

3D Digitisation of Cultural Heritage

Copyright Implications of the Methods, Purposes and Collaboration

by Pinar Oruç*

Abstract: 3D technology is increasingly used in the digitisation of cultural heritage and while parties engaging in such projects need copyright as an incentive, the copyright status of such 3D models are unclear. It is usually assumed they would not be protected, as the scans of existing objects are less likely to be original compared to the 3D models created from scratch. However, it is often overlooked that these projects vary greatly in terms of the chosen method (whether it is laser scanning or photogrammetry), the project's purpose (if it is for identi-

cal copying or if there is any restoration or creative contribution involved) and the collaboration of different people (ranging from employees to volunteers). This article will discuss the copyright implications of the chosen method, purposes and the level of collaboration, in order to show that each of these factors impact the category, originality and the authorship of the resulting work. It will be argued that it is possible, and in some instances very likely, for 3D projects to lead to protectable outcomes under the EU copyright law.

Keywords: copyright law; cultural heritage; laser scanning; photogrammetry; three dimensional; 3D; originality

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A. Introduction

1 Cultural heritage faces many challenges such as armed conflicts, targeted destruction, natural disasters and natural aging. To reduce the risk of such artefacts disappearing and to increase access, custodians of cultural heritage regularly engage in making reproductions of the movable heritage held in collections and the immovable heritage held on-site. It is not a new practice to make reproductions of fragile art works or to invest in cast courts for allowing visitors to experience works in distant areas. Considering these past practices of reproduction, embracing the 3D technology and implementing digitisation strategies seem like the next logical step. However, these 3D projects also come with the question of how to control their outcomes, therefore intellectual property law becomes directly relevant for incentivising such costly undertakings and for controlling the commercial exploitation of the results.

2 There is already a vast amount of scholarly literature on the relationship between 3D printing and intellectual property law: some aspects of the 3D printing can be protected by patent law if they are registered and 3D printing can also infringingly replicate patented inventions.¹ There could be potential trademark infringements, if the 3D printed object incorporates existing 2D marks or replicates another 3D shape mark.² There is also the overlap

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1 Simon Bradshaw, Adrian Bowyer and Patrick Haufe, 'The Intellectual Property Implications of Low-Cost 3D Printing' (2010) 7 SCRIPTed 1, 26; Rosa Maria Ballardini, Marcus Norrgård and Timo Minssen, 'Enforcing Patents in the Era of 3D Printing' (2015) 10(11) JIPLP 850; Lucas S Osborn, *3D Printing and Intellectual Property* (Cambridge University Press 2019) 60-81.

2 Angela Daly, *Socio-Legal Aspects of the 3D Printing Revolution*

between copyright and design law, for the shape of the artefacts and anything that exceeds surface decoration.³ But copyright is the most suitable for cultural heritage as it has been facing challenges of increasing digitisation already⁴ and it is also the most relevant one for the type of objects that are 3D digitised. In the existing discussion on the copyright status of the 3D models, it is often assumed that digitising existing objects, especially cultural heritage, equates to slavish copying and creates only non-original works. On the other side, parties engaging in digitisation need the incentive, so they argue that the outcome should be protected.

- 3 This article will focus on to what extent 3D scanning of cultural heritage leads to new works protectable under the EU copyright law. By assessing the copyright implications of varying methods, purposes and human involvement in these projects, the article will show that copyright can arise often in the 3D scanning of cultural heritage. Part B will focus on the two most common methods used for cultural heritage (laser scanning and photogrammetry) and explain what it means for the subject matter and originality of the outcome. Part C will discuss the three most common purposes for such projects (making identical copies, restoration and creative uses) and explain what it means for the originality of the outcome. Part D will assess the involvement of the employees, contractors and volunteers and explain what their contribution means for the originality and ownership of the outcome.
- 4 Two caveats should be added here. While the existing copyright literature on 3D scanning addresses all three scenarios of (a) creating a new 3D object by using software, (b) locating and modifying files found online, and (c) scanning existing objects,⁵ the first two will not be addressed in this article. Secondly, it will only focus on the scanning of the cultural heritage that is no longer subject to

(Palgrave Macmillan 2016) 36-37; Osborn, *3D Printing* (n 1); Dinusha Mendis, Mark Lemley and Matthew Rimmer (eds), *3D Printing and Beyond: Intellectual Property and Regulation* (Edward Elgar 2019).

- 3 Dinusha Mendis, “‘The Clone Wars’ - Episode 1: The Rise of 3D Printing and Its Implications for Intellectual Property Law - Learning Lessons from the Past?” (2013) 35 EIPR 155.
- 4 Osborn, *3D Printing* (n 1) 143; David Gillespie, ‘Copyright and Its Implications for 3D Created Datasets for Cultural Heritage Institutions’ (2015) 1(2) *International Journal of Culture and History* 135.
- 5 Dinusha Mendis, ‘Back to the Future’? From Engravings to 3D Printing – Implications for UK Copyright Law’ in Dinusha Mendis, Mark Lemley and Matthew Rimmer (eds) (n 2) 57.

copyright, and therefore not assess the potential copyright infringement caused by reproducing without permission.

