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Citation

Dinev, Plamen. 2020. Revisiting the copyright status of 3D printing design files. *European Intellectual Property Review*, 42(2), pp. 94-100. ISSN 0142-0461 [Article]

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Dinev, P (2020) 'Revisiting the copyright status of 3D printing design files' 42(2) European Intellectual Property Review 94–100

REVISITING THE COPYRIGHT STATUS OF 3D PRINTING DESIGN FILES

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European Intellectual Property Review 42(2)

INTRODUCTION

3D printing allows users to convert informational content into three-dimensional physical objects. As a natural extension of early digital technologies such as the internet and the personal computer, it is expected to replicate many of the legal issues brought by digitisation in the recent past. The intellectual property (IP) framework in particular, as “the bridge connecting innovations to markets”, is a vulnerable area.¹ Now nearly a decade after research on the IP implications of 3D printing began, the issue has moved to the centre of IP discourse. Studies have been carried out for the UK Intellectual Property Office,² and the European Parliament recently adopted a resolution to assess the IP issues surrounding the technology.³ This is a clear signal that regulatory measures may be imminent.

This article examines the copyright status of 3D printing design files, commonly referred to by the generic term “computer-aided design (CAD) files” in the legal literature.⁴ By drawing on analogies to other file formats and dissecting the digital modelling process, it offers an alternative to the dominant view on the issue in the UK. As a limitation, this analysis will be confined to copyright, and it will examine the issue in a scenario where modelling software is used to create a new 3D printing design file from scratch.⁵ It will start by providing a brief overview of 3D printing, which is essential to explain the key role design files play in the process.

A BRIEF OVERVIEW OF 3D PRINTING

”3D printing” is commonly used as an umbrella term for a number of distinct additive manufacturing (AM) processes whereby digital designs are converted into three-dimensional physical objects. While *3D Printing* is technically a brand name for a specific AM technology, the terms *3D printing* (lower case) and *additive manufacturing* are now commonly used interchangeably for all AM processes.⁶ Moreover, 3D printing is expected to replace all other names, including AM, and become the dominant term.⁷

History and significance

The core technology behind 3D printing is not exactly new.⁸ A fictional article on this concept first appeared in *New Scientist* in 1974,⁹ and a number of 3D printing processes were patented in the years to follow.¹⁰ Moreover, the adoption of 3D printing has been a multi-layered process which corresponds to different uses determined by the capabilities and costs of the technology at a given time.¹¹ As 3D printing was a prohibitively expensive process in its early days, its first uses were prototyping and tooling. But while the technology was initially limited to industrial use, this is no longer the case. AM devices are now considerably more accessible and there is a well-established consumer market. This last stage of 3D printing adoption, also referred to as home fabrication, is expected to have a “disruptive” impact as it introduces manufacturing capabilities where none existed before (at home) and allows average consumers to have more than merely a passive role in production.¹²

Decentralised manufacturing is especially important in terms of IP law. Some of the key IP issues surrounding 3D printing stem from the issue of *who* does things, as opposed to *how* things are done.¹³ In a similar manner to technologies such as the internet and the computer, which allowed individuals to easily reproduce and share content now largely consumed digitally, including music and films, 3D printing enables the same process for various tangible products—whether this involves Lego bricks, sculptures, or guns—as they can now “exist” in digital form. This allows users to interfere with all major IP categories, including patents, copyright, and trade marks.

Technology

3D printing converts digital designs into physical objects. In this sense, it produces tangible matter in a similar manner to inkjet printers, but in three dimensions. The starting point is obtaining a computer-aided design file containing a virtual representation of the three-dimensional physical object.¹⁴ Users can create such a file by utilising CAD modelling software or tools such as 3D scanning and photogrammetry. Alternatively, they can download a readily available file from an online repository. CAD modelling for 3D printing typically involves making a virtual model and then converting it into an appropriate (surface-mesh) file format, such as STL (Standard Tessellation Language) or AMF (Additive Manufacturing Format):

*“Physical objects can live in a digital form. For 3D printing, this digital form is often that of an .stl file. These files can be thought of as the object equivalent of a.pdf file – they are more or less universally printable by 3D printers”*¹⁵

STL is the de facto industry standard and the most commonly shared file format online. It encodes the geometry of the three-dimensional object by tessellating the model’s outer surface into millions of triangles and recording information about each triangle’s co-ordinates and vectors.¹⁶ As explored below, what is potentially important for the purposes of copyright law is that files such as STL contain both embedded computer code and visually significant information, in the form of digital design drawings, which users can view and edit prior to printing:

As a final step before manufacturing, the virtual model contained in the file has to be “sliced” into layers, typically generating G-code corresponding to each layer and providing machine-readable instructions to the printer. These layers are then additively deposited in physical form—using raw materials such as plastic, metal, and ceramics—until a tangible three-dimensional object is produced:

*“[A]ll additive manufacturing models are built by joining single layers of equal thickness ... [i]n the strictest sense, additive manufacturing processes are therefore 2½D processes.”*¹⁷

Some post-processing may be necessary before the printed item is ready for its intended use.

