by downloading from websites hosting CAD-files of which some may be copied from other's original works by their uploaders to the service.

5.1. Creation, distribution and hosting of CAD-files

The role of CAD-files will be analysed in depth, as the author predicts that substantial stages of infringement of copyrights are involved with the CAD-files in their phases of creation, distribution and hosting, with the all the respective ways a copyright can be infringed, and the liabilities of the parties if copyright protected works are used and distributed without the copyright owner's consent. Similar to the analogy of the music industry in the late 1990's, the file-sharing of copyrighted works without their owner's consent can have notable effects on their market for consumers.[82] As definitive case law has not been presented in the context of 3D printing, the author will analyse the older copyright cases with similarities to aspects of 3D printing. As in the discussed example-scenario of the earlier chapters, an individual has two ways to create a CAD-file of a 3D printable object; either by modelling the file in a computer-software, or by using a 3D scanner, which can derive the three-dimensional dimensions of the object and produce a CAD-file representing it. The aspect of CAD-files being subject to copyright protection upon their creation is disputable at the time being, but in the first approach it is much more plausible that the creation of a CAD-file could attract copyright protection, assumed that the creation is original, as some

[81] Silverman (2016), *supra nota* 3, p 5.
[82] Mazziotti, G. (2008). *EU Digital Copyright Law and the End-User*. Berlin: Springer-Verlag, p 142.

required extent of effort and time is invested in it.[83] The second approach of utilising a 3D scanner for the creation of CAD-file is highly unlikely to attract protection, as the creation is automated and the code of the CAD-file's design is derived from the already existent object, thus not requiring aspects of "originality" or effort invested by its creator. The utilitarian and aesthetic features determine the scope of protection for the design embodied within the CAD-file; objects which contain creative features and are not functional will attract copyright protection rather than patent protection.[84]

5.2. 3D printing copyright protected works

Similar to the examples discussed in the above chapters, the 3D printing of copyright protected works can have infringing implications dependent on the extent of alleged copying, and the utilisation of the tangible 3D printed objects and the subsequent actions taken by the 3D printers operator. An example in the context of copyright could be 3D printing figurines based on the characters of Lord of the Rings, created by J.R.R. Tolkien. The renowned three-step test of TRIPS, provided in Article 13 of the Convention, provides the exception to copyright infringement for private, non-commercial activity if the said action does not "conflict with a normal exploitation of the work and do not unreasonably prejudice the legitimate interest of the right-holder".[85]

5.2.1. Cooperative copyrights in the 3D printing process

The questions of cooperative copyrights arise, as discussed by Malaty and Rostama, in the meaning of co-authorship under copyright law if in the process of 3D printing, a first party creates a design, a second party creates the CAD-file implementing that design, and the third party partakes to 3D print it into a tangible form.[86] The example scenario above is a prime example of the legal questions the ecosystem of 3D printing can put forward for the legislators and in case of legal disputes, to consider and to formulate laws for.

[83] Dagne, T. W., Dubeau, C. (2015). 3D Printing and the Law: Are CAD Files Copyright-protected? – *Intellectual Property Journal*, Vol. 28, No. 101, 1-22.
[84] Daly (2016), *supra nota* 4, p 26.
[85] World Trade Organization (WTO), The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), art 13.
[86] Malaty, E., Rostama, G. (2017). 3D printing and IP law – *WIPO Magazine*, No. 1, p 34.

5.3. Regulation of 3D printing in the context of copyright law

In EU, the copyright legislation in the context of 3D printing follows the framework of 11 Directives and two Regulations, of which the "InfoSoc Directive", "Software Directive" and the "IPRED" are the most relevant in this context, InfoSoc Directive being one of the most comprehensive in its content.[87] Regulation of 3D printing in the context of copyright law as a separate notion as a directive in the EU or a passed bill by Congress of the U.S. does not exist as of yet. In the EC's Overview of 3D printing & IP law of 2016, the notion was made that introducing penalties at the legislative level would deter innovation within the new field of technology, and as such recommendation for legislation to revise and to adapt for acts within the ecosystem of 3D printing only ought to be made at a later time after the impact of low-cost 3D printing amongst consumers would be felt by IPRs.[88] While the author concurs, that legislative measures taken can sometimes yield negative results on innovation and new technologies, the initiative for adaptation should still be on the legislators to prevent from creating legislation which lags behind the curve of technological progression. As such, the burden of giving precedent judgements in case law of the context matter lies on the respective opinions of the Courts, which can vary significantly in the absence of definitive legislation.