B. Copyright implications of the chosen method

- 5 It is necessary to start the discussion with the methods of 3D scanning, which are laser scanning and photogrammetry.⁶ After providing a brief introduction to the technical side of these methods, the copyright implications will be assessed.
- 6 In the simplest terms, laser scanning works by sending laser light to the surface without any contact while photogrammetry works by calculating the measurements between specific points in the collected data. When comparing these methods, we see that laser scanning allows for higher accuracy, especially for large spaces.⁷ But it also requires expensive equipment and does not create good results for edges or reflective surfaces.⁸ On the other side, photogrammetry is preferred for smaller spaces with more realistic textures and its accuracy depends less on the equipment and more on the software.⁹ Its quality is affected more from outside conditions, such as changing light levels and surrounding vegetation.¹⁰ The choice between the two depends on the size of the object and the desired detail level.¹¹

6 Although methods such as hand measurement (for small objects) or global navigation satellite system (for topographies) are also used for heritage, these two are the most common ones for mass data collection. Historic England, ‘3D Laser Scanning for Heritage: Advice and Guidance on the Use of Laser Scanning in Archaeology and Architecture’ (2018) 2.

- 7 Annabelle Davis and others, ‘Pilbara Rock Art: Laser Scanning, Photogrammetry and 3D Photographic Reconstruction as Heritage Management Tools’ (2017) 5 *Herit Sci* 25.
- 8 Historic England, ‘3D Laser Scanning’ (n 6).
- 9 Lanmar Services, ‘Laser Scanning vs. Photogrammetry’ <<http://lanmarservices.com/2014/11/07/laser-scanning-vs-photogrammetry/>> accessed 2 April 2020.
- 10 Davis and others (n 7).
- 11 For example, web-uses require a photo-realistic representation simplified enough to be viewed easily, while objects for scholarly research needs to be precise to the millimetre. Grazia Tucci, Daniela Cini and Alessia Nobile, ‘Effective 3D Digitization of Archaeological Artifacts for Interactive Virtual Museum’ [2011] *International Archives of*

It is also possible to use these methods together, therefore addressing each other's shortcomings.

I. Laser Scanning

Most of the laser scanning projects operate on one of the three different principles: triangulation, pulse and phase.¹² Triangulation scanners work by detecting the position of a spot or stripe of laser light and has forms such as (i) static scanners for small objects placed on turntables, (ii) scanners attached to articulating arms, (iii) tripod-mounted scanners, (iv) handheld scanners for close range work, and (v) handheld and backpack-mounted scanners for mobile field use over extensive areas.¹³ Pulse scanners work by emitting a pulse of laser light and calculating the time it takes to return (speed of light) and their ability to rotate means greater coverage of the area its placed in, compared to triangulation method.¹⁴ Phase-comparison scanners rely on the phase differences between the emitted and returning signals and are useful for capturing higher accuracy scans of intricate cultural heritage.¹⁵

- 7 The laser scanning procedure usually starts with the surveying, which involves calculating how many scans and angles will be needed for that object and setting up the positioning.¹⁶ In one of the laser scanning projects, half of the data acquisition time is reported to be spent on the placement of the object.¹⁷
- 8 Once the data is acquired, the next stage is "processing", where raw data is further analysed. This stage includes the cloud alignment (aligning the points in the scans) and mesh fusion, and the

the Photogrammetry, Remote Sensing and Spatial Information Sciences 414.

- 12 Historic England, '3D Laser Scanning' (n 6) 7-8.
- 13 *ibid.*
- 14 *ibid* 10; Fabio Remondino, 'Heritage Recording and 3D Modeling with Photogrammetry and 3D Scanning' (2011) 3 *Remote Sens.* 1104; Massimiliano Pieraccini, Gabriele Guidi and Carlo Atzeni, '3D Digitizing of Cultural Heritage' (2001) 2 *Journal of Cultural Heritage* 63.
- 15 Historic England, '3D Laser Scanning' (n 6) 13; Naci Yastikli, 'Documentation of Cultural Heritage Using Digital Photogrammetry and Laser Scanning' (2007) 8 *Journal of Cultural Heritage* 423.
- 16 Tucci, Cini and Nobile (n 11) 415; Historic England, '3D Laser Scanning' (n 6) 26-27.
- 17 Tucci, Cini and Nobile (n 11) 416.

editing of polygonal mesh and texture – which would involve input such as removing the support the object was leaning on, correcting errors and holes in the surface, removing reflections, noise reduction and adding a more realistic texture.¹⁸ While some of these activities are automated, others require a human expert who can correctly identify and attribute features to the scans.¹⁹ It is then followed by simplification of the model for easier sharing and exporting it in the desired storage format.²⁰ It is common to keep most of the data so that it can be re-evaluated later with more developed technologies, to make these efforts more "future-proof".²¹

II. Photogrammetry

- 9 Photogrammetry has been described in the past as the "art, science and technology of obtaining reliable information about physical objects and the environment through the process of recording, measuring, and interpreting photographic images and patterns of electromagnetic radiant energy and other phenomena".²² Photogrammetry starts with field work (surveying and pictures) and is then completed by processing, which involves camera calibration, orientation, point clouds determination by image matching or point clouds registration by using laser scanning, followed by meshing and texturing to create a 3D model.²³
- 10 For large objects, there are many decisions to be made regarding the use of manned or unmanned aircrafts, how to capture elevations and problem areas in the photogrammetry of buildings and structures, using tripods and deciding on the right surface and light conditions for recording excavation areas.²⁴ For smaller objects, there are decisions to be

18 *ibid* 417; Historic England, '3D Laser Scanning' (n 6) 23-29.

19 Historic England, '3D Laser Scanning' (n 6) 40.

20 Tucci, Cini and Nobile (n 11) 417.

21 Historic England, '3D Laser Scanning' (n 6) 41.

22 José Luis Lerma and others, 'From Digital Photography to Photogrammetry for Cultural Heritage Documentation and Dissemination' (2013) 6 *DISEGNARECON* 1, quoting from Chester C Slama, Soren W Henriksen, Charles Theurer, *Manual of Photogrammetry* (1980) 4th. Edition, American Society of Photogrammetry.