REVISITING THE COPYRIGHT STATUS OF 3D PRINTING DESIGN FILES

As a 3D printer is unable to function without a digital design file as a starting point, the copyright status of files such as STL—which are commonly shared online and could potentially carry considerable economic value—is especially important. This section will look at the issues of subject-matter and originality before briefly addressing infringement. As courts typically rely on analogies when dealing with new technologies,¹⁸ comparisons with other digital processes and file formats will be used where appropriate. Moreover, the analysis below will examine the issue in a scenario where modelling software is used to create a design file from scratch.

The general law

In order for a work to be protected by copyright under CDPA 1988, it must fall under one of the recognised categories.¹⁹ While the Court of Justice of the European Union (CJEU) has seemingly put an end to the British “closed list” of categories,²⁰ by removing all subject-matter criteria and “collapsing the question of whether an intellectual production is protected into an assessment of its originality”,²¹ Arnold J rejected this broad interpretation in *SAS*.²² He held that it was not enough for a work to be an intellectual creation—it still had to be a literary or artistic work, as per art.2(1) of the Berne Convention. Bently and Sherman thus argue that the closed list continues to play a role, and that until the full implications of the CJEU’s rulings are clarified, these categories are the starting point for any copyright claim.²³

Moreover, the relevant originality criteria have to be satisfied. Following harmonisation at the EU level, a work must be the “author’s own intellectual creation” in order to qualify as original for the purposes of copyright law.²⁴ For instance, in *Infopaq*, the CJEU held that words as such, considered in isolation, are not subject to protection and that it is

”only through the choice, sequence and combination of those words that the author may express his creativity in an original manner and achieve a result which is an intellectual creation”.²⁵

The work must reflect the author’s personality in the sense that she is able to exercise “free and creative” choices and stamp the work with a personal touch which reflects her personality.²⁶ Moreover, mere choice is not sufficient—the choice must also be *creative*. Another key caveat, as

held in *Football Dataco*, is that choices “dictated by technical considerations, rules or constraints”²⁷ leave no room for such creative freedom. Lastly, it is important to note that while this harmonised standard was initially only applicable to computer programs,²⁸ databases,²⁹ and photographs, the CJEU has interpreted this criterion to apply to all copyright works within the European Union.³⁰ Having briefly outlined the relevant general law—which will be taken into account and applied throughout the analysis below—the next section will proceed to examine the copyright status of 3D printing design files.

3D printing design files as literary works

The dominant view in the UK is that 3D printing design files can be protected as “computer programs”, part of the broader literary works category, under s.3(1)(b) CDPA.³¹ The Software Directive provides the legal basis for the protection of computer programs within the EU. While it does not define the term, it states that “the expression in any form of a computer program” should be protected as a literary work.³² CJEU jurisprudence indicates that “any form of an expression of a computer program” refers to these forms of expression which permit reproduction in different computer languages, including source and object code, and “enable the program to perform the task for which it was created”.³³ Accordingly, the British formulation of literary works specifically includes programs within its remit.³⁴ Bradshaw et al. thus argue that, as a 3D printing design file contains code which represents a three-dimensional object, it “may be protected by literary copyright in the same manner as computer software (which, as a series of instructions, it resembles)”.³⁵ Mendis takes a similar view:

*“In the UK, the Copyright, Designs and Patents Act (as amended) states that a computer program and its embedded data are recognised as a literary work under copyright law. Applying the current law to the 3D printing context, it can be established that a computer program encompasses a CAD-based object design file within its definition and is therefore capable of copyright protection in the UK as a literary work.”*³⁶

Silverman similarly argues that it is “possible to protect the digital design file any type of 3D printed work as a literary work [*sic*]” on the basis that computer programs are specifically included as literary works under s.3(1)(b) CDPA and a 3D printing design file embeds computer code.³⁷ However, she does not go into further detail. Generally, this line of thought is based on the premise

that that the code generated when using modelling software (and converting the file) may effectively constitute a protectable computer program.

