AI & Intellectual Property: Towards an Articulated Public Domain

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Abstract

This article seeks to clarify the relation between AI and IP in the information society. It aims to critically examine our intellectual property framework at the dawn of the fourth industrial revolution. In that context, it contends that human authorship & inventorship remains the normative organ point of intellectual property law. Additionally, it argues that extending copyrights hinders innovation, cultural diversity and even fundamental freedoms. Adding extra layers to the existing rainbow of IP rights is not a good solution to balance the societal impact of technological progress. Legislative gaps can be remedied by contracts and generous application of fair use and the three-step-test. Finally, parts of the Roman multi-layered property paradigm can be relevant for AI. Building upon this framework, section VIII of the article includes a proposal for a new public domain model for AI Creations and Inventions that crossed the autonomy threshold: Res Publicae ex Machina (Public Property from the Machine).

The introduction of the legal concept of Public Property from the Machine is a Pareto improvement; many actors benefit from it while nobody -at least no legal person- will suffer from it.

For illustrative purposes, the article includes a human-machine collaboration example. The examined AI Assisted Creation (a sound recording of a musical work, which can be streamed online) does not qualify as Public Property from the Machine. The article also describes a pure AI Invention that does qualify as Public Property from the Machine and thus could be awarded with official PD mark status: a flu vaccine autonomously brewed by an AI called SAM.

This article describes the current legal framework regarding authorship and ownership of AI Creations, legal personhood, patents on AI Inventions, types of IP rights on the various components of the AI system itself (including Digital Twin technology), clearance of training data and data ownership. It examines whether the rationales and justifications of IP are applicable to AI from the perspective of the function of copyright. Besides that, the article presents ideas and policy suggestions on how the law ought to be understood or designed with regard to AI input and output. Laws that would facilitate an innovation optimum.

The main goal of this research is to contribute to the body of doctrinal knowledge by offering a relatively compact AI & IP overview analysis and in doing so, to provide some food for thought to interdisciplinary thinkers and policy makers in the IP, tech, privacy and freedom of information field. Because AI and the internet are without borders, the article makes these recommendations through the eyes of a global acquis of intellectual property, as being a set of universal principles that form the normative backbone of the IP system.

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I. Introduction

This article examines whether the rationales and justifications of IP are applicable to AI from the perspective of the function of copyright. It describes the current legal framework regarding authorship and ownership of AI Creations, legal personhood, patents on AI Inventions, types of IP rights on the various components of the AI system itself, clearance of training data and data ownership. Besides that, it attempts to present ideas and feasible policy suggestions on how the law ought to be understood or designed with regard to AI input and output. Laws that would facilitate an innovation optimum.

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[2] Graeme Dinwoodie & Rochelle Dreyfuss, 'An international acquis: Integrating regimes and restoring balance' in Daniel J. Gervais (ed), *International Intellectual Property: A Handbook of Contemporary Research* (Edward Elgar Publishing 2015) 121. There are differences between monistic and dualistic systems in case national law nevertheless deviates.

II. AI and the Function of Copyright Law

This section describes the current state of the art of AI. On top of that, it explains copyrights' principles and rationales as being part of the overarching normative concept of information law.

1. Artificial Intelligence

Artificial intelligence (AI) is usually described as either an entity, a system or a science.[3] AI can be another word for an intelligent machine. A non-human system that possesses cognitive functions and skills such as learning and reasoning. A smart computer that can think and plan strategically. A science that can assist humanity to find answers to the big questions/themes we face, such as climate change, dwindling natural resources, income inequality and how we should shape the future.[4]

AI, smart robotics, big data and blockchain are ground-breaking technological innovations that will fundamentally and definitively change society. These disruptive technologies bring us to the dawn of a new age in human history, or the 4th industrial revolution.

We distinguish 3 types of artificial intelligence: Weak AI or Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI) and Artificial Super Intelligence (ASI). These types of AI are able to reinforce each other. The evolution of AI does not happen at a linear, Darwinian pace. The combined use of innovative, powerful computer chips, 3D integrated circuits, machine learning algorithms, cloud computing, blockchain and big data has strong synergetic effects. Because of this synergy, developmental progress is made at an exponential rate.

The creations and inventions made by AI, 'independently' or in collaboration with their human creators, are potentially subject to intellectual property law.