23 *ibid.*

24 Historic England, 'Photogrammetric Applications for Cultural Heritage: Guidance for Good Practice' (2017), 53-73.

made about camera lenses, lighting and turntables.²⁵ Photogrammetric procedures have more difficulty in creating high quality and reliable models of large scale objects due to the lighting conditions, image block configuration and the camera resolution, but the developments in the software seems to be effective in making photogrammetry a viable alternative.²⁶ The development of software for assisting photogrammetry leads to increased automation and higher performance.²⁷ Because the majority of the accuracy depends on the post-processing, a single good camera can be sufficient for many projects.²⁸

- 11 This method is especially useful for heritage that is in danger or lost heritage. For example, the Bamiyan Buddhas, destroyed by the Taliban in 2001, were recreated this way. One of the projects relied on three sources: while the internet and tourist images were only useful to an extent, the 3D model was mainly based on metric images acquired in 1970, which provided more precise information about the measurements.²⁹ A light projection of 3D Bamiyan Buddhas was later used in 2015, with more than 150 people in attendance celebrating their revival.³⁰ In terms of community involvement, the parties providing the photography should understand the importance of providing photographs that are uncropped and free of any special effects.³¹ Tourists usually take similar photographs, so the collection of those raw images might not give the full scale and all angles of the lost heritage.³²

Nevertheless, examples like this mean that photogrammetry has an edge over laser scanning for allowing retrospective copies of lost cultural heritage.

III. Copyright analysis

- 12 In order to determine the copyright status of the 3D models created at the end of laser scanning and/or photogrammetry, four questions need to be asked.
- 13 The first question is whether the files are just copies of the existing works or if they can be treated as individual works on their own. It would be particularly problematic for functional objects, since the scope of cultural heritage is never explicitly limited to purely aesthetic objects. If the 3D models are viewed merely as the medium where the underlying work is recorded,³³ then the copies of functional objects could not be protected.
- 14 While some jurisdictions specifically exclude utilitarian objects from copyright protection,³⁴ these copies are more likely to be protected as derivative works within the EU. As long as they satisfy the originality standard, scans of existing objects – even the utilitarian ones – can still be potentially protected.³⁵ In the EU, the originality standard is that the work has to be the “author’s own intellectual creation”, and this can only be present when the author can make “free and creative choices” that are

25 *ibid* 73-76.

26 Thomas Kersten, Klaus Mechelke and Lena Maziull, ‘3D Model of Al Zubarah Fortress In Qatar - Terrestrial Laser Scanning Vs. Dense Image Matching’ [2015] *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.* Volume XL-5/W4 .

27 Lerma and others (n 22).

28 Historic England, ‘Photogrammetric Applications’ (n 24) 19.

29 Armin Grün, Fabio Remondino and Li Zhang, ‘Photogrammetric Reconstruction of the Great Buddha Of Bamiyan, Afghanistan’ (2004) 19 *The Photogrammetric Record* 177, 182.

30 Edward Delman, ‘Afghanistan’s Buddhas Rise Again’ (*The Atlantic*, 2015) <<https://www.theatlantic.com/international/archive/2015/06/3d-buddhas-afghanistan/395576>> accessed 21 February 2020.

31 Historic England, ‘Photogrammetric Applications’ (n 24) 79.

32 *ibid*.

33 ‘a machine instruction file is a material object (namely the tangible computer memory) in which the sculptural work is fixed (i.e.stored), and from which the work can be perceived (i.e., seen) with the aid of a machine (i.e., a 3D printer)’. Osborn, *3D Printing* (n 1) 146; Lucas S Osborn, ‘Of PhDs, Pirates, and the Public: Three-Dimensional Printing Technology and the Arts’ [2014] *Tex. A&M L. Rev.* 811, 833; Mikko Antikainen and Daniël Jongma, ‘The Art of CAD: Copyrightability of Digital Design Files’ in Rosa Maria Ballardini, Marcus Norrgård and Jouni Partanen (eds), *3D Printing, Intellectual Property and Innovation: Insights from Law and Technology* (Wolters Kluwer 2017) 264; Plamen Dinev, ‘Revisiting the Copyright Status of 3D Printing Design Files’ (2020) 42(2) *EIPR* 94, 99.

34 For US analysis, see: 17 US Copyright Act, §101; Kyle Dolinsky, ‘CAD’s Cradle: Untangling Copyrightability, Derivative Works, and Fair Use in 3D Printing’ (2014) 71 *Wash. & Lee L. Rev.* 591; Daly (n 2) 24-25.

35 Marcus Norrgård, Rosa Maria Ballardini and Miia-Mari Kasi, ‘Intellectual Property Rights in the Era of 3D Printing’ in Ballardini, Norrgård and Partanen (n 33) 66-67; Dolinsky (n 34); Burton Ong, ‘Originality from Copying: Fitting Recreative Works into the Copyright Universe’ (2010) 2 *IPQ* 165.

not dictated by their technical function.³⁶ The room for originality in these methods will be discussed below separately.

- 15 The second question is how to define these files. There are multiple formats involved, although the literature often focuses on the computer aided design (CAD) files.³⁷ CAD files can be created from scratch or by using pre-existing shapes and they can carry a variety of information such as names of parts or user comments.³⁸ They are then converted into surface-mesh files (usually as STL) which is the most downloaded format and therefore the most valuable, but they are not printable by themselves.³⁹ In order to be printed, these files have to be converted to machine-instruction files (usually G-Code), where the surface is sliced into many printable layers and the printer is instructed to move and build the item accordingly. At the end of this process, parties can choose to share the files or print the outcome as many times as they wish.
- 16 For outcomes of laser scanning and photogrammetry, the scans of existing objects can directly be turned into surface-mesh files with the help of software, but they would have to be transferred back to CAD format for further corrections and manipulation.⁴⁰ It should be noted that both methods above mention the “processing” stage, meaning that it is likely that

the files change formats multiple times and there could potentially be original contributions during these changes.