Moreover, in a more recent work, Mendis makes a related—but distinct—argument that in light of *Abraham Moon*³⁸ and *Anacon*,³⁹ “a CAD design file containing the instructions for printing a 3D model, represented through a design document containing written symbols as well as a visual image, can be considered as a *literary* and artistic work” (emphasis added).⁴⁰ This argument refers to literary works more broadly, as opposed to computer programs in particular, and focuses on the “written element” underlying the file (practically still the code). In particular, it refers to Jacob J’s formulation of literary works in *Anacon*:

*”My first thought was that it would be absurd to regard a circuit diagram as a literary work, but the more one thinks about the ambit of that expression, as used in the Act, the more one is driven to the conclusion that provided it is all written down and contains information which can be read by somebody ... the more one sees that that is just what it is ... musical notation is written down but needs expressly to be taken out of the definition ... But that which is not expressly taken out remains within it.”*⁴¹

In *Anacon* and *Abraham Moon*,⁴² a circuit diagram for a dust meter analyser and a manually written two-page document containing instructions for making a fabric, respectively, were protected as literary works. In the former case, Jacob J emphasised that literary copyright may subsist in a work as long as information is “written down” and “can be read by somebody”.⁴³ While this is a broad formulation and can possibly be interpreted as including any written information, regardless of the method by which it is created or the medium in which it is recorded,⁴⁴ a literary work will only be protected to the extent that it is an original expression.

In order to fully assess the arguments outlined above, it would be useful to illustrate how the computer code (or written element) embedded in a 3D printing design file is typically generated. Generally, selecting a certain shape or dimension in CAD modelling software will result in computer code mirroring this selection when the file is saved as STL or equivalent. This code is automatically generated by the software which converts the file into a surface-mesh format. Moreover, users operating the software typically have no direct interaction with the code. Elam thus argues that a 3D printing design file can be distinguished from an original computer program

as its underlying code is effectively “pre-determined” by the author of the computer-aided design software:

*“Even if a CAD file embeds a code, it is not the equivalent of a computer program. This in light of the fact that the designer of a CAD model does not write the code herself, at least not directly ... [T]he CAD software programmer has already predetermined the code associated with a pre-made shape or a free-hand drawing ... It is ... only the CAD software that finds protection under the Software Directive ... not the CAD file itself.”*⁴⁵

Similarly, referring to the code embedded in 3D printing design files and the literary works category more broadly, Osborn takes the view that

*“literary works are only protected to the extent they contain creative expression. If every line of code is dictated by efficiency or other external factors, there is no protectable expression ... A draftsman uses a CAD program to draw the image, and the computer translates the shapes into textual code using algorithms directed to utilitarian goals, not creative ones ... [T]he literal code does not reflect creativity as to its wording. The only creativity attributable to the draftsman would correspond to the creativity in the CAD drawing ... ”*⁴⁶

Although this assertion is primarily made on the basis of US copyright law, a similar outcome is likely to be reached under the CJEU’s “own intellectual creation” test outlined above. More specifically, it is questionable whether the automatically generated code in a 3D printing design file can be regarded as a work involving sufficient “free and creative” choices to independently qualify as an original expression in its own right. All of the potentially creative choices exercised by the user of the modelling software are made in relation to its graphic or design drawing component, which represents the file’s principal creative value, as opposed to its underlying textual and numerical data which merely encodes this information through a conversion process strictly dictated by technical considerations and constraints.⁴⁷

The medium-message dichotomy and artistic works

In a recent work, Arnold J discussed the dichotomy between content copyrights and signal copyrights, illustrating this with the distinction between a literary work (content/message) and the

paper on which it is printed (signal/medium).⁴⁸ His reasoning was cited and applied in *Abraham Moon* (considered a different context above).⁴⁹ In the instant case, the claimant had produced the design for a fabric on a ticket stamp containing verbal and numerical instructions for making the item. The defendants produced a similar fabric, which infringed copyright in the *ticket* itself. The Court held that the ticket was, inter alia, an artistic (graphic) work based on its visual significance.⁵⁰ As noted by Mendis,⁵¹ Birss J also stated that the ticket served as a record of an image, comparing it to the artistic works created by David Hockney on an iPad before they were produced in physical form and displayed at the Royal Academy:

