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ARTICLE

Will Technology-Aided Creativity Force Us to Rethink Copyright's Fundamentals? Highlights from the Platform Economy and Artificial Intelligence

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Abstract The platform economy, the move towards artificial intelligence (AI) and the growing importance of new creative and transformative technologies such as 3D printing raise questions as to whether copyright law suffices in its present form. Our article argues that copyright law is malleable enough to fulfil some of its traditional functions in this new technology-aided (and technology-dominated) environment. However, certain adjustments and complementary instruments seem to be necessary to revitalise these functions. For example, moral rights could be more effectively harmonised at international level, and made more easily enforceable, to reflect the global reach of social media and to protect their essential reputational value in a digital economy that prioritises online exposure over remuneration opportunities. We also consider that creators' rights are difficult, if not impossible, to license and enforce in an environment where contractual practices such as social media terms and conditions impose standard agreements that either do not compensate creators at all or compensate them only marginally. In this context, restoring the bargaining power of creators through the right of access to the platforms' data seems to have become as important as copyright itself. Finally, doubts remain as to whether requirements such as authorship and originality can continue to apply and trigger copyright protection. To this end, we believe that the distinction

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between fully generative machines and other technologies that merely assist human creators is essential for the proper identification of "authorless" works. For such works we advocate the adoption of a very short right that would support computational creativity without stifling human ingenuity.

Keywords Copyright · Moral rights · Platformisation · Artificial intelligence · Robots · 3D printing

1 Introduction

The aim of this article is to foster a discussion about the flexibility and resilience of copyright laws vis-à-vis a constantly evolving spectrum of creators whose output significantly relies on aid provided by new technologies.[1] The article considers whether technology-aided creativity should force us to rethink basic concepts of copyright law and the main criteria to grant legal protection. This is a relevant challenge for a discipline that is being constantly subject to change because it is itself a creature of technology. The article reviews several creative processes induced or facilitated by environments and technologies that have become pervasive and ubiquitous in today's economy and digital society: content platformisation and artificial intelligence (AI). We intend to succinctly investigate if copyright is still the policy tool through which new generations of creators relying on the above-mentioned processes can claim and obtain remuneration and credit for their works.

Copyright's history is well known. Yet, it is worth reflecting briefly on its distinct roots, at least in the Western world, because they are relevant to understand whether this body of law can still govern the new forms of creativity that this article is going to analyse. In its first British codification, after the fast-paced evolution of printing technology, copyright aimed to fight copying.[2] Nowadays this right does more than that, giving its owners control over access to, and use of, a variety of cultural and technological artefacts. Common law countries have always interpreted copyright as a tool to foster creativity and stimulate the spreading of new and original works by clearly prioritising the definition of ownership over that of authorship. This approach is ultimately justified by the so-called utilitarian or incentive-based theory of copyright law, which draws on the basic assumption that creative people need the promise of a financial reward to be adequately motivated to create.[3] Deprived of this prospect, a legal system would not encourage "the Progress of Science and useful Arts" as emphasised in the US Constitution.[4] In systems where incentive-related justifications remain predominant, it is obvious that corporations, and not individual creators, initiate and ultimately control creative processes, including those where the

[1] Some scholars have already speculated about whether some non-traditional works could be protected by copyright. *See*, for instance, Reese (2014); Samuelson (2016); Buccafusco (2016).

[2] *See* amongst others Eisenstein (1979), pp. 27–29, 36; Davies (2002), p. 14.

[3] *See*, *e.g.*, Arrow (1962), p. 609; Hadfield (1992); Landes and Posner (1989). For a comparative description of different approaches, *see* Fisher (2001), p. 168.

[4] *See* Art. I, Sec. 8 of the U.S. Constitution.

human input is limited or difficult to distinguish from that of a machine or a transformative tool.[5] Very different is the situation of civil law jurisdictions – like continental-European laws – which ultimately justify copyright to protect the efforts and personality of authors, revealing the influence of property theories such as John Locke's labour theory[6] and Friedrich Hegel's personality theory.[7] In essence, these systems provide legal protection to a painting, literary work, or musical work in so far as that creative work is linked to its author or artist as a direct manifestation of his or her *human* personality.[8] This is also the reason why civil law countries traditionally use another expression to define this type of intellectual property (i.e. "author's right")[9] and attach non-economic prerogatives (such as moral rights to "attribution" and "integrity" of their works) to the notion of "authorship". This approach clearly places these systems in a more disadvantaged or challenging position when it comes to understanding and classifying works where the personal touch of humans progressively loses relevance.

Against this background, our article briefly reviews the main characteristics of new creative processes where authors benefit, to a different extent, from a digitally networked environment, such as an online platform, or technical aid, such as that provided by AI or 3D printing technologies which have strongly transformative purposes. We believe it is worth discussing the implications of these processes for traditional concepts of "authorship" and "ownership" that still determine whether technology-aided or technology-induced forms of creativity are protected under copyright law. Our goal is to stimulate a debate within communities of legal scholars and practitioners about possible reforms through the introduction of new rights that might be desirable for society to adequately support new creative processes without stifling human creativity and the output of legacy content industries.

2 Content Platformisation is a Challenge to Copyright's Fundamentals: Why?

Online platforms have played an increasingly important role in cultural and artistic spheres since the appearance of Apple's iTunes Music Store in 2001 and YouTube in 2005. In these environments, different categories of users rely on hardware architecture and software allowing them to communicate, interact, exchange, and find content and services.[10] Platforms have been essential in enabling content re-intermediation at a time fully disintermediated content deliveries, as exemplified by large-scale file-sharing, made the internet structurally unfit to remunerate authors

[5] *See* Ginsburg and Budiardjo (2019), pp. 353–355, where the authors recall that the advent of photography gave rise to the first cases of "machine authorship", bringing a new challenge for courts to determine whether a human could have claimed authorship of a machine-generated image.

[6] *See* Locke (1952), §§ 25–51, 123–26.

[7] *See* Hegel (1952), p. 41.

[8] *See also* Hughes (1988), pp. 306, 330.

[9] *Droit d'auteur* in French; *diritto d'autore* in Italian; *derecho de autor* in Spanish; *direito de autor* in Portuguese; *Urheberrecht* in German.

[10] Poell et al. (2019) (whose literature review details the main characteristics and the economic and business implications of platforms).

and content producers and to allow them to enforce their rights under copyright law. Commercial platforms and the advent of the Web 2.0 have progressively transformed the internet into a marketplace where old and new generations of creators have greater chances to exercise their moral and economic rights and can gain exposure, building new audiences and developing strategies to earn from their artistic endeavours and to make a living.[11] This phenomenon has been very evident in the music sector, where technological advancements and the emergence of new business models made this industry move from the quasi-hegemony of compact discs to intangible services providing access to music downloads and, at a later stage, online streaming in less than 20 years.[12] Streaming platforms, in particular, have not only transformed content exploitations from the creators' and producers' side, but they have also encouraged new forms of music consumption that prioritise access over ownership.[13] As we will see, this phenomenon has posed existential challenges to creators, copyright and remuneration of creativity because of proprietary platforms' design, data infrastructures and network effects as well as their exponential commercial success.[14]

2.1 Structural Differences Among Platforms: Economic and Legal Issues

Because of their different structures, online platforms raise different issues for content creation. The main difference consists of how each platform gives access to cultural or artistic content. iTunes, Spotify, Deezer and other on-demand services work as intermediaries between traditional content producers and consumers. All the copyright works they supply are licensed in advance on the grounds of deals and predetermined fees each platform negotiates with right-holders, individually or collectively. These services act either as retailers of permanent digital copies (i.e. downloads) or as suppliers of subscription-based streaming platforms that give consumers access to large collections of professionally created works.[15] Social media, instead, are much more complex from a copyright perspective because their users play a diverse, much more active, and relevant role. Social media allow their users to create a profile where each of them can publish and share content with other users and, potentially, with the public at large.[16]

[11] From an economic point of view, online platforms mediate and coordinate between various stakeholder groups in two-sided markets: *see*, for instance, Rochet and Tirole (2002). Today's platforms are very often multi-sided, mediating between more than two user groups: *see* Evans et al. (2005).