- 17 The third question is how to categorise the files under the copyright’s subject matter, for which there are diverging views in the literature. Based on the definition of computer programs,⁴¹ it could be argued that the CAD files have enough room for user input in them to be treated as “mini-programs” or “preparatory design”.⁴² Alternatively, they could be seen as literary work, similar to instructions given to create something new, such as a knitting pattern or circuit diagram, based on the cases from the UK.⁴³ As another alternative, some scholars argue for seeing CAD files as artistic works (in addition to literary works), based on the fact that they could be scans of existing artistic works,⁴⁴ or the fact that they carry instructions to create a new artistic work.⁴⁵ It could also be possible to argue that these works are protectable as databases, provided that they are “authors own intellectual creation”,⁴⁶ which is not always the case.⁴⁷

36 Case C-5/08 *Infopaq International A/S v Danske Dagblades Forening* [2009] ECDR 16; Case C-145/10 *Eva-Maria Painer v Standard VerlagsGmbH and Ors* [2012] ECDR 6 89; Case C-393/09 *BSA v Ministerstvo kultury* [2011] ECDR 3; Cases C-403/08 and C-429/08 *FAPL v QC Leisure and Karen Murphy v Media Protection Services* [2011]. It is also harmonised for some types of works through EU Directives: Directive 2009/24/EC of the European Parliament and of the Council of 23 April 2009 on the legal protection of computer programs (Software Directive) Art 1(3) for computer programs, Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases (Database Directive) Art 3(1) for databases and Directive 2006/116/EC of the European Parliament and of the Council of 12 December 2006 on the term of protection of copyright and certain related rights (Term Directive) Art 6 for photographs.

37 Osborn points out that the literature mainly focuses on CAD files while ignoring other files in the process. Osborn, *3D Printing* (n 1) 29.

38 *ibid* 28; Antikainen and Jongsma (n 33) 258; Osborn, ‘Of PhDs, Pirates, and the Public’ (n 33) 28.

39 Osborn, *3D Printing* (n 1) 31.

40 *ibid* 29.

41 Computer programs are defined as “programs in any form, including those which are incorporated into hardware... also includes preparatory design work leading to the development of a computer program provided that the nature of the preparatory work is such that a computer program can result from it at a later stage”. Software Directive, Recital 7.

42 Dinusha Mendis, ‘In Pursuit of Clarity: The Conundrum of CAD Software and Copyright – Seeking Direction Through Case Law’ (2018) 40(11) EIPR 694; Dinusha Mendis, ‘Clone Wars Episode II - The Next Generation: The Copyright Implications Related to 3D Printing and Computer-Aided Design (CAD) Files’ (2014) 6 Law, Innovation and Technology 265; Bradshaw, Bowyer and Haufe (n 1); Dolinsky (n 34); Osborn, *3D Printing* (n 1); Iona Silverman, ‘Optimising Protection: IP Rights in 3D Printing’ (2016) 38(1) EIPR 5.

43 See further *Abraham Moon & Sons v Thornber* [2012] EWPC 37, [2013] FSR 17; *Anacon Corporation v Environmental Research Technology* [1994] FSR 659 (Ch D); *Brigid Folley v Ellot* [1982] RPC 433 9EWHC Ch; Mendis, ‘In Pursuit of Clarity’ (n 42).

44 Antikainen and Jongsma (n 33) 258; Mendis, ‘Back to the Future?’ (n 5); Daly (n 2); Haritha Dasari, ‘Assessing Copyright Protection and Infringement Issues Involved with 3D Printing and Scanning’ (2013) 41 AIPLA QJ 279.