*“The only thing which makes sense to be referred to as the artist’s work in that case is the computer file recording the image. The same images, hanging on the wall of the Royal Academy ... are not the actual pictures drawn by the artist, they are ‘copies’ produced from the computer file. Although Mr Hockney ... uses a technique different from that of Mr Aveyard, in both cases the only record fixed in a material form of the visual image the artist created is an organised table of essentially numerical data which, when looked at directly by a layman, means nothing ... Artistic copyright must relate to the content of the work of the artist and not the medium in which it is recorded. It is or should be a ‘content’ copyright and not a ‘signal’ copyright. The visual image of Skye Sage if it was fixed in a material form as a drawing would be protected by artistic copyright. It seems to me that to deny artistic copyright in this case – despite the fact that the visual image is indeed fixed in a material form – is to confuse the medium with the message.”*⁵²

Similarly, a 3D printing design file per se merely serves as the medium of expression (much like a PDF or JPEG) where a work may be recorded.⁵³ An original artistic work, such as a sculpture,⁵⁴ created through CAD modelling and recorded as a digital design drawing in STL form or equivalent (which can subsequently be utilised to make a tangible copy) should not be treated any differently from the same work produced in physical form, “much like a digital painting made using painting software should not receive any less protection than an actual painting”.⁵⁵

Moreover, models depicting purely utilitarian or functional physical objects, which are not subject to copyright, are unlikely to be protected unless the design drawing per se qualifies as an original graphic work under s.4(1) CDPA 1988. Graphic works,⁵⁶ part of the broader artistic works category, have been defined as works containing “visually significant” information which can be

appreciated simply with the eye.⁵⁷ The definition of graphic works encompasses a non-exhaustive⁵⁸ list of works, meaning that works of a similar general nature may fall within its remit, such as drawings, plans, and diagrams. While the code embedded in a 3D printing design file may not necessarily be of visual significance, its design component certainly is. What these files essentially contain is design drawings viewable on a computer screen.⁵⁹ However, it should be remembered that the work must also satisfy the requisite originality standard. As explored below, this criterion will be a deciding factor in the context of models depicting utilitarian objects.

In terms of originality, using CAD software to create a model of an *artistic* object, in principle, allows for sufficient free and creative choices to be exercised by the user:

*”[A] CAD file is a...cumulative reflection of the design process. When it is created, whether from scratch or through choosing existing shapes, the final product will embody the designer’s choices through these elements...If a file is created from scratch, it is likely to meet the requirement of originality....”*⁶⁰

However, Antikainen and Jongsma argue that a model portraying a utilitarian object will not generally satisfy the originality criteria under EU law.⁶¹ More specifically, they claim that the user’s choices when creating such a model are “severely limited at best” owing to the lack of creative freedom and the technical considerations involved in the process.⁶² It should be noted that British courts have previously held that a drawing or diagram representing a purely utilitarian item can be an original artistic work in its own right, regardless of whether the tangible object it depicts is subject to copyright. For example, in *Anacon*, concerning a circuit diagram for an electronic dust meter analyser, the Court was satisfied that “the creation of the plaintiffs’ circuit diagram had involved sufficient original work to create a copyright work”.⁶³ Similarly, in *Autospin*, sketches for an oil seal qualified as, inter alia, original artistic works.⁶⁴ It could be argued that a 3D printing design file depicting an object of this kind should not be treated any differently. However, both *Anacon* and *Autospin* were decided under the traditional British approach to originality which merely requires “labour, skill, and judgment”—meaning that as long as the work is not copied and there is trivial effort and skill exercised in its creation, it may be treated as original.⁶⁵ Albeit in a different context, Bently notes that:

*”[I]t seems unlikely that the requirement of an ‘own intellectual creation’ will be reducible to the ‘not copied’ test that was widely appealed to in the heyday of industrial copyright ... drawings of nuts, bolts and even exhaust pipes—might well not pass muster.”*⁶⁶

As the copyrightability of such drawings is becoming increasingly tenuous, it is certainly arguable that a 3D printing design file depicting a purely utilitarian object is generally unlikely to meet the ‘own intellectual creation’ standard now required under EU law, at least in the vast majority of cases.⁶⁷ The reason for this is that these expressions are likely to be dictated by technical considerations and the digital modelling process will provide little, if any, room for free and creative choices to be exercised by the user of the software.

INFRINGEMENT

While infringement is beyond the scope of this work, this section will provide a brief summary of some key points for the sake of completeness. Making a digital copy of a 3D printing design file containing an original authorial work without permission may amount to infringement.⁶⁸ As s.17(3) CDPA covers the reproduction of a two-dimensional *artistic* work in three dimensions and vice versa, infringement may arise where a physical product is made by using such a design file as well as where a protected physical work is scanned in order to obtain a file. However, s.51(1) CDPA imposes an important limitation. It states that:

”[I]t is not an infringement of any copyright in a design document or model recording or embodying a design for anything other than an artistic work or a typeface to make an article to the design or to copy an article made to the design.”