[12] Barker (2018).

[13] Luck (2016), p. 5.

[14] Mazziotti (2020). Online platforms' success depends on the (mostly) positive *cross-sided network effects* between their users' groups. *Network effects* derive from the fact that a platform is more useful with a higher number of users. *Cross-sided* network effects subsist when a higher number of users of group A makes a given platform more useful for users of group B. For example, a higher number of listeners on Spotify makes this service more profitable for music producers; and vice versa. Content platforms exploit these effects since an increasing number of consumers on one side attracts an increasing number of sellers on the other side, and conversely: *see*, for instance, Rochet and Tirole (2006).

[15] *See* Renda et al. (2015), p. 116.

[16] *See* Boyd and Ellison (2007).

From a commercial point of view, the essence of social media's businesses is not so different from that of traditional, free-to-air TV broadcasters, whose profits come from advertisers who are willing to pay for consumer attention. A major difference derives from the availability for online platforms of vast amounts of real-time personal data generated by content consumption. Online platforms have been able to translate such data into relevant metrics that allowed several creative industries (especially the music industry) to reshape their business models and to transform their products into an unpaid service based on personalised advertising.[17] This is certainly the case of content-sharing platforms like YouTube, Instagram and TikTok, whose main sources of revenue are advertising-based.[18] However, these online services differ from free-to-air TV, and have a significant commercial advantage, because they have neither an editorial responsibility nor institutional duties of information, education and entertainment of their audiences under media law.[19]

Legally speaking, the social media industry rose to prominence without requiring platform owners to acquire copyright control over the contents uploaded by their users. Considering that social media users are technically free to upload all types of content, these platforms have traditionally stored and made available very large collections of existing or newly created content, a significant portion of which is unprofessional, amateur-created work.[20] From the outset, social media companies structurally relied upon liability exemptions granted to web hosting service providers, the aim of which was to ensure neutrality of interactive online services and foster their structural and commercial growth.[21] In this legal and technological context—at least until the entry into force of provisions such as Art. 17 of Directive 2019/790 in the EU[22]—copyright lost relevance because social media platform

[17] Croll (2015).

[18] This is however also the case with licensed services such as Spotify and Deezer, which adopt a so-called "freemium" (*i.e.* both free and subscription-based) model. These services' revenues also come from advertising because their data collection and personalisation are among their most important competitive advantages. For instance, Spotify's focus on personalised content has strongly reinforced this platform's freemium model, working as a key factor in converting users from free to premium subscriptions: *see* Kastrenakes (2019). As emphasised in the relevant literature, curated user-specific playlists are part of their product offering and perceived value: *see* Iqbal (2022).

[19] For an analysis of the new obligations created under EU law to regulate the contents of online platforms, including social media services, *see* Mazziotti (2021b), p. 228.

[20] Media and communication scholars coined the concept of "professionalizing amateurs" to emphasise how (some) amateur-created works enabled by platforms have given rise to new forms of content production and home-made creations that empower non-professional, early career or disenfranchised categories of authors to gain online exposure, build and curate new audiences and eventually become "professionals": *see*, for instance, Cunningham and Craig (2019b), pp. 11–14.

[21] Examples of legislation preserving neutrality of online intermediaries are, in the US, the Digital Millennium Copyright Act (DMCA), which entered into force on 28 October 1998, amending the US Copyright Act (*see* US Code, Title 17); and Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market, OJ L 178/1, 17 July 2000 (hereinafter "e-Commerce Directive").

[22] *See* Directive 2019/790 of 17 April 2019 on copyright and related rights in the Digital Single Market and amending Directives 96/6/EC and 2001/29/EC [2019] OJ L 130/92 (hereinafter "2019 Copyright Directive").

owners do not seek intellectual property control or exclusivity over the creative works shared through their services.[23] Terms of service have been far more important as social media's main legal infrastructure because, in governing the contractual relationship between platform users and service providers, they aimed at clearing users' copyright through non-exclusive licences.[24] Under these complex agreements, platform owners such as YouTube acquire a perpetual, territorially unrestricted, and free licence to exploit all user-authored works across their networks.[25] At the same time, users contractually undertake the promise to create and upload their works without using and sharing third parties' unauthorised materials, holding direct liability for possible copyright infringements.[26] That is (or was) all, at least from a copyright perspective.

2.2 Content Platformisation and Its Implications for Creativity

On-demand and social media platforms have become the primary channels through which billions of users around the world access creative works on an everyday basis.[27] These services have increasingly replaced (or supplemented) traditional vectors such as television and radio, expanding the reach of content delivery and of creative industries to an unprecedented degree.[28] Compared to on-demand services, user-generated content platforms have a much greater impact on copyright's orthodoxy because they have historically subverted the conditions of production and distribution of creative works by enabling large-scale uses of unauthorised

[23] As emphasised by media and communication scholars, in the so-called "Social Media Entertainment" industry, creators simultaneously rely on and license their content to a variety of platforms (including YouTube, Facebook, Instagram, Twitch, Snapchat and Twitter) "to aggregate participatory fan communities which, through a portfolio of entrepreneurial strategies, they convert into commercial value": *see* Cunningham and Craig (2019b).

[24] For instance, *see* Facebook's Terms of Service at: <https://www.facebook.com/terms.php> and Instagram's Terms of Use at: <https://www.facebook.com/help/instagram/termsofuse>.

[25] *See* YouTube's Terms of Service at: https://www.youtube.com/static?template=terms&gl=IT> where the service users are informed about the rights they grant to YouTube, other users and the duration of such licences ("until the Content is removed") when they upload their own works on the platform.

[26] *Ibid.* ("If you choose to upload Content, you must not submit to the Service any Content that does not comply with this Agreement or the law. For example, the Content you submit must not include third-party intellectual property (such as copyrighted material) unless you have permission from that party or are otherwise legally entitled to do so (including by way of any available exceptions or limitations to copyright or related rights provided for in European Union law). You are legally responsible for the Content you submit to the Service. We may use automated systems that analyze your Content to help detect infringement and abuse, such as spam, malware, and illegal content.").

[27] Available data evidence a steady increase regarding the number of users of social media worldwide, from approximately 2.86 billion people in 2017 to 3.96 billion in 2022 (a figure projected to increase to nearly 4.40 billion people in 2025): *see* https://www.statista.com/statistics/278414/number-of-worldwide-social-network-users/.

[28] As argued by van Dijck (2013), pp. 117–127, YouTube evolved from home-casting to broadcasting at a very early stage, abandoning its initial community-oriented social networking purpose to become a fully-fledged player in the media entertainment industry.

copyright works.[29] This happened notwithstanding the above-mentioned process of right clearance through the users' acceptance of platforms' terms of service. Despite their exponential growth in the past 15 years and their transformation into media behemoths, these services developed and scaled up without a clear definition of the conditions under which platforms should have been liable for their users' infringements of third parties' copyright.[30] This situation, linked to the attempt to protect Europe's legacy content industries, led to the adoption of Art. 17 of the 2019 Copyright Directive and to the emergence of cases where the CJEU had the opportunity to review the scope of application, effects and legality of this complex provision, also from the perspective of freedom of expression.[31] In short, while codifying a standard of copyright liability of social media platforms by excluding the application of the exemption embodied in Art. 14 of the e-Commerce Directive, Art. 17 obliges EU member states to make these service providers *directly* liable for works their users make publicly available. Despite the criticism and harsh controversies this provision raised among different stakeholders and European academics from the time it was proposed by the European Commission in September 2016, the (qualified) majority of EU lawmakers adopted Art. 17 on the assumption that content-sharing platforms were taking too much of the value of Europe's cultural industries.[32]

The adoption of Art. 17 aimed mostly at addressing a large-scale economic problem by seeking to reduce a so-called "value gap" created by uncompensated or poorly remunerated exploitation of creative works across social media. Despite this clear and primary goal, so far European legal scholars have focused almost

[29] *See* European Commission (2016), where the Commission stressed: "The negotiation position of right holders is affected by the fact that they are not in a position to keep their content away from these platforms. When uploaded content is infringing, they can only ask the platforms to take down the content, in each individual case, which leads to significant costs for them and appears insufficient to them given the large scale of uploads."