5.3.1. Analysis of case law

In order to predict the IPR infringements of the future involving 3D printers and CAD-files, it is beneficial to draw the widely discussed analogy of the music and entertainment industry which have felt the impact of digitisation in the last couple decades due to digitisation of their market product. One of the most renowned cases where the role of manufacturers of products and their role as intermediaries for facilitating infringement of copyright law was in *Sony Corp. of America v. Universal City Studios, Inc*. from 1984.[89] The manufacturer of the VCR's, Sony, was alleged to provide means of copyright infringement by providing consumers equipment by which they could record TV broadcasts and watch them at a later time. In the present case of 3D printer's and their material's providers, the legal proceedings against such companies would not be successful, as it would be easy to prove that even though the machines and materials they provide can be used by a consumer to infringe upon IPRs, as in Sony case the Court ruled that although VCRs can be

[87] Kur, Dreier (2013), *supra nota* 29, p 64.
[88] European Commission, *supra nota* 21, p 22.
[89] Supreme Court of the United States, 464 U.S. 417 (1984), Sony Corporation of America et al. v. Universal City Studios, Inc., et al.

utilised to record copyright protected material and then sold for commercial gain, it doesn't exclude the original other purpose of utilisation, that being the recording of broadcasts to one's preference and then watching them at a later time which operates in the limits of fair use and doesn't deprive the copyright owner any further than the original act of broadcast. An analogy to the present case of 3D printers, even though they can be utilised for purposes of infringing IPR's, it doesn't exclude their utilisation from making physical objects that do not infringe upon IPR's thus being not solely created as a mean of infringing them.[90]

An example scenario of enforcing rights in the context of 3D printing was seen as a CAD-file replicating the physical features of Tintin's moon rocket was distributed on the CAD-file online platform Thingiverse. Derived from the comics of Herge, who had created the graphical illustration of the moon rocket at dispute in his 1953 comic book *Destination Moon*, the CAD-file implemented the design copied from Herge´s published works. A DMCA takedown notice was issued to the platform for infringing upon copyright law, as the extent of copyright protection for lifetime of the creator and additional 70 years from the date of death were still active at the time of issue in 2013. Daly has examined the case in depth, and came to the conclusion that a case such as this with elements of reproduction without the copyright's owners consent with additionally potential for infringement of trade mark with unauthorized associating with the original creator are most likely to be enforced with high success, whereas as author has examined above, in cases of patents, their enforcement of rights for distributing CAD-files is notably more cumbersome due to the lack of a similar tool as DMCA takedown notice.[91]

5.3.2. Enforcement of rights

Enforcement of copyright owner's rights in cases of infringement have been seen in the past two decades in cases of distribution of copyrighted works of music and moving pictures via P2P-networks in which a recurring pattern has been to deliver DMCA takedown notices, or to request for injunctions for the platform facilitating the unauthorized distribution without the owners' consent, as was ruled in *Twentieth Century Fox Film Corporation and others v British Telecommunications plc*.[92] For enforcing the rights on the EU-level in the context of 3D printing and platforms facilitating the distribution of CAD-files, of which some could contain copyright

[90] Daly (2016), *suprq nota* 4, p 31.
[91] *Ibid*., p 41.
[92] High Court of Justice of England and Wales, [2011] EWHC 2714 Ch, *Twentieth Century Fox Film Corporation and others v British Telecommunications plc.*

infringing content, the InfoSoc Directive sets out sanctions and remedies in Chapter IV, Article 8, under which the copyright owners are given legal basis for MS's to ensure that they can apply for an injunction against intermediaries who distribute their copyrighted works or content with copied elements without their consent.[93] The enforcement of copyright owners' rights by relying on DMCA takedown notices in cases of alleged infringement of distributing copyrighted material without owners consent may well prove to be the tool with most leverage, even in jurisdictions outside U.S.; Daly makes an insightful remark that even though many of the users and clients of platforms such as Thingiverse are not physically located within U.S. soil and thus not subject to legal notices such as DMCA takedown notices, most of the platforms distributing CAD-files are registered to U.S. and thus subject to U.S. laws.[94]

The author predicts that if the distribution of copyright infringing CAD-files grows notably within the following decade, the enforcement of copyright owners will follow the analogy from the entertainment industry. The numerous failed attempts to serve injunctions for intermediaries such as the renowned Pirate Bay, which after a time have without failure found a new provider to continue their operation, the pattern of ISP's restriction of access to such sites could recur with platforms such as Thingiverse and Shapeways. As for legislative basis for technical preparations and implementations, the owners do have legal tools for enforcement to prevent third parties from reverse engineering, in essence from making alterations to the code of the CAD-file, as well as to the process of 3D printing, as the parties could implement measures of protection such as the DRM-technology, which would prevent the third parties from the abovementioned actions. Legislative basis for such an act of enforcement of copyright holder's rights can be found in Article 11 of the WCT 1996, which obliges the contracting parties to the treaty to implement legal protection and legal remedies against circumvention of technological measures of the copyrights owner's works.[95] As such, the question of enforcement of these rights against infringement is not purely legal, but also contains questions of high technical aspects as noted before with the proposals of DRM- and TPM-technology inclusions to the CAD-files and the 3D printers themselves.