Section 51(3) CDPA further defines a design document as “any record of a design, whether in the form of a drawing, a written description, a photograph, data stored in a computer or otherwise”, which is likely to be broad enough to include 3D printing design files within its remit.⁶⁹ As a result, while the act of 3D printing a *non-artistic* work (if there is any copyright in the design document in the first place) may be exempt from infringement, making a digital copy of a protected file—an inevitable prerequisite in many cases—could, in principle, still amount to infringement.

CONCLUSION

This article has examined the copyright status of 3D printing design files under the Copyright, Designs and Patents Act 1988, aiming to provide an alternative view on the issue and clear guidance as to the circumstances where digital design models are likely to receive protection under the existing framework. It is argued that copyright will typically subsist in original artistic works created through computer-aided design modelling and recorded in STL form or equivalent. In contrast, digital design drawings depicting functional or utilitarian objects are generally unlikely to meet the originality standard required under EU law.

FOOTNOTES

- ¹ Rosa Ballardini and Marcus Norrgård, “Digitising patent law: challenges from 3D printing technologies” (2016) 38 E.I.P.R. 519, 521.
- ² *Dinusha Mendis et al., “A Legal and Empirical Study into the Intellectual Property Implications of 3D Printing: Executive Summary” (IPO, 2015),* https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/421222/A_Legal_and_Empirical_Study_into_the_Intellectual_Property_Implications_of_3D_Printing_-_Exec_Summary_-_Web.pdf; *Thomas Birtchnell et al., “3D Printing and Intellectual Property Futures” (IPO, 2018),* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/757767/3D-printing.pdf [Both accessed 6 December 2019].
- ³ *European Parliament, “Three-dimensional printing, a challenge in the fields of intellectual property rights and civil liability” (2017),* [europarl.europa.eu/oeil/popups/ficheprocedure.do?reference=2017/2007\(INI\)](http://europarl.europa.eu/oeil/popups/ficheprocedure.do?reference=2017/2007(INI)) [Accessed 6 December 2019].
- ⁴ In terms of terminology, it is important to note that legal scholars generally use the term “CAD file” interchangeably with file formats such as STL (stereolithography/Standard Tessellation Language), the industry standard and most commonly shared 3D printing file format online. In fact, the 3D printing design process typically starts with making a virtual model in CAD software, converting it into a surface-mesh format, such as STL, and finally using slicer software to produce machine-readable (G-)code before an object can be printed. For the sake of simplicity and consistency with existing works, this article will focus on—and use the term *3D printing design file* to refer to—surface-mesh files such as STL which are typically shared online and arguably constitute the most economically significant format in the production chain.
- ⁵ CAD modelling is the most commonly used method to create a 3D printing design file from scratch. For an overview of the specificities and copyright status of design files obtained through 3D scanning and re-creating existing objects, see *Michael Weinberg, “What’s the Deal with Copyright and 3D Printing?” (2013), p.15, Public Knowledge,* publicknowledge.org/news-blog/blogs/whats-the-deal-with-copyright-and-3d-printing [Accessed 6 December 2019], including the text in fn.49; *Dinusha Mendis, “Clone Wars Episode II – The Next Generation: The Copyright Implications relating to 3D Printing and Computer-Aided Design (CAD) Files” (2014) 6(2) Law, Innovation and Technology 265, 276.*
- ⁶ *Andreas Gebhardt and Jan-Steffen Hötter, Additive Manufacturing: 3D Printing for Prototyping and Manufacturing (Munich: Hanser Gardner Publications, 2016), p.3.*
- ⁷ *Gebhardt and Hötter, Additive Manufacturing (2016), p.3.* The two terms will be used interchangeably in this article.

8 *Peter Troxler and Caspar van Woensel, "How Will Society Adopt 3D Printing?" in Van den Berg et al. (eds), 3D Printing: Legal, Philosophical and Economic Dimensions (New York: Springer, 2016), p.185.*

9 David Jones, "Ariadne" (1974) 64(917) *New Scientist* 80.

10 See, for instance, Charles Hull (1986) US Patent 4575330 (stereolithography); Scott Crump (1992) US Patent 5121329 (fused filament fabrication).

11 Thierry Rayna and Ludmila Striukova, "From rapid prototyping to home fabrication: How 3D printing is changing business model innovation" (2015) 102 *Technological Forecasting and Social Change* 214, 216.