[30] Until recently, EU law, following the example of US law, sought to foster the growth of the online communication infrastructure by granting liability exemptions to providers of web hosting services: *see*, respectively, the US Digital Millennium Copyright Act (DMCA) 1998, Sec. 512(c), and Art. 14 of the e-Commerce Directive. At least in the US, courts found that platforms such as YouTube and Vimeo are exempted from liability in so far as they prove absence of "red flag" (*i.e.* apparent) knowledge or awareness of infringing activities: *see Viacom v YouTube*, 676 F.3d 19, 39 (2d Cir. 2012) and *Capitol Records v Vimeo*, 826 F.3d 78 (2d Cir. 2016). In the EU, instead, at least until the adoption of Art. 17 of the 2019 Copyright Directive, there were uncertainties about how, and how much, such immunity could have been granted to social media. From a historical perspective, it is important to recall that these uncertainties persisted even though the Court of Justice of the European Union had already made clear that a liability exemption could not apply to online services that did not confine themselves to providing a *neutral* hosting service, which consists of merely technical and automatic processing of potentially infringing contents uploaded by its customers: *see* Case C-324/09 *L'Oreal and Others v eBay International AG and Others* [2011] ECR I-06011, paras. 116–124. The Court of Justice clearly held that an online operator who provides assistance that entails, in particular, optimising the presentation of its contents or promoting them should not have been viewed as neutral (para. 116).

[31] *See* Art. 17 of the 2019 Copyright Directive; *see*, respectively, Joined Cases C-682/18 and C-683/18 *Frank Peterson v Google LLC and Others and Elsevier Inc. v Cyando AG* [2021] OJ; C320/2 and C-401/19 *Poland v Parliament and Council* [2022].

[32] *See* Proposal for a Directive of the European Parliament and of the Council on Copyright in the Digital Single Market, COM/2016/0593 final–2016/0280 (COD), whose Art. 13 embodied a significantly different version of today's Art. 17.

exclusively on pure copyright liability matters and the potential threats to freedom of expression and competition that this provision triggers and, at the same time, seeks to mitigate.[33] Very little has been written, instead, on the implications for copyright and contract law of the radical transformation of cultural, artistic and entertainment landscapes induced by social media entertainment and the related multiplication of sources, types of authors, varieties of works, creative processes, and formats.[34] This transformation has originated from services and companies which are outside of cultural sectors and work essentially as data analytics businesses.[35] All these services have given rise to markets where tech companies rely on user-generated works to entice their users and to keep them active on their platforms with the purpose of collecting their data and targeting them with customised commercials.[36] The fact that, in the platform economy, different digital businesses are structurally tied to one another has given a handful of very large online platforms a competitive advantage over legacy content industries and traditional intermediaries, and disproportionately strong bargaining power over independent (and isolated) content creators.[37] Cunningham and Craig defined this emerging and fast-growing environment as a "Social Media Entertainment" industry (SME), a term describing a sector characterised by broad and nonexclusive content-sharing practices that includes "platforms, creators, intermediaries, and fan communities operating interdependently, and disruptively, alongside legacy media industries".[38] This environment influences creativity by facilitating the emergence of entirely new stocks of works and empowering new generations of creators.[39] Even more importantly, platforms influence the way authors create by giving them new technologies and information they can rely upon, for both artistic and commercial purposes. Artistically, platforms have given creators much easier and more powerful ways to cooperate with each other, providing totally new contexts, formats, technological affordance, scalable environments, and audiences.[40]

[33] *See*, for instance, Dusollier (2020); Leistner (2020); Spoerri (2019); Spindler (2019).

[34] *See* Cunningham and Craig (2019a), p. 7.

[35] *See* Mazziotti (2021a), pp. 213–217.

[36] *See* Wu (2018), who generally discusses the implications of platform-dominated attention markets for the US antitrust policy and its digital economy at large.

[37] *See* Cunningham and Craig (2019a), p. 2.

[38] *Ibid*., p. 2.

[39] For instance, a report published in 2018 and funded by the US-based advocacy organisation "Recreate Coalition" identified 14.8 million Americans who earned, just in 2016, nearly US$6 billion in revenue by publishing their personal, independent creations across nine platforms (including YouTube, Instagram and Twitch): Shapiro and Aneja (2018). Moreover, Cunningham and Craig (2019a), p. 5, showed that millions of YouTube partner creators received compensation from their contents, on a worldwide basis: for instance, until 2017, 4,000 professionalising-amateur channels reached at least one million subscribers; in the same period, the most successful 5,000 channels generated 250 billion YouTube viewings.

[40] *See* Ballon et al. (2014), who argued that the same network effects that give platforms huge economic power also provide enhanced communication and networking opportunities for horizontal, grassroots creativity and collective organisation. This means that a very oligopolistic digital economy where the relationship between platforms and individual creators is hugely disproportionate can also enhance self-expression and facilitate the emergence of a plurality of voices: *see* Cunningham and Craig (2019a), p. 3.

Commercially, platforms generate and provide data analytics on user preferences and consumption patterns, which give both large media conglomerates and early-career individual creators unprecedented opportunities to produce content that is appealing for their customers or followers and more lucrative for both the service provider and the content creator.[41]

2.3 Low-Cost Creativity and the Demise of Remuneration Opportunities and Expectations

If, from an artistic and commercial point of view, algorithm-based platforms can help new categories of content creators express their talent and emerge, the same platforms simultaneously challenge one of copyright's essential functions: the expectation of creators to be remunerated for commercial exploitation of their works. The point of these new media is that they can host and make available overwhelming amounts of digital content.[42] This abundance gives rise to a problem of "overchoice",[43] considering that item selection can become cumbersome and complicated.[44] This problem forces platforms to incorporate algorithms that are essential for such services to respond and adjust to consumers' personal preferences in a flexible and immediate way. If we consider that these algorithms automatically filter, rank and recommend contents – influencing their display, findability and overall exposure – we can easily understand that they are not neutral, raising questions as to how they are designed and implemented, and who ultimately makes these decisions.[45] Moreover, the fact that platforms' design and network effects facilitate "winner-takes-all" dynamics and self-reinforcing trends induces scalability in large digital markets for creative works and triggers even more inequality in terms of income generated by different kinds of works.[46]

In this media environment, a significant challenge to creators' ability to rely on their copyright while being active on platforms is the condition of secrecy which pervades the functioning of their algorithms and recommender systems as well as all licensing or monetisation agreements under which authors are entitled to receive remuneration from the service provider.[47] Given that platforms treat royalties paid

[41] *See* Raustiala and Sprigman (2019), showing how the data that streaming services like Netflix, Spotify, and Apple collect enable those producers and content suppliers to know in depth what their subscribers like. These authors argue that this knowledge is already shaping the works that streaming companies produce.

[42] *See* Masnick and Ho (2014).

[43] *See* Gourville and Soman (2005).

[44] *See* Kunaver and Požrl (2017), p. 154.

[45] *See* Haim et al. (2018).