45 Mendis, ‘In Pursuit of Clarity’ (n 42).

46 Database Directive, Art 3(1)

47 Antikainen and Jongsma (n 33) 272; Osborn, *3D Printing* (n 1) 168.

- 18 The category of the work matters more for countries with a closed-list of protected subject matter, such as the UK; while civil law countries keep an open-list approach,⁴⁸ and use the originality standard to determine what is protected. This open-list approach requires assessing whether previously unconsidered things, such as smell of perfumes or taste of cheese, could receive copyright protection. The category might also matter for originality in the UK; because the originality standard for computer programs, databases and photographs are harmonised with the EU Directives, but not harmonised for other types of works. For other countries, determining the correct category seems to be a relatively small problem compared to determining the originality of the scans.
- 19 The fourth and most important question is whether these methods have enough room for originality. The general understanding is that 3D models created from scratch are more likely to be original, while the scans of existing objects rarely have enough room for originality.⁴⁹ While there are no cases for the 3D scanning of cultural heritage yet, *Bridgeman v Corel* can be helpful in explaining this viewpoint. This case showed that photographs of two-dimensional public domain paintings lacked sufficient originality to be protected as new works.⁵⁰ It was held that they could not be protected because the result was not original enough, which was in line with developments in the US at the time.⁵¹ The outcome of this case and its discouraging impact on heritage institutions were widely discussed.⁵² It should be mentioned here that even the recreation of seemingly two-dimensional works is not always straightforward. One interesting example is the digitisation of 2D paintings in 2013, when a researcher used a 3D scanner to detect the details of the usage of brushes and the amount of paint and then recreated these images by 3D printing.⁵³
- 20 Going back to the methods above, it should also be noted that there is no single determining point during the 3D digitisation for the originality threshold, the creative decisions could be in the planning, the scanning or the processing, as long as they affect the final outcome.⁵⁴
- 21 *In arguing for originality in laser scanning*, it was mentioned above that they come in many different types, with differing levels of human control.⁵⁵ As such, the level of free and creative choices could be different between the scanning of an object placed on a turntable and the scanning performed by hand-held or backpack-mounted scanners. Depending on the size of the scanned location, the use of phase and/or pulse scanners and drones add another layer in the scanning stage, where original decisions might be made.⁵⁶ Even if there is only one possible angle (such as an archaeological excavation with a limited view), choosing the correct method and device to capture the scan might equate to
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- 48 See for a detailed comparison: J.A.L. Sterling, *Sterling on World Copyright Law* (5th edn, Sweet & Maxwell 2018) Chapter 6.
- 49 Antikainen and Jongma (n 33) 269; Osborn, *3D Printing* (n 1) 168; John Hornick, '3D Printing and IP Rights: The Elephant in the Room' (2015) 55 Santa Clara L. Rev. 801, 812.
- 50 *Bridgeman Art Library v Corel Corp.*, 36 F Supp 2d 191 (SDNY 1999).
- 51 'distinguishable variation' in *Gerlach-Barklow v Morris & Bendien* 23 F 2d 159 (SDNY 1927); 'something more than merely trivial, something recognizably his own' in *Alfred Bell v Catalda Fine Arts* 191 F 2d 99 (2d Cir 1951); 'substantial as opposed to trivial variation ... an element of creativity' in *L Batlin & Son v Snyder* 536 F 2d 486 (2d Cir 1976); as quoted in Robert C Matz, 'Bridgeman Art Library, Ltd. v. Corel Corp.' (2000) 15 Berkeley Tech LJ 3. See also *Meshworks, Inc. v. Toyota Motor Sales USA, Inc.*, 528 F.3d 1258 (10th Cir. 2008); *Osment Models, Inc. v. Mike's Train House, Inc.*, No. 2:09-CV-04189-NKL, 2010 WL 5423740; cf. *Alva Studios, Inc. v. Winninger*, 177 F. Supp. 265 (SDNY 1959) and *Lucky Break Wishbone Corp. v. Sears Roebuck & Co.*, 373 F. App'x 752, 755 (9th Cir. 2010) for the US approach to copies of existing objects.
- 52 For *Bridgeman* case: Matz (n 51); Terry S Kogan, 'Photographic Reproductions, Copyright and the Slavish Copy' (2012) 35 Colum. J.L. & Arts 445; Mary Campbell Wojcik, 'The Antithesis of Originality: Bridgeman, Image Licensors, and the Public Domain' [2008] Hastings Comm. & Ent. L.J. 257; Robin J Allan, 'After Bridgeman: Copyright, Museums, and Public Domain Works of Art' (2007) 155 U. Pa. L. Rev. 961. For similar cases see also Sterling (n 48) 288.
- 53 '3D Printer Creates Identical Reproductions of Fine Art Paintings' (designboom, 2013) <www.designboom.com/art/oce-3d-printer-creates-identical-reproductions-of-fine-art-paintings-09-30-2013/> accessed 20 February 2020.
- 54 Michael Weinberg, '3D Scanning: A World without Copyright' (2016) 7.
- 55 For different levels of human involvement in works and its implications for copyright, Thomas Margoni, 'The Digitisation of Cultural Heritage: Originality, Derivative Works and (Non) Original Photographs' (2014); Dasari (n 44) 298-305.
- 56 Laser scanning by using drones can be compared to the example of taking aerial photographs of Paris mentioned in Margoni (n 55) 34. Due to technological developments, whoever is controlling the laser scanning drone nowadays would have more control than a person setting up a camera to take photographs in regular intervals in this example.

having enough room for free and creative choices. Secondly, positioning of the objects play a big role in the desired outcome and it was mentioned above that deciding on the right position can take up as much as half of the data acquisition. Based on the decision in *Painer*, it is clear that the lighting and positioning of the object can impact the originality of the outcome.⁵⁷ It should especially be noted that this case also mentions situations after the image is captured for adding a “personal touch”.⁵⁸ While some argue that lighting, colour and shadows disappear during the processing stage, especially if they are aiming for accuracy,⁵⁹ there could be further choices in the processing such as removing errors or adding realistic textures.

- 22 *In arguing for originality in photogrammetry*, there are the capturing and processing stages. If the photographs are new and created as part of the project, then the arguments about the choosing the right device and positioning also apply here. If the images were not specifically created for the project, but were processed with the help of photogrammetry, then we would need to assess the processing stage.
- 23 One of the issues would be whether this method only involves facts. Since photogrammetry uses existing images to learn the measurements and positioning of objects, those things alone would not be copyrightable.⁶⁰ However, the processing might mean that the right information needs to be chosen, interpreted and brought together, which might show sufficient originality. If the end result is going to be treated as a database, then the materials need to be individually accessible.⁶¹ While the data is arranged in a systematic way in photogrammetry,

are the outcomes of photogrammetry individually accessible? The closest example would be the geographic locations on a map, in which the CJEU confirmed that it would be.⁶² However, it would be less likely to be original, if photogrammetry just relies on all existing images and if there is not much room for creative choices in the selection or arrangement.⁶³ There is also the sui generis database right for protecting the substantial investment in obtaining, verifying or presenting the contents of the database.⁶⁴ Where (i) data obtaining and verifying is limited (photogrammetry relying on existing photographs), or (ii) added information disappears in the conversion to 3D printable formats,⁶⁵ it is unlikely for the result to receive a database right. Another concern regarding the originality of photogrammetry method is the heavy reliance on the software. If there is no human involvement and the data collected is merely fed to the photogrammetry software, at which stage would there be free and creative choices? It should be noted that while software is useful for increasing automation, it is still not fully automated, and a human’s involvement is still needed to ensure that the correct data is collected and the processing stage goes smoothly.