12 *Angela Daly, Socio-Legal Aspects of the 3D Printing Revolution (London: Macmillan, 2016), p.4; Troxler and Van Woensel, "How Will Society Adopt 3D Printing?" in 3D Printing: Legal, Philosophical and Economic Dimensions (2016).*

13 See also, more generally, *Chris Anderson, Makers: The New Industrial Revolution (New York: Random House, 2012).*

14 *H. Lipson and M. Kurman, Fabricated: The New World of 3D Printing (Hoboken: NJ: John Wiley & Sons, 2013), p.12.* For a more detailed overview, see *Ian Gibson, David Rosen and Brent Stucker, Additive Manufacturing Technologies Rapid Prototyping to Direct Digital Manufacturing (New York: Springer, 2010)* (identifying eight key steps in the process: CAD data creation; format conversion and processing; transfer and manipulation; machine setup; build; clean-up; post-processing; application).

15 *Weinberg, "What's the Deal with Copyright and 3D Printing?" (2013), p.14, Public Knowledge, publicknowledge.org/news-blog/blogs/whats-the-deal-with-copyright-and-3d-printing [Accessed 6 December 2019].*

16 *Dibya Chakravorty, "STL File Format (3D Printing) – Simply Explained" (5 August 2018), All3DP, https://all3dp.com/what-is-stl-file-format-extension-3d-printing [Accessed 6 December 2019].*

17 *Gebhardt and Hötter, Additive Manufacturing (2016), p.22; Flaviana Calignano et al., "Overview on Additive Manufacturing Technologies" (2017) 105(4) Proceedings of the IEEE 593, 593.*

18 Kyle Dolinsky, "CAD's Cradle: Untangling Copyrightability, Derivative Works, and Fair Use in 3D Printing" (2014) 71(1) *Washington and Lee Law Review* 590, 628.

19 Copyright, Designs and Patents Act (CDPA) 1988 s.1(1).

20 *Bezpečnostní Softwarová Asociace—Svaz Softwarové Ochrany v Ministerstvo Kultury (C-393/09) EU:C:2010:816; [2011] E.C.D.R. 3; Infopaq International v Danske Dagblades Forening (C-5/08) EU:C:2009:465 [2012] Bus. L.R. 102; see also Luke McDonagh, "UK Patent Law and Copyright Law after Brexit: Potential Consequences" (2017), p.9, CIGI, cigionline.org/sites/default/files/documents/Brexit%20Series%20Paper%20no3.pdf [Accessed 6 December 2019].*

21 *Lionel Bently and Brad Sherman, Intellectual Property Law (Oxford: Oxford University Press, 2014), p.62.*

22 *SAS Institute Ltd v World Programming Ltd [2013] EWHC 69 (Ch); [2013] R.P.C. 17 at [27], [33].*

23 See *Bently and Sherman, Intellectual Property Law (2014), p.62* for further details.

24 *Infopaq (C-5/08) EU:C:2009:465 [2012] Bus. L.R. 102 at [45]; Bezpečnostní softwarová asociace (BSA) EU:C:2010:816; [2011] E.D.C.R. 3 at [50].*

25 *Infopaq (C-5/08) EU:C:2009:465 [2012] Bus. L.R. 102 at [45].*

26 *Painer v Standard VerlagsGmbH (C-145/10) EU:C:2011:798; [2012] E.C.D.R. 6* at [89], [92].

27 *Football Dataco Ltd v Yahoo! UK Ltd (C-604/10) EU:C:2012:115; [2012] 2 C.M.L.R. 24* at [39].

28 Council (Software) Directive 91/250 art.1(3).

29 Directive 96/9 art.3(1).

30 See, for instance, *Painer (C-145/10) EU:C:2011:798; [2012] E.C.D.R. 6* at [66].

31 Simon Bradshaw et al., “The Intellectual Property Implications of Low-Cost 3D Printing” (2010) 7(1) SCRIPTed 1, 24; Iona Silverman, “Optimising protection: IP rights in 3D printing” (2016) 38 E.I.P.R. 5, 8; Mendis, “Clone Wars Episode II” (2014) 6(2) Law, Innovation and Technology 265, 271.

32 Software Directive art.1(1)–(2) (this also covers a computer program’s preparatory design material).

33 *BSA EU:C:2010:816; [2011] E.D.C.R. 3* at [35], [38].

34 CDPA 1988 s.3(1)(b), (c). CDPA does not define “computer program” either, but Bently and Sherman note that it is clear that this encompasses the source code, object code, firmware, and that the term “computer program” is not necessarily synonymous with “software” in this context; see *Bently and Sherman, Intellectual Property Law (2014), p.67*.