[46] *See* Taleb (2007), whose "Power Law" predicted that in the online environment authors would have been a population with "a very small number of giants and a huge number of dwarves", due to scalability, self-reinforcing trends and global viral phenomena arising at any point on the global market. Symmetrically, Anderson (2006), coined the notion of "long tail" to suggest that small or niche repertoires, which would not have been profitable in the pre-digital economy, could have survived and developed in the internet world.

[47] *See*, for instance, Mazziotti (2021a), p. 222.

to content creators as confidential information, interviews with authors, agents, collecting societies and their respective representatives as well as artists' spontaneous public statements are the only sources through which we can have an idea about how much each platform is paying to them.[48] As emphasised in the literature, revenue-sharing businesses created by social media are giving talented amateur creators unprecedented opportunities to become professionals by growing within "diverse platforms, verticals of content and business models".[49] In this context, social media platforms act as a new category of content producers and online distributors, based "on constant generation of very low cost, original content".[50] These services launch and offer increasingly open and free-to-join partnerships and advertising programmes for content creators (such as YouTubers or Instagrammers) to work solely (or mostly) inside online platforms, often partnering with platform-affiliated firms that help them maximise value from their works and audiences.[51]

If the remuneration that artists derive from online platforms, and in particular social media, is so low or even negligible, one might legitimately wonder why creators, including talented professionalising amateurs, are so motivated to produce and publish their works on platforms. Although the phenomenon of very low compensation is common to all platforms, artists' remuneration across social media is much lower than across on-demand services.[52] This shows that, at least at the beginning, original content creators on social media do not seek remuneration opportunities. They rather aim to acquire and enhance online exposure to such an extent that, if their original content becomes very successful or even viral, they can earn much higher per-stream fees under advertisement-based contractual partnerships with a large platform.[53]

[48] For instance, the Business Insider made available composer and cellist Zoe Keating's earnings from streaming services from January to September 2019: *see* Meyers (2020). Keating disclosed her fees originating from approximately 2 million streams on Spotify; 617,800 on Pandora; and 495,500 on Apple Music. These numbers show that the music services that paid her the lowest amounts were Spotify (with a per-stream royalty of USD 0.003) and Pandora (USD 0.002). Other services, such as Apple's, instead paid much higher remuneration (USD 0.012).

[49] *See* Cunningham and Craig, (2019a), p. 7.

[50] *Ibid*., p. 5.

[51] This is a business model that YouTube pioneered in 2006 and all platforms have progressively followed, setting out pre-determined splits of advertisement-based revenues that content creators generate by developing their community of followers and triggering network effects. *See*, for instance, the YouTube Partner Programme at: <https://support.google.com/youtube/answer/7101720>; or Meta's partnerships with its Facebook and Instagram creators at: <https://www.facebook.com/creators> and <https://creators.instagram.com/> (accessed 11 May 2022).

[52] Stakeholder representatives interviewed by one of this article's co-authors revealed that ad-based royalties that artists earn on social media like YouTube are, at least under standard contractual conditions, in the range of USD 80 to 100 per one million viewings: *see* Mazziotti (2021a), p. 216. This amounts to an average per-stream fee ranging from USD 0.00008 to 0.00011 (approximately ten times lower than Keating's royalties derived from streaming services: *see supra* note 48).

[53] *See*, for instance, the case of one of the most-watched YouTube videos ever ("Gangnam Style"), created by pop star Psy. From the time of release until January 2013, this video gathered 1.23 billion viewings, generating a total revenue of USD 8 million (due to a per-stream fee of 0.0065): *see* Mims (2013).

Proliferation of creativity in the absence of copyright protection or adequate remuneration opportunities should not come as a surprise if we think of historical precedents and actual practices coming from pre-platform (or pre-internet) eras, as mentioned earlier. The claim that copyright stimulates creativity, while supported by many commentators and scholars, is also frequently challenged empirically. Creative people, like painters, poets and musicians, often come up with new works just because they like and are passionate about what they do. Also, it is well known that much creativity nowadays is advanced via free licences including Creative Commons and the GNU's General Public License commonly adopted for open-source software. In these cases, the initial spark to create does not come from an expectation of economic returns secured by copyright laws – it comes, instead, "by innate urges that are often quite resistant to financial considerations".[54] Entire categories of authors expressly relinquish their copyright to facilitate widespread collaboration or collective authorship on solidarity grounds. Free encyclopaedias like Wikipedia and the whole open-source movement in the software industry evidence that certain types of creativity can also be advanced through free licences. However, in the platform economy, copyright's loss of centrality and relevance is not only due to a conscious and formal relinquishment. It is mostly the consequence of a structural change in the digital media industry and of the exceptional bargaining power of a very few platform owners and their ability to attract exponential numbers of creators and audiences.[55] This impressive growth has allowed social media platforms to impose standards of use and licensing of creative works that systematically compress or nullify authors' opportunities and expectations to obtain fair remuneration for their work. This situation has inevitably forced right-holders, especially early-career creators emerging from social media, to consider monetisation or other commercial strategies, such as partnerships and sponsorships (as in the "influencer" businesses) to eventually take economic advantage of their exposure across platforms.

2.4 Which Creators' Rights Have Become More Relevant Across Online Platforms?

In analysing the role of law, and of copyright law in particular, we shall consider today's platform economy as a technological and commercial reality that has irreversibly weakened and threatened the essence of authors' economic rights, persuading creators to prioritise online exposure over remuneration expectations. At the same time, it is indispensable to understand how creators' rights can evolve or regain centrality in a global scenario where policy makers from all over the world have shown very different attitudes and policy priorities.

A first reflection concerns authors' moral rights to attribution and integrity of their works, for which the platform economy does not seem to have had an equally disruptive or negative impact. Since online exposure has become mostly a reputational asset for creators to boost their live performances, influencer careers

[54] *See* Darling and Perzanowski (2017), p. 3.

[55] *See* Wu (2018), p. 132.

and/or other downstream businesses, being identified through their own works has become an even more important prerogative for old and new generations of creators.[56] Moreover, the fact of holding a subjective right to control, to a certain extent, alterations, translations, and other modifications of their works, and of having the ability to enforce such rights also through available content recognition technologies, should enable creators to capitalise, in a variety of ways, on their exposure, reputation and artistic influence.[57] Yet, these moral rights, despite their long history and their formal incorporation into the most important international copyright agreements, are not easy to exercise for the overwhelming majority of creators. We shall consider how difficult and expensive access to legal advice or to courts can be, especially for creators who are at an early stage of their career or are not yet professionals. Moreover, even across strongly harmonised copyright systems such as those of the members of the European Union, authors' rights to attribution and integrity are not conceived uniformly. This means that even in jurisdictions where individual creators receive strong protection under the law, like the systems broadly following the continental-European *droit d'auteur* model, global platforms can easily minimise the relevance of creators' moral rights and disregard the harm caused by their potential violation. This is certainly an area of law that policy makers and academics should investigate more in depth, especially when it comes to solutions and technologies that can help creators preserve information regarding their authorship and rights ownership in increasingly accessible and searchable digital archives. For instance, blockchains and smart contracts could significantly help protect attribution rights in sectors, such as the art market and the visual arts, where authenticity is more important and economically valuable than copyright itself.[58]

A second reflection concerns the above-mentioned major changes and challenges the phenomenon of content platformisation has entailed for creators and for the digital economy. Today's scenario suggests that traditional copyright law might have become a broadly ineffective bargaining tool, if not an irrelevant policy instrument, at least in its present shape. Certainly, the traditional and very broad rights granted to creators, at least on paper, are insufficient to let copyright perform its essential function to help them be fairly remunerated for their work. In an economy dominated by data analytics businesses, authors' economic rights are inevitably incomplete without including right-holders' access to information without which they cannot effectively understand the value and commercial uses of their works. Given the negligible bargaining power of average copyright holders

[56] Ten years ago, Ginsburg and Subotnik (2012), p. 101, recalled that even Flickr users predominantly used a Creative Commons licence (Non-Commercial–No Derivatives) which aims to preserve authors' moral right to attribution. This shows that even Flickr's non-professional photographers care about being identified as authors when their work is disseminated online.