[93] European Parliament and the Council of the European Union, 2001/29/EC of 22 May 2001 Directive on the harmonisation of certain aspects copyright and related rights in the information society, L 167, Brussels, art 8.
[94] Daly (2016), *supra nota* 4, p 42.
[95] World Intellectual Property Organization (WIPO), Copyright Treaty of 20 December 1996, art 11.

CONCLUSION

This research was set out to conduct an extensive examination of the possible legal problems the emergence of 3D printing could yield in the context of IPR's and their respective branches. The main results the author found during the course of the research varied; in every branch of IP the potential for infringement upon the rights were found, but the extensiveness varied between them. In the process of the research it was revealed to the author that the impact of mainstream utilization of 3D printing would be most notable in the field of patents, due to their role as protecting exclusivity of innovation for tangible objects with functional attributes, whereas in the field of other industrial properties, the proprietor's already possess the tools for enforcing their rights for the use of their trade mark or design due to the already existent market of counterfeit products. The author hypothesised that the emergence of 3D printers to the reach of mainstream consumers and their subsequent utilization could yield potential infringements for IPR holders within the next decade as the technological culture revolving around them would grow. It is related to this hypothesis that the legislation regarding the preservation of the system of IPR´s would have to be revised in order to counter the widespread infringement upon the right holder's rights.

It is inevitable that 3D printing will have legal, but also social and economic implications. The question of liabilities will arise if consumers utilize tangible objects produced by 3D printers which could inflict bodily harm when structural features failure. The decentralization of manufacturing utility products by consumers themselves could provide results, similar to that of the market of delivered-ice and their replacement by refrigerators. The legal implications of 3D printing in the context of IP law are most notable, due to the nature of what the 3D printers are capable of producing in which patents are the most affected branch, but also due to their operation requiring digital blueprints of CAD-files, which themselves have characteristics of copyrights and designs.

When the legislators begin to revise IP law to adapt for the phenomenon's brought by affordable 3D printing by mainstream consumers, certain analyses ought to be made in order to balance the need for protecting IPR's as well as on the other hand, the proportionality of the sanctions given by the courts to some extent, in the possible cases of infringement in the context of 3D printing

and CAD-files. The music industry analogy has been analysed earlier in the course of this research, but not from the perspective of the average consumer; the author contemplates, that one of the main reasons why copyright infringements by acts of circulating copyright protected works between the late 1990's and the present day has been as widespread as it is, is not only due to the third parties already possessing the means for committing infringement, but also due to the lack of legitimate options with similar digital ease of use as the computer programs used for the infringement.

The examples of regulation in the context by means of DRM- and TPM-technologies on the hardware-level seems on paper a plausible option for countering IPR infringements by utilization of 3D printers, but the degree of their success depends on the extent of their implementation amongst the industry manufacturing the 3D printers. As such, it is possible that in the U.S. the FDA would establish rules demanding the implementation of such said technological measures into the 3D printers, similar to those required in the EU by the Directorate-General for Internal market, Industry, Entrepreneurship and SMEs resulting in the renowned CE marking. If such technological measures were adopted on a regulatory level and legitimate options of platforms were provided for consumers to circulate their original CAD-file designs, the author presumes that the potential detrimental impact of widespread utilization of 3D printers for infringement upon IPR's would be notably lesser compared to the option that none of such measures are taken and the holders of IPR have to re-live the negative experiences of digitisation of the turn of the millennium. A regulatory approach such as this should however be balanced, as it could yield detrimental results in the field of patents for manufacturers experimenting with new prototype-models, or in the field of designs, cause imbalanced competition amongst competitors and result in foreclosure from the markets.

The author speculates that the applicability of the conclusions arrived to in the course of the research are similar to those of the reports produced by the other researchers of the field, namely that globally the legislators should prepare to revise legislation concerning IP. Additionally, the author feels that the applicability of the conclusions, and even more than in the previous proposal, the owners of the IPR's would realise the potential development within the following decade and would revise their approach to the legal questions of 3D printing and CAD-files by revising their contract terms to include stipulations regulating the subject.