35 Bradshaw et al. “The Intellectual Property Implications of Low-Cost 3D Printing” (2010) 7(1) SCRIPTed 1, 22. They further argue that Laddie J’s obiter dicta in *Autospin* may be interpreted as supporting this interpretation; see *Autospin Ltd v Beehive Spinning [1995] R.P.C. 683 Ch D* at 698 (noting that it is possible to define any shape in non-graphic notation, and that a literary work consisting of computer code “represents the three dimensional article”).

36 Mendis, “Clone Wars Episode II” (2014) 6(2) Law, Innovation and Technology 265, 271 (referring to s.3(1)(b) - (c) of CDPA).

37 Silverman, “Optimising protection: IP rights in 3D printing” (2016) 38 E.I.P.R. 5, 7.

38 *Abraham Moon & Sons Ltd v Andrew Thornber Ltd [2012] EWPC 37; [2013] F.S.R. 17*.

39 *Anacon Corp v Environmental Research Technology [1994] F.S.R. 659 (Ch D)*.

40 Dinusha Mendis, “In Pursuit of Clarity: The Conundrum of CAD Software and Copyright – Seeking Direction Through Case Law” (2018) 40 E.I.P.R. 694, 699 (the facts of these cases are discussed further below).

41 *Anacon [1994] F.S.R. 659* at 660.

42 *Abraham Moon Ltd [2012] EWPC 37; [2013] F.S.R. 17* at [99] (“[a]s a literary work the Skye Ticket Stamp embodies a series of instructions which define how to make something”).

43 *Anacon [1994] F.S.R. 659* at 660 (the words and numerals were an “engineer’s notation” meant to be read by an expert).

44 Section 178 of CDPA 1988 states that the term “writing” in CDPA “includes any form of notation or code, whether by hand or otherwise and regardless of the method by which, or medium in or on which, it is recorded, and [that] ‘written’ shall be construed accordingly”.

45 Elam, “CAD Files and European Design Law” (2016) 7 J.I.P.I.T.E.C. 146, 148 (see paras 16–19); *Mikko Antikainen and Daniel Jongsma, “The Art of CAD: Copyrightability of Digital Design Files” in Rosa Ballardini*

et al. (eds), 3D Printing, Intellectual Property and Innovation (Alphen aan den Rijn: Kluwer, 2017), p.267 (arguing that classifying 3D printing design files as computer programs may amount to “stretching the scope of the ... [Software] Directive beyond its intent”, and that regarding the code as a protectable literary work on the basis that it contains series of instructions is “misguided” as it incorrectly places the emphasis on the appearance of the file); Pedro Malaquias, “Consumer 3D Printing: Is the UK Copyright and Design Law Framework Fit for Purpose” (2016) 6(3) Queen Mary Journal of Intellectual Property 321 (arguing that analogies between computer programs and CAD files “do not seem convincing”); art.1(3) of the Software Directive (stating that a computer program must be the “author’s own intellectual creation”). It should be noted that while it might be technically possible to manually write the code for a simple object, in virtually all cases, this code will be automatically generated by the software and the user operating the software will have no direct interaction with it.

46 *Lucas Osborn, 3D Printing and Intellectual Property (Cambridge: Cambridge University Press, 2019), pp.169–171.*

47 *Lucas Osborn, 3D Printing and Intellectual Property (2019), pp.170–171* (noting that “[a]lthough a JPEG file is a ‘computer program’ (per the U.S. copyright statute’s definition) and can be represented in code format, this fact alone cannot transform the text, generated by a digital camera, into a protectable work” and that, in relation to 3D printing design files, “the copyrightability of the basic code necessary to depict a drawing is tied directly to the copyrightability of the image itself”).

48 Richard Arnold, “Content copyrights and signal copyrights: the case for a rational scheme of protection” (2011) 1(3) Queen Mary Journal of Intellectual Property 272, 272.

49 This case was also discussed in detail in the context of 3D printing by Mendis; see Mendis, “In Pursuit of Clarity” (2018) 40 E.I.P.R. 694, 698.

50 *Abraham Moon Ltd [2012] EWPC 37; [2013] F.S.R. 17* at [102] (as discussed above, the ticket in the instant case was *also* a literary work; see [90]). Graphic works are outlined in CDPA 1988 s.4(1)(a),(2)).

51 See Mendis, “In Pursuit of Clarity” (2018) 40 E.I.P.R. 694, 699–700.

52 *Abraham Moon [2012] EWPC 37; [2013] F.S.R. 17* at [105]–[106].