[57] *See* Sundara Rajan (2019), where the author also stressed that moral rights might also regain centrality as a tool to distinguish and protect the rights of *human* individuals in an environment where AI-created works are increasingly common.

[58] On the supremacy of authenticity in the art market, especially from a US law perspective, *see* Adler (2018), pp. 330–37. On the increasingly relevant function of technology and self-help in digital culture for authors to protect their rights without having to rely on costly and burdensome litigation, *see* Adler and Fromer (2019), pp. 1502–1508.

vis-à-vis tech giants, creators' rights to access this information would need to become enforceable through a legal infrastructure that each large platform should be legally obliged to create. As we have emphasised, in this economy the most significant commercial asset is not so much the creative content the services gather and make available to the public as it is, instead, a massive collection of users' personal data, as processed by sophisticated and secret algorithms. This enables large-scale and very lucrative forms of personalised advertising which has little or nothing to do with the relatively small (and only) revenue source that social media usually share with the content creators. The analytics which reflect the number of viewings or streams of creators' works are the only and very superficial information being provided to them through their accounts or because of their partnerships with a platform. This means that creators have no idea about the type and scale of personal data-based exploitation that their works enable and the profits that are being made on a platform. This condition of blindness explains why a right to transparency for authors and performers to obtain data on their content exploitation has the potential to restore copyright's main function when it comes to economic rights.[59] This right was incorporated and codified under Art. 19 of the 2019 Copyright Directive. Despite its potential, European legal scholars have paid little or no attention to this provision, whose national transpositions in the 27 EU member states can boost individual creators' and their collecting societies' bargaining power. If social media platforms treat content as a mere bait to trigger user engagement, we believe that the establishment of a creators' right to transparency and to obtain data regarding content exploitation that tech companies so far have treated as sensitive information is more than legitimate and justified. We shall also consider that this EU policy initiative comes together with a new set of platform regulations, such as the "Digital Markets Act", that aim at restoring conditions of fairness and competition between platforms, broadly defined, and their business users and commercial partners.[60] Equally relevant, for the purpose of making all creators' rights (including moral rights) more easily enforceable, would be an obligation for large content platforms to build accessible and extra-judicial mechanisms allowing creators to resolve their disputes with the platform itself and with other users in an effective, uncomplicated, and inexpensive way. Again, EU law is a precursor in this regard if we consider the copyright-specific redress mechanisms and the dispute resolution systems that Art. 17 of the 2019 Copyright Directive makes mandatory and whose effectiveness will be tested in the next few years. This shows that copyright holds a very special place within the horizontal platform regulation the EU is creating to revise the current standards of digital services liability.[61] To conclude, it must be seen how quickly and how effectively these structural changes will materialise and whether the EU's interventionist approach will influence other lawmakers, at least in the Western world.

[59] *See* the 2019 Copyright Directive, Art. 19.

[60] European Commission (2020a).

[61] European Commission (2020b).

3 Artificial Intelligence and 3D Printing

In addition to content platformisation, other technologies have revolutionised creativity by enabling production of entirely new works and profoundly expanding the scope of creative processes and legal constructs: artificial intelligence (AI) and 3D printing. Indeed, AI creates. It produces art, music and literature, and it does so independently and autonomously, with little or no involvement on the part of human beings. There are many examples of such creative technologies, including the machine which has produced the Next Rembrandt (an AI-generated painting produced through a 3D printing technique and from data of Rembrandt's body of work),[62] Jukedeck (an AI-based program which generates music)[63] and the Cybernetic Poet (a software which is capable of writing poetry),[64] amongst many others.[65] 3D printing, on the other hand, is a technology that converts information into a physical object, just like regular computer printing – except that the physical object exists in three dimensions, not just two.[66] The widespread adoption of this technology can bring about a real Copernican revolution in not only mass production of goods (allowing new products to be manufactured right in the consumer's home),[67] but also in artistic production. The Next Rembrandt itself is an example of how 3D printing technology, combined with AI, can be used to create visual art.

3.1 Algorithmic Creativity

To better understand the ongoing debate concerning copyrightability of this kind of works, we should distinguish between computer-*aided* and computer-*generated* works. While the former category represents outputs that are created by humans with the mere support of machines, and for which copyright's requirements are still fully applicable, the latter refers to works independently produced by AI. Ryan Abbott expands on this by referring to a spectrum: "On the one end, computers may function as simple tools that assist human authors [...], much the way that a pen [...] can help someone to write".[68] He also notes that "[a]t the other end of the spectrum, computers generate works under circumstances in which no human author [...] can be identified". In other words, the degree of robots' independence in producing the work is inversely proportional to the level of human contribution: more machine independence entails less human involvement.[69] Jane Ginsburg and Luke Ali Budiardjo referred to machine independence as creating "authorless works".[70]

[62] *See* the webpage https://www.nextrembrandt.com.

[63] *See* the webpage https://www.jukedeck.com.

[64] *See* the webpage http://www.kurzweilcyberart.com/poetry/rkcp_poetry_samples.php.

[65] For other examples, *see* Bonadio and McDonagh (2020), p. 113.

[66] *See* Lemley et al. (2019), p. 37.

[67] *See* Daly (2016), p. 4.

[68] *See* Abbott (2017), p. 2.

[69] *Ibid.*

[70] *See* Ginsburg and Budiardjo (2019), p. 439.

However, for them the idea that a machine's creativity can be compared to that of a human "author" is still far from materialising on the above-mentioned spectrum with the magnitude and relevance that others have already attributed to it. These authors show all their scepticism about the current significance of the question of whether machines can create by referring to it – simply – as a "wrong question".[71] To be capable of fully replacing an author, according to them, a machine should be able to conceive and execute a work without being designed or trained to accomplish specific tasks, as happens for sector-specific purposes such as business analytics, language translation and automated news reporting.[72] This opinion echoes the much earlier idea that "behind every robot there is a good person"[73] in so far as the robots and machines which create are ultimately produced by human beings. Despite uncertainties and scepticism about the classification of works as entirely machine-generated and their volumes and effective relevance in the above-mentioned "mere assistance – creation spectrum", it seems fair to conclude that so long as technology gets more sophisticated the involvement of human beings in creative processes might gradually fade away to the stage of authorless works.

3.1.1 Authorship and Originality

Having said that, should copyright protect works conceived and created purely by artificial intelligence? If so, how do we answer the questions of authorship and originality with regard to these works? First, we have an issue with authorship because we might lack a human author. Indeed, copyright laws in countries such as the US do require human authorship, although statutes and laws, including the Berne Convention, do not explicitly refer to such a requirement. Works must also be original. And the way originality has been interpreted, for example in the EU, leaves little doubt about the importance of having a human being as creator.[74] This is even more so in the civil law jurisdictions of continental-Europe that have traditionally emphasised the rights of the authors as human creators.

The same way as the Irish Copyright and Related Rights Act, the UK Copyright, Designs and Patents Act 1988 (CDPA) suggests a pragmatic solution.[75] CDPA Sec. 9(3) provides that "[i]n the case of a literary, dramatic, musical or artistic work which is computer-generated, the author shall be taken to be the person by whom the arrangements necessary for the creation of the work are undertaken". The CDPA

[71] *Ibid*., pp. 396–402.

[72] *See* Ginsburg and Budiardjo (2019), p. 402 ("Any apparent 'creativity' in a machine's output is directly attributable either to the code written by the programmers who designed and trained the machine, or to the instructions provided by the users who operate the machine. No machine itself is a *source* of creativity [...]").