- 24 To sum up, varying methods mean varying original contributions for copyright purposes. Both laser scanning and photogrammetry are common methods with multiple changes taking place at every stage. Selecting the right method, device, angle, positioning at the capturing stage and then selecting the right processes, measurements and interpretations in the processing stage show enough room for free and creative choices. It is a separate question if these digitisers actually want to create a new work, which will be discussed in the next part.

57 See *Painer* (n 36), *Antiquesportfolio.com v Rodney Fitch & Co* [2001] FSR 345, [2001] ECDR 52 (EWHC Ch); *Margoni* (n 55) 19; *Mendis*, ‘Clone Wars Episode II - The Next Generation’ (n 42) 277-278.

58 “In the preparation phase, the photographer can choose the background, the subject’s pose and the lighting. When taking a portrait photograph, he can choose the framing, the angle of view and the atmosphere created. Finally, when selecting the snapshot, the photographer may choose from a variety of developing techniques the one he wishes to adopt or, where appropriate, use computer software.”: *Painer* (n 36) [91].

59 *Osborn*, ‘Of PhDs, Pirates, and the Public’ (n 33) 831.

60 *Weinberg* (n 54) 14.

61 A database is defined as “a collection of independent works, data or other materials arranged in a systematic or methodical way and individually accessible by electronic or other means”: Database Directive, Art 1(2).

62 “...Article 1(2) of Directive 96/9 must be interpreted as meaning that geographical information extracted from a topographic map by a third party so that that information may be used to produce and market another map retains, following its extraction, sufficient informative value to be classified as ‘independent materials’ of a ‘database’ within the meaning of that provision.” Case C-490/14 *Freistaat Bayern v Verlag Esterbauer* EU:C: 2015:735 [29]; See also *Lionel Bently and Brad Sherman*, *Intellectual Property Law* (5th edn, Oxford University Press 2018) 67.

63 *Antikainen and Jongmsma* (n 33) 272.

64 Database Directive Art 7, Case C-444/02 *Fixtures Marketing Ltd v Organismos prognostikon agonon podosfairou AE (OPAP)* [2004] ECR I-10549 [2005] 1 CMLR. 16.

65 *Antikainen and Jongmsma* (n 33) 273.

C. Copyright implications of the project's purpose

25 It is worth mentioning here again that creative decisions could take place at any stage of the project. It means that depending on the purpose, there could be different types of contribution taking place at the capturing and processing of both of the methods described above. This section will roughly divide it into three purposes: identical copies, restoration, and creative purposes. Any subsequent purposes (such as research, education, virtual repatriation) would usually be achieved by creating identical copies. It should be repeated here again that while these activities would count as reproduction and adaptation and could infringe the copyright in the scanned object, this article only addresses the scenarios where the scanned originals are already in the public domain.

I. Identical copies

26 The benefits of digitisation in creating preservation copies is widely recognised.⁶⁶ As mentioned in the Introduction, cast courts of identical copies allow people to experience cultural heritage in remote areas.⁶⁷ With the technological developments, 3D printed versions are no longer inferior to the original and can be preferred for allowing a more personal, hands-on approach with the copies,⁶⁸ while saving the originals from further contact. As mentioned earlier, the case law for identical copies of public domain works (*Bridgeman v Corel*) seems discouraging. As discussed in Part B, there is great

66 European Commission, Recommendation of 24 August 2006 on the digitisation and online accessibility of cultural material and digital preservation' ((EC) 2006/585) [2006] OJ L236/28; Declaration of cooperation on advancing digitisation of cultural heritage (2019).

67 "Just as the Romans once used casting to obtain copies of Classical Greek statuary, the British, and then the Americans, used this technique in the nineteenth century to develop collections of copies of sculptural works in Italy. These copies were publically displayed, even in major museums, and used in teaching history of art, and applied art courses, at universities": Charles Cronin, 'Possession Is 99% of the Law: 3D Printing, Public Domain Cultural Artifacts and Copyright' (2016) 17 Minn. J.L. Sci. & Tech 709, 712.

68 Osborn, 'Of PhDs, Pirates, and the Public' (n 33) 820-821; Sonia K Katyal, 'Technoheritage' (2017) 105(4) California Law Review 1111, 1129; Matthew Rimmer, '3D Printing Jurassic Park: Copyright Law, Cultural Institutions, and Makerspaces' [2016] Pandora's Box 1, 9.

skill involved in making accurate copies. While showing that skill alone is not enough for originality, if there are free and creative choices to be made to create a "good copy",⁶⁹ then these works can still be original.

27 On the other hand, not all choices will matter when aiming for accuracy. For example, the decisions made during the printing, such as aiming for the right colour⁷⁰ or the right material,⁷¹ will not matter in determining the originality of the 3D model itself. Similarly, when the CAD file is converted into an STL file, they lose features such as lighting and shadows (as they are not needed for the printing),⁷² which means that the original decisions regarding those aspects also disappear. So, achieving sufficient originality is not impossible for identical copies, but it requires an incredibly careful expert consideration of the decisions made at every stage.