The author feels that as 3D printing is one of the most developing field of technology close to the mainstream consumer within the following decade, the possibilities and need for further research is self-evident. Further possibilities in the field of research for 3D printing and its legal, social and economic implications are many, for example, in which ways should legislation, not only of IP, be revised in order to adapt to the technological change brought by 3D printing? What is the role of DMCA notices in cases where CAD-files contain characteristics derived from protected copyrights and trade marks as an inspiration for the file's creator but still deviate from the source of inspiration? To which extent trade mark protected 3D models will be impacted by 3D printing due to their closeness? And lastly, after evident case law becomes available, how the different jurisdictions of e.g. U.S. and the MS's of EU approach cases of alleged infringement in the context of 3D printing and CAD-files?

LIST OF REFERENCES

Books

1. Christensen, C. M. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Brighton: Harvard Business School Press.

2. Chua, C. K., Leong, K. F. (2015). *3D printing and additive manufacturing: principles and applications*. Hackensack: World Scientific.

3. Daly, A. (2016). *Socio-legal aspects of the 3D printing revolution*. London: Palgrave Macmillan

4. Jacob, R., Alexander, D., Fisher, M. (2013). *Guidebook to Intellectual Property*. 6th ed. Oxford and Portland: Hart Publishing.

5. Kur, A., Dreier, T. (2013). *European intellectual property law: text, cases and materials*. Northampton: Edward Elgar.

6. Mazziotti, G. (2008). *EU Digital Copyright Law and the End-User*. Berlin: Springer-Verlag.

7. Pila, J., Torremans, P. L. C. (2016). *European intellectual property law.* Oxford: Oxford University Press.

8. Stazi, A. (2015). *Biotechnological Inventions and Patentability of Life: The US and European Experience*. Cheltenham: Edward Elgar Publishing Limited.

9. World Intellectual Property Organization. (2004). *WIPO Intellectual Property Handbook: Policy, Law and Use*. 2nd ed.

Articles

10. Ballardini, R. M., Norrgård, M. (2016). Digitising patent law: challenges from 3D printing technologies. – *European Intellectual Property Review,* Vol. 38, No. 8, 519-521.

11. Bechtold, S. (2016). 3D printing, intellectual property and innovation policy. – *International Review of Intellectual Property and Competition Law,* Vol. 47, No. 5, 517-536.

12. Braun, V., Taylor, M. (2012). 3D printing. – *Computer and Telecommunications Law Review,* Vol. 18, No. 2, 54-55.

13. Burgett, J. M. (2009). Hmm... What's That Smell? Scent Trademarks – A United States Perspective. – *INTA Bulletin,* Vol. 64, No. 5.

14. Dagne, T. W., Dubeau, C. (2015). 3D Printing and the Law: Are CAD Files Copyright-protected? – *Intellectual Property Journal,* Vol. 28, No. 101, 1-22.

15. Froemming, J., Day, J. (2017). 3D Printing: Key Legal Issues and Options for Change. – *INTA Bulletin,* Vol. 72, No. 20.

16. Malaty, E., Rostama, G. (2017). 3D printing and IP law. – *WIPO Magazine,* No. 1, 28-34.

17. Manta, I. (2011). The Puzzle of Criminal Sanctions for Intellectual Property Infringement. – *Harvard Journal of Law and Technology,* Vol. 24, No. 2, 469-517.

18. Mendis, D. (2013). "The clone wars": episode 1 – the rise of 3D printing and its implications for intellectual property law – learning lessons from the past? – *European Intellectual Property Review,* Vol. 35, No. 3, 155-169.

19. Nissan, A. M. (2016). Regulating the Three-Dimensional Future: How the FDA Should Structure a Regulatory Mechanism for Additive Manufacturing (3D Printing). – *Boston University Journal of Science and Technology*, Vol. 22, 267-298.

20. Owoeye, O., Adewale, M. (2016). 3D printing and patent law: a balance of rights and obligations. – *European Intellectual Property Review,* Vol. 38, No. 11, 697-702.

21. Rimock, M. (2015). An Introduction to the Intellectual Property Law Implications of 3D Printing. – *Canadian Journal of Law and Technology,* Vol. 13, 1-25.

22. Silverman, I. (2016). Optimising protection: IP rights in 3D printing. – *European Intellectual Property Review,* Vol. 38, No. 1, 5-10.