[73] *See* Miller (1993), p. 1045.

[74] Case C-5/08 *Infopaq International A/S v Danske Dagblades Forening*; Case C-145/10 *Eva-Maria Painer v Standard Verlags GmbH and Others* (considering that a work reaches the originality threshold when entailing an "intellectual creation" where a personal creative touch of the author is visible).

[75] *See* Ireland's Copyright and Related Rights 2000, Chapter 2, Sec. 21, according to which "author" is the person who creates the work and includes "(f) in the case of a work which is computer-generated, the person by whom the arrangements necessary for the creation of the work are undertaken".

defines a computer-generated work as one created by a computer with no human author.[76] In other words, Sec. 9(3) CDPA seems to create a legal fiction.[77] It considers the "author" to be a person who has not directly produced the output but has "simply" carried out the arrangements necessary for the work to come into existence. Although this approach seems to depart from the anthropocentric and human-oriented character of copyright regimes, it still determines authorship with a pragmatic view to attributing *ownership* on the grounds of a link between a human and the work resulting from her technical arrangements and activities. Certain authors argued that such a provision is an exception to the requirement of originality, since the works in question do not "derive" directly from a human author.[78] In Ginsburg's and Budiardjo's taxonomy, instead, the UK definition reads more like a pragmatic extension of the concept of authorship than an acknowledgment of its absence: for them, "authorless" is only a work created by a machine without the supervision or involvement of the machine's designer with respect to a specific output.[79] In reality, a law provision that seems to be a perfect fit for works entirely created by intelligent machines raises doubts and difficulties about the identification of the person who has made the necessary arrangements for production of the algorithmic work: the programmer? The user? The data provider or trainer? Or potentially all or some of them, so as to give rise to joint authorship? Following the classification proposed by Ginsburg and Budiardjo, the computer-generated work described under the provision of Sec. 9(3) CDPA would be either the sole creation of the designer of the machine (if this person builds a machine capable of producing outputs without any creative contribution of the machine's user) or a joint work of both the designer and the user if the outputs reflected both their creative contributions.[80] This means that the above-mentioned UK law provision might not help much and might not necessarily solve the issue of authorship when it comes to works created by fully generative machines which enable their users to produce output without the designer's involvement or supervision. Those types of works might prove to be *authorless* even under UK (or Irish) law.

3.1.2 Public Domain Option and a Sui Generis Right Proposal

Assuming that works produced by fully generative technologies like machine-learning are authorless and, as a result, cannot be protected by copyright, as the law

[76] *See* Sec. 178 of the Copyright, Designs and Patents Act 1988.

[77] *See* McCutcheon (2013), pp. 950–1.

[78] *See* Guadamuz (2017).

[79] *See* Ginsburg and Budiardjo (2019), p. 453 ("[...] if the designer and the user do not collaborate with respect to a specific result – for example, if the designer builds and trains the machine and then sells or licenses it to a user, who employs it without the designer's involvement – and neither contribute expression sufficient to form an 'original work of authorship', then the resulting output may be 'authorless'"). The need for an expansion of the concept of "author" has been acknowledged for a long time in legal scholarship, including in the US since the 1980s: *see* Butler (1982), pp. 744–45 (noting that "[w]hen courts find that a given product of AI software is authored by a machine rather than a person, the court should presume the existence of a fictional human author").

[80] *See* Ginsburg and Budiardjo (2019), pp. 452–456.

stands, would it make sense to make them fall in the public domain? This could be an effective solution as there is no human being directly connected to their creation. Indeed, one may argue that machines, unlike human beings, do not need the incentives offered by copyright law. As has been ironically noted by Pamela Samuelson, what they need is just electricity.[81] Not granting exclusive rights over AI-produced outputs would also minimise the anti-competitive risks that an over-proliferation of monopolistic rents over AI-created works may bring. Yet, on the other hand, one may also note that denying copyright protection to AI-produced works may decrease the incentives to invest in AI technologies. A diminished number of such outputs would potentially have negative consequences in many specific fields where the impact of AI research is and will certainly be beneficial. The medical, artistic and educational sectors amongst others could potentially be affected, causing losses in terms of investment in socially desirable research and future AI applications.[82]

Thus, we need to strike a balance between encouraging AI entrepreneurship by offering limited legal protection to it and safeguarding human ingenuity in the long run. As several scholars have suggested (including one of the authors of this article), a *sui generis* right might be an appropriate compromise solution.[83] Whether it is called "*sui generis*", or a new generation of "related right", "robot copyright"[84] or something else, does not really matter.[85] We believe that, if finally adopted, the scope of such right should be limited, permitting the owner to prevent others from using and exploiting slavish copies of the AI-produced output, be it a painting, a song or a journalistic article. What would basically be illegal would just be the verbatim copying of an AI-created work.[86] Moreover, this right should be very short, for example three years from the date the work was published. In an AIPPI "Study Question" on these issues, the Dutch delegates proposed exactly this term of protection.[87]

But why do we specifically need a short and thin right? The main reason is that a more relaxed protection for this type of work would significantly reduce (if not totally eliminate) the risk of a futuristic (and scary) scenario where robotic, fully generative, human-detached creativity might gradually displace human ingenuity. This is also why the UK regime granting machine-generated works copyright

[81] *See* Samuelson (1985), p. 1199.

[82] *See* Hristov (2016), p. 439.

[83] *See* Bonadio and McDonagh (2020).

[84] *See* Lauber-Rönsberg and Hetmank (2019), p. 577.

[85] *See* also Ramalho (2017), pp. 16–20. This author proposes to adopt either (i) a regime such as the one embodied in Art. 7 of Directive 96/9/EC on the legal protection of databases, OJ L 77/20, 27 March 1996 (hereinafter "EU Database Directive"), where a 15-year EU database right aims at protecting investments made in producing mere compilations of data; or (ii) a sort of "disseminator's right" comparable to the 25-year publisher's right in previously unpublished works provided under Art. 4 of Directive 2006/116/EC on the term of protection of copyright and certain related rights (codified version), OJ L 372/12, 27 December 2006.

[86] For a proposal attributing a thin scope of protection to programmers, *see* Yu (2017), pp. 1268–1269.

[87] AIPPI Summary Report (2019), p. 17.

protection (which lasts for 50 years after the death of the fictional author)[88] probably goes too far, if we consider it even applicable to machine learning output (and we have seen this to be very uncertain). The risk is that giving AI manufacturers and companies incentives for robot productions by offering conventional copyright protection may entail a lower number of human-produced creative outputs in the long run.[89] Fierce competition with creative robots, fuelled by strong copyright protection for machine-generated works, may reduce the intrinsic motivation that still drives many people to create.[90] In particular, in a platform-dominated internet, there is a risk that human creative freedom will be curtailed by massification of computational creativity, which is capable of swamping the supply of human-created cultural productions. Obviously, it is still to be seen whether audiences and consumers will perceive the progressive disappearance of human creative input as aesthetically or intellectually unattractive. Despite impressive technological developments, there are sectors like the film and TV industries where the replacement of human ingenuity and human actors by machine creativity and robots might simply not happen if consumers perceive it to be distasteful. Assuming that AI creative capacity is hugely vaster and quicker than the human kind, and considering that in certain sectors this type of substitutability is more likely to happen than in others (or has already materialised), granting ordinary protection to algorithmic works would increase the risk for humans to be increasingly replaced by machines and for them to infringe copyright in AI-created works. It would be rather difficult for creators to come up with works that are original enough to distance themselves from what intelligent machines have already created, much more easily and rapidly.[91] What we would risk is a weakening of human creative skills.[92] The narrower scope and shorter duration of protection we propose here would help neutralise the risk of gradual saturation of human ingenuity created by potential overuse of massive, fast, and cheap algorithmic creativity.[93] For example, the fact that only verbatim copying would be illegal would guarantee that human creators would be able to freely use, adapt and rearrange AI-produced works.