2. Copyright

This article considers copyright (an intellectual property right), as part of the overarching normative concept of information law.[5] As such, intellectual property law should contribute to a legal framework that best serves the information society, while respecting fundamental rights and freedoms.[6]

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[3] Here's an example of an informed definition of AI as an entity: *'Artificial intelligence is an entity (or collective set of cooperative entities), able to receive inputs from the environment, interpret and learn from such inputs, and exhibit related and flexible behaviors and actions that help the entity achieve a particular goal or objective over a period of time.'* Daniel Faggella, What is Artificial Intelligence? An Informed Definition (Emerj, 12 December 2018) https://emerj.com/ai-glossary-terms/what-is-artificial-intelligence-an-informed-definition/ accessed 12 May 2019. About the current lack of a clear legal definition of robots and AI see: Bryan Casey and Mark Lemley, 'You Might Be a Robot' (Cornell Law Review, 2019), SSRN: https://ssrn.com/abstract=3327602

[4] Stephen Hawking, *Brief Answers to the Big Questions* (John Murray 2018)

[5] João Pedro Quintais, *Copyright in the age of online access: Alternative compensation systems in EU copyright law* (Wolters Kluwer 2017) 11, 12

[6] Institute for Information Law, '*Information Law: Expanding Horizons*' IViR Research Program 2012-2016 (2012) 3. See also Burkhard Schafer, *Editorial: The Future of IP Law in an Age of Artificial Intelligence,* SCRIPTed [Vol. 13, Issue 3] (December 2016) 284 https://script-ed.org/wp-content/uploads/2016/12/13-3-schafer.pdf accessed 12 May 2019, and Jack Balkin, 'Digital Speech and Democratic Culture: a Theory of Freedom of Expression for the Information Society', New York University Law Review, Vol. 79, No. 1, 2004; Yale Law School, Public Law Working Paper No. 63.

The main objective of a copyright (as with other IP rights) is to incentivize and maximize creativity, cultural diversity, technological progress and freedom of expression.[7] As such, an important goal of copyright is to stimulate creation and dissemination of diverse cultural expression by enabling successive generations of authors to draw freely on the work findings of their successors.

Copyright consists of a set of international principles, including rationales and justifications, and a set of norms, (laid down in) Treaties, EU Directives, national laws and case law.[8] The main IP Treaties are the Berne Convention, the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) and the WIPO Copyright Treaty (WTC), to which almost all countries of the world are members. This multilevel framework means that, at a national level in both USA and EU, there is an obligation to comply with international treaties.[9]

The universal principles underneath copyright are human authorship, subject matter such as literary, artistic and scientific works, original expression, a minimum of creative choices and ownership by a legal subject.[10] Human authorship is linked to human communication and freedom of expression.[11] A copyright grants the author the exclusive right of compensation for the publication and reproduction of his work, and a right of prohibition. Simply put: the right to exclusively benefit from the exploitation of his creation and the right to say no.[12] Without limitations of such exclusive rights, innovation would stagnate.

General rationales and justifications for the existence of these exclusive and economic rights are the promotion of science and useful arts and the authors right to remuneration. Civil law countries emphasize the authors natural rights, including moral rights, in common law countries copyrights utilitarian principles are traditionally more dominant.[13] Copyright rationales and justifications should inform appropriately structured policy choices.[14]

The exclusive character of copyrights is not absolute. Authors' monopoly on their creation is limited by an array of exceptions and limitations, either by law or by contract.[15] The control rights holders can exercise over their works is limited by copyright duration and legal norms such as freedom of speech, equity, unfair competition law and anti-trust law. Furthermore, the American fair use

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[7] Martin Senftleben & Lotte Anemaet, 'Het verleidelijke gezang van een Griekse Sirene - Auteursrecht in het licht van Bourdieus sociologische analyse van het literaire en artistieke veld' (2015) *Auteurs-, media- & informatierecht*, *39* (1) 1-8

[8] Paul Goldstein & Bernt Hugenholtz, *International Copyright: Principles, Law, and Practice* (3rd edn, OUP 2013) 4, 5

[9] Quintais (n 5) 15

[10] Goldstein & Hugenholtz (n 8) 4, 5.

[11] Craig, Carys J. and Kerr, Ian R., The Death of the AI Author (March 25, 2019). Available at SSRN: https://ssrn.com/abstract=3374951 The authors make an ontological inquiry into the plausibility of AI-authorship that transcends copyright law. See also: Daniel Gervais, 'Can Machines be Authors?', Kluwer Copyright Blog, 2019 http://copyrightblog.kluweriplaw.com/2019/05/21/can-machines-be-authors/

[12] Bernt Hugenholtz & Martin Kretschmer, 'Reconstructing Rights: Project Synthesis and Recommendations' in Bernt Hugenholtz (ed), *Copyright Reconstructed: Rethinking Copyright's Economic Rights in a Time of Highly Dynamic Technological and Economic Change* (Wolters Kluwer 2018) 3, 4

[13] Goldstein & Hugenholtz (n 8) 6

[14] Daniel Gervais, *(Re)structuring Copyright: A Comprehensive Path to International Copyright Reform* (Edward Elgar Publishing 2017) 3

[15] Copyright exceptions include fair dealing, parody, citation, education, thuiskopie/accessible copies and government works.

principle, which allows more permissible use than most civil law countries, is recognized as limitation of copyright in the USA.[16]

Copyright can also be limited (or circumvented) by contract and by licensing frameworks such as creative commons CC0 (a voluntary act that produces a simulated public domain)[17], open source, copyleft and the GNU General Public License (GPL).[18] Freedom of contract prevails as a norm in both common and civil law systems.[19]

The exceptions and limitations to copyright are restricted by the Berne Convention three-step-test.[20] On an international copyright level, this test constitutes a flexible balancing tool that offers national policy makers possibilities for the creation of an appropriate system of copyright exceptions and limitations at the national level.[21] On a case by case level, the three step test can be used to determine whether limiting exclusive rights to commercial exploitation is proportional, reasonable and fair, in the light of user interests, public interest or other cultural, social or economic interests.[22] In essence, the three step test is a *wohltemperiertes* tuning mechanism which can be used by legislators and courts to reach a more balanced, practical and normatively desirable outcome.