23. Srivatsan, T. S., Manigandan, K., Sudarshan, T. S. (2016). Additive Manufacturing of Materials: Viable Techniques, Metals, Advances, Advantages, and Applications. – *Additive Manufacturing: Innovations, Advances, and Applications.* (Eds.) T. S., Srivatsan, T. S., Sudarshan. Boca Raton: CRC Press, 2-43.

24. Sun, H. (2014). Reforming anti-dilution protection in the globalization of luxury brands. – *Georgetown Journal of International Law,* Vol. 45, 783-823.

25. Van Overwalle, G., Leys, R. (2017). 3D printing and patent law: a disruptive technology disrupting patent law? – *International Review of Intellectual Property and Competition Law,* Vol. 48, No. 5, 504-537.

26. World Intellectual Property Organization. (2006). Bioethics and Patent Law: The Case of The Oncomouse. – *WIPO Magazine,* No. 3, 16-17.

EU and international legislation

27. 15 U.S.C. Federal Trademark Dilution Act.

28. 35 U.S.C. U.S. Patent Act.

29. Council Regulation (EC) No 6/20220 of 12 December 2001 on Community Designs.

30. Council Regulation (EC) No 207/2009 of 26 February 2009 on Community Trade Mark.

31. European Economic Community (EEC), 76/76/EEC of 26 January 1976 Convention for the European Patent for the Common Market, L 17/2.

32. European Economic Community (EEC), 89/695/EEC of 15 December 1989 Agreement Relating to Community Patents, L 401, Luxembourg.

33. European Parliament and the Council of the European Union, 2001/29/EC of 22 May 2001 Directive on the harmonisation of certain aspects copyright and related rights in the information society, L 167, Brussels.

34. United Kingdom Parliament, Copyright, Designs and Patents Act 1988.

35. World Intellectual Property Organization (WIPO), Berne Convention for the Protection of Literary and Artistic Works of 9 September 1886, amended on 28 September 1979.

36. World Intellectual Property Organization (WIPO), Copyright Treaty of 20 December 1996.

37. World Trade Organization (WTO), The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).

Court decisions

38. High Court of Justice of England and Wales, [2010] EWHC 608 Ch, *Twentieth Century Fox Film Corporation and others v Newzbin Limited*.

39. High Court of Justice of England and Wales, [2011] EWHC 2714 Ch, *Twentieth Century Fox Film Corporation and others v British Telecommunications plc.*

40. Supreme Court of the United Kingdom, [2013] UKSC 16, *Schütz Limited. v. Werit Limited.*

41. Supreme Court of the United Kingdom, [2011] UKSC 39, *Lucasfilm Limited and others v Ainsworth and another*.

42. Supreme Court of the United States, 464 U.S. 417 (1984), *Sony Corporation of America et al. v. Universal City Studios, Inc., et al.*

43. Supreme Court of the United States, 563 U.S. 754 (2011), *Global-Tech Appliances, Inc. v. SEB S.A.*

44. Tribunal De Commerce, [2010] ETMR 10, *LVMH v eBay.*

45. United States District Court, S.D., New York, 652 F. Supp 2d 512 (S.D.N.Y. 2009), *Pfizer Inc. v. Sachs*.

Other sources

46. European Commission - Overview of 3D printing & intellectual property law (2016), Under the contract with the Directorate General Internal Market, Industry, Entrepreneurship and SMEs (MARKT2014/083/D), Annex 3. Accessible: https://ec.europa.eu/docsroom/documents/18921/attachments/3/translations/en/renditions/pdf, 2.5.2018.

47. Holdbrook, T. (2016). *How 3D Printing Threatens Our Patent System*. Accessible: https://www.scientificamerican.com/article/how-3-d-printing-threatens-our-patent-system1/, 21.3.2018.

48. International Organization for Standardization (ISO). (2015). *ISO/ASTM 52900:2015(en)*, Accessible: https://www.iso.org/obp/ui/#iso:std:iso-astm:52900:ed-1:v1:en, 09.01.2018.

49. *List of various patents of Zippo-brand lighter*, Zippo Manufacturing Company. Accessible: https://cdn.shopify.com/s/files/1/1295/7985/files/Windproof_Patent.pdf?467049124388331634, 21.3.2018.

50. *Patent for ink-jet printing of viable cells, US2004237822 (A1)*, European Patent Office (EPO). Accessible: https://worldwide.espacenet.com/publicationDetails/biblio?FT=D&date=20041202&DB=&locale=en_EP&CC=US&NR=2004237822A1&KC=A1&ND=1, 21.3.2018.

51. *Spritam, the first 3D printed drug to be approved by the FDA*, Aprecia Pharmaceuticals LLC. Accessible: https://www.spritam.com/#/patient, 21.3.2018.