3.2 3D Printing

Having considered issues regarding authorship in an economy increasingly dominated by large content platforms and computational creativity, why should 3D printing be viewed as a source of additional issues and concerns? How challenging is this technology for copyright's fundamentals and how much of its

[88] Section 12(7) of the CDPA provides that copyright in computer-generated works "expires at the end of the period of 50 years from the end of the calendar year in which the work was made".

[89] *See* Gervais (2019), p. 2059.

[90] On intrinsic motivations as factors which encourage creativity, *see* Buccafusco and Sprigman (2016).

[91] AIPPI Summary Report (2019), pp. 7, 8.

[92] *Ibid*., p. 13.

[93] *See* again AIPPI Summary Report, (2019), p. 17 (noting that a shorter term of protection is justified in light of "the reduction in costs by using the AI in generating the works … to safeguard the rights of traditional authors from being replaced by the cheaper labour of AI").

development is linked to content platformisation and artificial intelligence? 3D printing has evolved over the last few years from a purely hobbyist use into the domain of industrial manufacturing where it is not only used by consumers who merely copy and replicate pre-existing works but also, and increasingly so, by a wide range of visual artists coming up with original artworks, whether sculptures or paintings. Essentially, this technology is a process of manufacturing three-dimensional products from various raw materials, starting from a design file.[94] 3D printing is based on a design model or drawing saved in a digital format, either after scanning the original object or by copying the code into a Computer Aided Design (CAD) file.[95] This file is then used as the standard for subsequent print reproduction. While the current state of the art of 3D printing makes it viable only for certain product categories, there is a reasonable basis to believe that "3D printing will become both cheaper and better in the not-too-distant future".[96]

3D printing allows information to be transformed into three-dimensional physical things.[97] Many of the legal issues that digitisation has triggered in the past few years are also likely to occur in this field. The primary legal question is whether copyright's basic notions, in their existing form, can capture the essence of this technology. From the perspective of this article, 3D printing raises question marks mostly when it comes to originality and authorship of the intangible and tangible works that characterise this new way of designing and manufacturing objects. A proper analysis presupposes an understanding of the design and functioning of various printers and the identification of distinct creative contributions that, in the design and manufacturing processes, lead to the conception and execution of artworks. Artificial intelligence is fully involved in this technology because of the design and manufacturing of machines and software that determine different degrees of preparedness of a printer and a fully (or partially) generative character of the design file and technologies that ultimately create artefacts. Whether 3D printing technology can create by itself or enable machine users (i.e. third parties) to autonomously produce their own original artefacts essentially depends on the design and programming decisions of the machine manufacturer and of the technology developer (who are likely to be the same person or company).

Starting with the design or drawing embodied in a CAD file, one may argue that, if created from scratch, this intangible work is likely to meet the requirements for originality.[98] If the user shapes and manufactures her own new and independently developed design and product, for that user the printer is just an ordinary tool that merely assists her in bringing a creation from the stage of conception to that of development and production. Obviously, no particular copyright issues arise even if the user takes a design or product that is legally in the public domain and reproduces it, both digitally (in the CAD file) and physically, thus manufacturing an object

[94] Overview of 3D printing and intellectual property law under the contract with the Directorate General Internal Market, Industry, Entrepreneurship and SMEs (MARKT2014/083/D), p. 9.

[95] *Ibid*.

[96] *See* Lemley et al. (2019), p. 37.

[97] *Ibid*., p. 38.

[98] *See* Dagne (2018), p. 366.

whose copyright or design term of protection has already expired. Here, the terms of copyright protection are not difficult to determine. If a 3D printing machine user creates and manufactures original works by herself or uses a public domain photograph to create a new work incorporating this photograph she is clearly the (only) author and copyright owner of such work. It goes without saying that her personal touch is indispensable for this type of work to meet the standard of originality or, under US law, the threshold of a minimum of creativity without which 3D scan data and printouts of public domain works would remain unprotected.[99] 3D scan data of public domain materials, in particular artefacts, do not seem to meet the originality requirements of either the CJEU[100] or the US law threshold.[101] Under EU law, this conclusion is even more solid after the entry into force of Directive 2019/790, whose Art. 14 obliges EU member states not to grant copyright or related right protection to any material resulting from an act of reproduction of a work of visual art when its term of protection has expired (unless the material resulting from that act of reproduction is original in the sense that it is the author's own intellectual creation).[102]

Another element that can easily raise uncertainties regarding authorship (and thus copyright protection) in this domain is the protection of the CAD design file itself. We shall consider the file format (STL STereoLithography) in which many 3D files are stored. This is a widely used format (if not a standard) to represent three-dimensional surface geometry used for manufacturing three-dimensional parts.[103] Because of the pre-determined, irrefutable character of its algorithm, the file is hard to protect through copyright because the format itself does not leave the designer with room for manoeuvre and creative choices that would make the file copyrightable. However, the final product can still meet the originality requirement, and be protectable, possibly as a literary work, if a CAD design file contains the 3D printing instructions and consists of a design document embodying both written symbols and a visual image.[104] In the absence of these elements, a 3D-printed design file in itself only works as a format of expression (comparable to a PDF, JPEG or TIFF file) in which a work can be recorded. This conclusion is even clearer

[99] At least until recently, there was no consensus among EU member states on the threshold of originality above which copyright in scans or printouts of public domain materials could be considered: *see* Margoni (2014).

[100] *See* Case C-5/08 *Infopaq International A/S v Danske Dagblades Forening*; Case C-145/10 *Eva-Maria Painer v Standard Verlags GmbH and Others* (considering that a work reaches the originality threshold when entailing an "intellectual creation" where a personal creative touch of the author is visible).

[101] *See Feist Publ'ns v Rural Tel. Serv*., 499 U.S. 340, 345 (1991); and *Bridgeman Art Library v Corel Corp.*, 36 F. Supp.2d 191 (S.D. N.Y. 1999).

[102] *See* Directive 2019/790, Art. 14 (Works of visual art in the public domain): "Member States shall provide that, when the term of protection of a work of visual art has expired, any material resulting from an act of reproduction of that work is not subject to copyright or related rights, unless the material resulting from that act of reproduction is original in the sense that it is the author's own intellectual creation."

[103] *See* Chua et al. (2004), p. 301.

[104] *See* Mendis (2014), p. 271 (arguing that a 3D-printed design file contains code that represents a three-dimensional object, and therefore can be protected by literary copyright just like computer software). *See also* Mendis (2018), p. 699.

if a 3D printer is a fully generative machine whose creation of CAD files can be viewed as authorless because of the absence of free and creative elements in its design. More complex is, inevitably, the circumstance in which a 3D printer designer (or printing machine user) creates a file using a mere scan or photograph of a pre-existing copyright work. Here the person or company involved in the creation of the CAD file and in the manufacturing process should obtain a licence from the copyright owner to prevent infringement of the right of reproduction in the existing copyright work. Moreover, for a three-dimensional, physical product or artwork deriving from the 3D printing process to acquire copyright protection as a derivative work, the follow-on work should include original features that distinguish it from the original work with the modifications falling within the scope of the original author's licence. As emphasised in the literature, modifications to existing files cannot be considered copyrightable until they look like original works in their own right.[105] To acquire copyright in a 3D file, therefore, its author must clear the reproduction right in the pre-existing work and, in addition, be able to prove that her design or drawing is original in so far as it embodies the author's personal touch.