53 Elam, “CAD Files and European Design Law” (2016) 7 J.I.P.I.T.E.C. 146, 148–149.

54 Sculptures are explicitly included in the definition of artistic works under s.4(1)(a) of CDPA.

55 See *Antikainen and Jongsma, “The Art of CAD” in 3D Printing, Intellectual Property and Innovation (2017), p.264* (noting that in such circumstances, copying the file containing the work will infringe the right to reproduction); see also *Osborn, 3D Printing and Intellectual Property (2019), p.146* (arguing that, under US law, 3D printing design files are not works per se but rather *copies* of protected works: “[e]ven though DMFs are not copyrightable works, it is common, if inexact, to say that DMFs are protected by copyright ... [a] more precise statement would be that a DMF is a copy of a protected work ... that is a mouthful, so it is common to elide the phrase and simply state that a file is protected by copyright”).

56 CDPA 1988 s.4(1)(a),(2).

57 *Anacon [1994] F.S.R. 659* at 659–660 (“The essential nature of a graphic work was that it was a thing to be looked at ... [w]hat mattered was what was visually significant,”).

58 *Russell-Clarke & Howe on Industrial Designs, 9th edn, edited by Martin Howe, James St Ville and Ashton Chantrielle (Wildy & Sons, 2016), para.5-006* (noting that the Act’s wording suggests that “objects which might have been regarded as not falling strictly within any of the categories of painting, drawing, etc. or engraving, etc. [under the old 1956 Act] but are of a similar general nature, will be regarded as graphic works under the 1988 Act.”); in *Kenrick v Lawrence (1890) 25 Q.B.D. 99*, a drawing of a hand on a voting card was protected.

- 59 Pedro Malaquias, “Consumer 3D Printing: Is the UK Copyright and Design Law Framework Fit for Purpose” (2016) 6(3) *Queen Mary Journal of Intellectual Property* 321; Elam, “CAD Files and European Design Law” (2016) 7 *J.I.P.I.T.E.C.* 146, 148 (describes the visual content in CAD files as “design drawings”); see also Mendis, “In Pursuit of Clarity” (2018) 40 *E.I.P.R.* 694, 700.
- 60 Teshager Dagne and Chelsea Dubeau, “3D Printing and the Law: Are CAD Files Copyright-protected?” (2015) 28 *Intellectual Property Journal* 101, 123–124 (while the author is primarily referring to Canadian law, a similar outcome is likely to be reached under EU law as long as sufficient free and creative choices are made); see Mendis, “In Pursuit of Clarity” (2018) 40 *E.I.P.R.* 694, 274 (“where a sufficient number of creative choices have to be made in designing the CAD-based file, it can be argued that there is no reason why such digital models should, as a rule, fail to meet the requirements”); Teshager Dagne, “*Subsistence of Copyright over CAD files in 3D Printing: The Canadian, the U.S. and European Outlook*” in Bonadio and Lucchi (eds), *Non-Conventional Copyright: Do New and Atypical Works Deserve Protection?* (Cheltenham: Edward Elgar, 2018), p.364.
- 61 Antikainen and Jongsma, “*The Art of CAD*” in *3D Printing, Intellectual Property and Innovation* (2017), p.264.
- 62 Antikainen and Jongsma, “*The Art of CAD*” in *3D Printing, Intellectual Property and Innovation* (2017), p.265 (“[t]he creator’s options concerning composition and angle in the case of a three-dimensional design of the engine part ... is [sic] severely limited at best. In the case of a wireframe model, there may be even less creative freedom because there can be no choice in regards to colour or shading ...”).
- 63 *Anacon* [1994] *F.S.R.* 659 at 659.
- 64 *Autospin* [1995] *R.P.C.* 683 at 684, 694 (“[a] drawing will be treated as original for copyright purposes if the author expended more than trivial effort and relevant skill in its creation”).
- 65 See Bently and Sherman, *Intellectual Property Law* (2014), p.94 and onwards for further details on the relevant criteria.
- 66 Lionel Bently, “The return of industrial copyright?” (2012) 34 *E.I.P.R.* 654, 670; see also Osborn, *3D Printing and Intellectual Property* (2019), p.168.
- 67 For an overview of scenarios where a CAD file depicting a purely utilitarian object can still be protected under EU law: see Antikainen and Jongsma, “*The Art of CAD*” in *3D Printing, Intellectual Property and Innovation* (2017), pp.265–266.
- 68 CDPA 1988 ss.17
- 69 Malaquias, “Consumer 3D Printing” (2016) 6(3) *Queen Mary Journal of Intellectual Property* 321.