II. Restoration

28 When the aim is not creating the object as it is now but to restore it to its former glory, there could be restoration decisions for removing weather damage or cracks, smoothing of the edges, purposefully separating a single work into different parts and changing the scale; all of which could lead to sufficiently different scans. On multiple occasions, the contributions in restorations were treated as

69 "In cases where there is no complete record of the antecedent work intact... such as when an impurity-obscured painting is restored to its former glory or when a scholar tries to accurately recreate an obscure ancient work for which no complete records have survived the passage of time, the conclusions reached and decisions made by the recreative author may well be different from those of another person engaged in the same task": Ong (n 35) 184.

70 "the varying color temperatures of natural lighting differentiate the appearance of the originals and digital reproductions from hour to hour": Shoji Yamada, 'Who Moved My Masterpiece? Digital Reproduction, Replacement, and the Vanishing Cultural Heritage of Kyoto' (2017) 24 International Journal of Cultural Property 295, 302.

71 "Some parts may be durable, but other materials will be predictably short-lived. These less durable materials would be best used as models or precursors to final objects. There are some very robust materials used for aerospace or deep-sea applications": Melvin J Wachowiak and Basiliki Vicky Karas, '3D Scanning and Replication for Museum and Cultural Heritage Applications' (2009) 48 Journal of the American Institute for Conservation 141, 147.

72 Antikainen and Jongsma (n 33) 260.

original throughout the EU countries.⁷³ While also requiring a careful analysis of the contribution of the restorer, this purpose is more likely to lead to an original work, compared to identical copies.

- 29 Restoration could also be interpreted as restoring an unprintable 3D model: it was previously mentioned that format changes can mean the disappearance of original decisions. But changing formats could also allow for making an original contribution: for example, the files should be checked for mistakes during format changes, because any gap in the surface-mesh file might lead to a failed printing-job.⁷⁴ But if the subsequent restorations made to the file is the only way of achieving those results, then it would not be an original work as there were no choices involved.

III. Creative Purposes

- 30 3D models can allow presenting works in new range of possibilities such as interactive exhibitions.⁷⁵ Scholars refer to expressive scans where the outcome significantly differs from the original objects and therefore display sufficient originality.⁷⁶ Further alterations to identical copies can also lead to new works. Anyone with access to existing 3D models can make personal changes, so that they can interact with heritage in a deeper way. For example, there are various 3D models of the Nefertiti bust turned into different objects such plant pots and accessories that can be found online⁷⁷, which are based on an

73 Andreas Rahmatian, 'Copyright protection for the restoration, reconstruction and digitization of public domain works' in Estelle Derclaye (ed), *Copyright and Cultural Heritage: Preservation and Access to the Works in a Digital World* (Edward Elgar 2010) 51-77; Paul Torremans, 'Legal issues pertaining to the restoration and reconstitution of manuscripts, sheet music, paintings and films for marketing purposes' in Paul Torremans (ed), *Copyright Law. A Handbook of Contemporary Research* (Edward Elgar 2007) 28-48. See also *Eisenman v Qimron*, C.A. 2790/93, 2811/93, 54(3) P.D. 817.

74 Osborn explains that this part sometimes requires the involvement of a person with the necessary skills and knowledge, but this human dependency might decrease in the future with better technology. Osborn, *3D Printing* (n 1) 30.

75 For 3D projects see: 'Arts and Culture Experiments' <<https://experiments.withgoogle.com/collection/arts-culture>> accessed 20 February 2020.

76 Weinberg (n 54) 10; Katyal (n 68) 1147.

77 Thingiverse <<https://www.thingiverse.com/tag:Nefertiti>> accessed 21 February 2020.

identical copy of the bust.⁷⁸ Modifying and printing these objects and using them in daily life could bring a deeper understanding than seeing the original bust held in a glass case in the Neues Museum. Overall, the works created for creative purposes are more likely to be original and deserving of copyright protection, compared to identical copies.

- 31 To sum up, the purpose of 3D scanning and printing carries a great importance in affecting their copyright status. As the original contributions could occur at any stage, every work should be assessed separately. Even when the aim is to create an identical copy, it is possible to make free and creative choices to achieve such accuracy. Projects with purposes such as restoration and creative uses are even more likely to produce original results.

D. Copyright implications of the human involvement

- 32 It is also important to remember that such 3D digitisation is usually performed by multiple parties providing their skills and assistance at different stages. It matters for originality because it means any of these parties can display "free and creative choices" that result in something original. Secondly it also determines who stamped the work with their personal touch,⁷⁹ in order to become the author(s).⁸⁰ The rules for authorship could be particularly important for the desirability such projects.

- 33 Both methods of laser scanning and photogrammetry will require human involvement in order to avoid errors. For example, when the points in the multiple scans are being aligned, even with laser scanners with built-in compasses, it is necessary to check for metal objects that could affect the compass.⁸¹ But the involvement for overcoming technical hurdles might be less original compared to the involvement to determine the methods or shape of the 3D model.

- 34 It could be challenging to distinguish the authors. One of the benefits of laser scanning is argued to be automated to an extent where "the outcome will be homogenous even when different operators work

78 'Nefertiti Hack' <<http://nefertitihack.alloversky.com/>> accessed 21 February 2020.