An interesting implementation of the notion of authorship and ownership in a CAD file occurred in a Canadian case (*Oakcraft Homes Inc v Ecklund*) where a home builder used, without permission, a house plan prepared by a competing home builder for the same family.[106] The original house plan consisted of sketches a company named Oakcraft had handed to the family with its quotation for their new home proposal. The family eventually decided to hire a competing firm which took Oakcraft's house plan and implemented it, with minor amendments, in a CAD file, as has become customary in the planning and construction business. The second home builder completely omitted to check who the author of the house plan was. The Canadian court found the house plan copyrightable and held that the copyright was owned by the original designer, who had conceived and designed the house. Although some technicians had turned the original work into a CAD file, the court found that they had merely used the CAD software as a mere tool – the sole author being the designer because there was clear and convincing evidence that he "employed intellect and experience along with skill and judgement in creating his plan".[107] As has been noted, the role played by technicians in this case can be compared to the use of a camera or scanner, and the mere use of a machine is not a sufficient exercise of skill and judgement to create an original work capable of attracting copyright.[108]

From our analysis, it is clear that the copyrightability of each CAD file must be evaluated on a case-by-case basis on the grounds of existing legal principles that seem more than sufficient to strike a balance between the competing interests of original and follow-on creators. Originality and, thus, authorship as well as copyright protection essentially depend on (i) how a CAD file is created; (ii) where the embodied design originates from; and (iii) whether the embodied design work

[105] *See* Dagne, (2018), p. 366.

[106] *Oakcraft Homes Inc v Ecklund*, 2013 CanLII 41981, para. 48.

[107] *Oakcraft Homes Inc v Ecklund*, 2013 CanLII 41981, para. 50.

[108] *See* Dagne (2018), p. 361.

eventually meets the threshold of originality under the relevant copyright law because of the free and creative contributions deployed in the conception and execution of the design. On these grounds, a copyright claim will be most successful and will cover both the design and, as a result, the manufactured work or artefact. When 3D printing technology is combined with AI for purposes of artistic production and creation of visual art – as in the above-mentioned example of the Next Rembrandt – the dilemmas for lawyers and policy makers are the same as those we have seen with regard to partially or fully generative machines, for which 3D printers work as mere practical tools. This means that copyright protection of 3D prints and artefacts ultimately depends on the findings regarding protection of the upstream, machine-generated work and the legislative solutions and reform we discussed above.

4 Conclusions: Policy Issues and Legal Trends

The platform economy, the move towards AI and the growing importance of new creative and transformative technologies such as 3D printing raise questions as to whether copyright law suffices in its present forms. Legislative developments and a potential reconsideration of the foundations of copyright protection in the above scenarios are still unclear. Moreover, the scant case law on these issues does not help formulate solid hypotheses. However, we have seen that copyright is certainly malleable enough to perform some of its traditional functions in this new technology-aided (and technology-dominated) environment. For example, we argued that authors' moral rights to attribution and integrity are still important to help authors capitalise on their online presence, protect their reputation, and develop new business models. It is also clear that broadening or strengthening the subject matter of copyright would help fill protection gaps in areas where creators' rights have rarely (or never) applied before. We believe that for moral rights to become more effective and to perform their function, they should be harmonised at international level to reflect the global reach of social media and should be enforceable through out-of-court dispute resolution mechanisms to be viewed as a mandatory element of each platform's legal infrastructure. Moreover, new forms of creativity clearly show that copyright law, as it stands, may need adaptations and complementary instruments in order to continue to fulfil some of its essential functions and promote the public interest. In fast-growing markets where AI-generated works are increasingly common, doubts remain as to whether requirements such as authorship and originality can continue to matter, even given the difficulty of distinguishing fully generative machines from other technologies that merely provide assistance to human creators. We also pointed out that the same uncertainties exist for works where the data provided by platform analytics to platform owners and content producers could ultimately determine the main characteristics of their creative output.

In an economy dominated by platforms, it has also become clear that the right to legally control and license copyright works does not count much if creators do not have the right to access data about the exploitation of their works. Copyright is

difficult, if not impossible, to license and enforce in an environment where contractual practices such as social media terms and conditions dictate standard agreements that either do not compensate creators at all or compensate them only marginally. In this context, restoring the bargaining power of creators through the right of access to the platforms' data seems to have become as important as copyright itself. New mandatory provisions on authors' and performers' rights in the 2019 Directive on Copyright in the Digital Single Market show that copyright-related rights, such as the right to transparency of information, could play an essential role in facilitating smooth transactions, also via the intermediation of collecting societies, and fair remuneration.[109] Such regulatory interventions would have been hard to imagine under the afore-mentioned system of liability exemptions that social media and other online intermediaries benefited from for nearly two decades. The fact that, in the EU, lawmakers have created criteria of stricter liability for social media platforms for a broad variety of legal torts, with a special emphasis on copyright infringement, shows that creators' rights need some technical assistance and a favourable regulatory environment to thrive and become more easily enforceable. Such rights would become less relevant in the online environment if regulatory interventions did not enable technology developers and online service providers to facilitate the achievement of public policy objectives through cooperation with right-holders. One of these goals is certainly that of not depriving creators of legal protection that copyright has traditionally provided, in one way or another. The irrelevance or de facto demise of copyright would make content creation economically irrelevant and lead to an even greater concentration of power in the hands of a few tech companies and platforms that are vertically integrated and can benefit greatly from algorithmic and data-driven creativity, especially with the support of powerful AI technologies. However, we have also seen that recognising strong copyright protection in AI-generated works would run the risk of strengthening the already dominant position of the few companies developing the most advanced and creative AI technologies.

It is precisely in relation to AI-generated works that we have argued for some kind of *sui generis* legal solution that should aim to strike a fair balance between the need to incentivise creation of machine-learning technologies and the need to protect human creativity from fast-growing competition with machines. After all, there is a precedent of a *sui generis* system under EU law, which is the quasi-copyright protection offered under the 1996 EU Database Directive to non-original databases. This directive protects non-creative databases through a *sui generis* right granted to creators of mere compilations of data for a limited time (15 years). But if the law grants an even shorter and thinner *sui generis* right to AI-produced works, as we suggest, how would such a right be enforceable? Would it not be subject to the same risks of no or low remuneration that we described in the section on platforms? What would be the economic impact of such a new right? Our reflections on the immense resources of tech companies in the AI market reflect the extreme concentration of power we described in the context of platforms. Future research on

[109] *See* 2019 Copyright Directive, Chapter 3, Arts. 18–23 ("Fair remuneration in exploitation contracts of authors and performers").

these questions may soon be necessary, especially if new regulations come into force to curb the power of very large technology companies, as seems likely in the EU.

Finally, we concluded our analysis by arguing that current copyright laws seem comprehensive enough to govern the complex interactions and dynamics created by 3D printing, although there are still some issues to be addressed, as we briefly recalled. For example, the legal protection and clearance of pre-existing rights in 3D printing files might need to be clarified to facilitate and boost a smooth and legitimate adoption of 3D printing technologies. We believe that the most important priority for governments is to make sure that existing laws are still valid and effective so long as 3D printing technology continues to advance. This should not spur emotional reactions to unknown or imagined threats, but rather effective strategies enabling lawmakers to tackle specific concerns. One of these could be the ability of right-holders in 3D design files to effectively prevent unauthorised use of such works by third parties. The experience with online music, film, video games and apps platforms shows that online services might boost distribution of new digital goods in a legitimate way. However, it remains to be seen whether and how, in specific markets for 3D files, content recognition technologies and other enforcement mechanisms – which are successful in other industries – can effectively protect authors' rights in artistic elements, designs and drawings that might be copied without the necessary copyright permissions.[110]

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[110] *See* Osborn (2019), p. 148 *et seq*. (discussing the copyright protection of useful articles under US law). For a European perspective, *see* Antikainen and Wietse Jongsma (2017), p. 257.

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