79 Painer (n 36) [92].

80 This depends on the national copyright laws of the given jurisdiction regarding joint and co-authorship.

81 Historic England, '3D Laser Scanning' (n 6) 32.

on a project”.⁸² If it means there is only one way of doing something, then there is no originality. But if it means that different operators will still make contributions, but their individual contribution is impossible to separate, then the outcome will be protected and these operators could be treated as joint authors.⁸³

35 If the creation of 3D model was completely automated (and it could be soon, with the help of the technology), then we would have to check the copyright laws for computer-generated works. While there are references to the author of the computer program under EU Law, the rules on computer-generated works did not make it to the final draft of the Software Directive.⁸⁴ If such 3D scans are to be treated as computer-generated works, then the originality criteria to be applied is also uncertain.⁸⁵

36 While determining the author, it is useful to understand the employment practices of the heritage sector. For such projects, the author would usually be the institution who scans their collections or the parties who run the on-site digitisation project. It would then be up to them to release them online for free or keep the models to themselves and use it for purposes such as making replicas for the gift shop. One important issue to consider here is whether the employees would hold copyright to the scans they created. Most civil law countries have rules that assume the employee as the author, unless there is a contractual provision; whereas common law countries usually carry the assumption that the works created during employment belong to the employer.⁸⁶

37 It is less straightforward for projects that were outsourced to scanning companies. In finding a balance between the desire to have complete control over a project and the discouraging costs of scanning devices, it makes sense to rely on

82 Tucci, Cini and Nobile (n 11) 415.

83 The rules on joint authorship is not harmonised. Bently and Sherman (n 62) 139; Mark Perry and Thomas Margoni, ‘Ownership in Complex Authorship: A Comparative Study of Joint Works’ (2012) 34(1) EIPR 22.

84 Explanatory Memorandum to the proposal for a Software Directive, COM (88) 816 final, 17 March 1989; Ana Ramalho, ‘Will Robots Rule the (Artistic) World? A Proposed Model for the Legal Status of Creations by Artificial Intelligence Systems’ (2017) 12 Journal of Internet Law.

85 Bently and Sherman (n 62) 117; *Copinger & Skone James on Copyright* (Sweet & Maxwell 2017) para 3-274.

86 Sterling (n 48) 206-209; Jorgen Blomqvist, *Primer on International Copyright and Related Rights* (Edward Elgar 2014).

contractors especially when the work is a one-off/ not continuous.⁸⁷ To avoid future problems with the third-party digitisers, cultural heritage institutions are usually advised to make it clear in the contracts regarding who will hold the copyright at the end of these projects.⁸⁸

38 For the images used in photogrammetry, it can be challenging to determine their authors. While the tourist images in the abovementioned Bamiyan Buddhas project came from a named person who visited the area in 1960s,⁸⁹ it might not be equally straightforward due to the fact that lots of mobile phones have cameras now and some of the photographs could be taken in a hurry before the volunteers leave the heritage site in immediate danger. If the photographs of the volunteers are subject to copyright (noting the specific right for non-original photographs in jurisdictions such as Germany, Italy and Spain),⁹⁰ then the digitisers need the volunteer’s permission to reproduce their photographs. Even if these reproductions are only used for obtaining measurements between two points, the project would still be storing copies of these images. Furthermore, since the tourist images are very similar to each other, it could be impossible to distinguish the author if the end result is based on one specific work.⁹¹

39 Finally, it is important to note that determining an author means that these scans will not be in the public domain, unless the author choose to release them through Creative Commons or a similar license. It is a common criticism that heritage institutions are trying to control public domain works and pull them back into the scope of

87 Historic England, ‘3D Laser Scanning’ (n 6) 45. Although it is about scanning books, see also Nick Poole, ‘The Cost of Digitising Europe’s Cultural Heritage’ Report for Comité des Sages of European Commission (2010), 43 for the cost difference between digitising in-house versus outsourcing (cheaper).

88 Margoni (n 55).

89 Grün, Remondino and Zhang (n 29) 184.

90 The Term Directive protects photographs that are the author’s own intellectual creation, but Article 6 allows Member States to protect other photographs too. See Copinger (n 85) 3-263; Margoni (n 55) 13; Bently and Sherman (n 62) 117.

91 As an interesting example on tourist photographs, see Oliver Smith, ‘How an Incredible Coincidence Sparked a Facebook Plagiarism Row’ (*The Telegraph*, 2015) <<https://www.telegraph.co.uk/travel/news/How-an-incredible-coincidence-sparked-a-Facebook-plagiarism-row/>> accessed 7 May 2020.

65 copyright.⁹² While some argue that it is unfair for public institutions to prevent others from enjoying these public domain works fully, others argue that their investment in digitising their collections should give them some form of benefit and copyright can be the right incentive. Copyright should establish a balance here, by rewarding the efforts that deserve protection while keeping the low effort, non-original engagement with cultural heritage outside the scope of copyright control. As the 3D projects are needed in order to overcome the risk of disappearance of heritage of all humankind, keeping a lenient approach to the likelihood of originality should not necessarily be interpreted as being detrimental to the public.

E. Conclusion

40 The discussion above shows that for the scanning of cultural heritage, it is possible and, in some instances, highly likely for the outcome to be protected by copyright due to the varying methods, purposes and people involved. Each of these elements need to be assessed carefully for every 3D model. Both laser scanning and photogrammetry methods create works, that fit under the protected subject matter of copyright and display enough originality under EU law. While the literature usually assumes heritage scanning will mean creating identical copies, there are multiple possible purposes for carrying out 3D scanning and these purposes can lead to free and creative choices during the capturing and processing stages. Finally, there are many different parties collaborating in these projects and each contribution should be assessed carefully for determining the originality and the authorship of the work. It is important to determine these correctly, as the parties making the scans usually rely on copyright as an incentive to undertake such projects.

92 Kenneth D Crews, 'Museum Policies and Art Images: Conflicting Objectives and Copyright Overreaching' (2012) 22 *Fordham Intell. Prop. Media & Ent. L.J.* 795; Ong (n 35) 186-187.