Ideas cannot be subject to copyright: they can and should not be monopolized or privatized.[23] Ideas are public domain. Only the expression of ideas can be protected.[24] This is known as the idea/expression dichotomy. In many cases, the interests of copyright owners must be balanced against competing public interests such as freedom and equality rights.

III. Authorship and Ownership of AI Creations

This section explores the question whether AI Creations i.e. computer generated creations and machine learning output can and ought to be copyrighted.

The law as it stands does not recognize non-human copyright. Authorship is fundamentally connected with humanness.[25] Is it dogmatically and doctrinally correct to assume that there can be no copyright on pure AI Creations since AI is not human, moreover there is no originality and creativity linked to human personality present in AI Creations? Do pure AI Creations even exist today?

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[16] Lawrence Lessig, 'Re-crafting a Public Domain', Yale Journal of Law & the Humanities, Vol. 18, Iss. 3, Art. 4 (2013) 57

[17] Lessig (n 16) 83

[18] Open source robotics hardware accelerates research and innovation. See also Mirjana Stankovic, Ravi Gupta, Bertrand Andre Rossert, Gordon Myers and Marco Nicoli, White Paper: 'Exploring Legal, Ethical and Policy Implications of Artificial Intelligence', LJD (2017) 18

[19] Goldstein & Hugenholtz (n 8) 5

[20] Hugenholtz & Kretschmer (n 12) 4

[21] Christophe Geiger, Daniel Gervais & Martin Senftleben, 'Understanding the 'three-step test'', in Daniel J. Gervais (ed), *International Intellectual Property: A Handbook of Contemporary Research* (Edward Elgar Publishing 2015) 189

[22] ibid.

[23] Pamela Samuelson, 'Challenges in Mapping the Public Domain', in Lucie Guibault & Bernt Hugenholtz (eds), *The Future of the Public Domain: Identifying the Commons in Information Law* (Kluwer Law International 2006) 7-25

[24] Goldstein & Hugenholtz (n 8) 5

[25] Craig & Kerr (n 11)

1. EU and United States

To answer this question, we need to distinguish between purely AI Created Works and AI Assisted Works.[26] In the case of the former there can be no copyright because of -*inter alia*- the absence of a human author's own intellectual creation as an extension of his personality. In case of the latter copyrights may arise in favour of the person who made creative choices, stemming from his or her artistic imagination, the artificial agent's owner or the user of the creative robot. Besides that, the requirement of originality for the emergence of copyright, linked to generative code (instead of a human author) is problematic.[27] Works solely made by code are not protected. They are free as the air to common use.[28] This is how the law is now, both in the EU and the United States.

Moreover, purely AI Created Works require an active agent capable of producing works. Autonomous creative agents do not yet exist.[29] They are merely faithful agents.[30] Aesthetically attractive machine productions may appear to be creative, but they are not.[31] So doctrinally, there can be no question of AI authorship. In that sense, the AI author hasn't been born yet. There are no AI Authored Works. As technology progresses, and autonomous creative agents that are granted legal status produce truly original works, this may change. Awarding copyright to AI Authors is another story, since authorship is connected to humans.

2. UK: CGW Regime

Contrary to the EU and USA approach, the UK implemented a computer generated works (CGW) regime, which means -in short- that the AI's programmer gets copyright on the machine's output.[32] In other words, the UK stretches human authorship towards algorithmic authorship. The CGW regime qualifies machine generated outputs as 'works' under copyright law. No moral rights are assigned (a causal link between human creativity and the output is absent) and the protection term is limited to 50 years.

Japan is planning a similar strategy, but with a commercial impact threshold: only AI Generated Works that have a significant economic impact, will be granted protection. The legal subject (person

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[26] In case of purely AI Created Works (or AI Made Creations) no human is involved i.e. these works have crossed the autonomy threshold. There is debate as to whether such works exist anno 2019. In case of AI Assisted Works (or AI Assisted Creations) there is a minimum of human intervention present. An example of an AI Assisted Work can be found here: https://www.nextrembrandt.com/

[27] Yanisky-Ravid, Shlomit and Velez-Hernandez, Luis Antonio, Copyrightability of Artworks Produced by Creative Robots, Driven by Artificial Intelligence Systems and the Concept of Originality: The Formality - Objective Model (March 30, 2017). Minnesota Journal of Law, Science & Technology, Forthcoming. Available at SSRN: https://ssrn.com/abstract=2943778

[28] Yochai Benkler, 'Free as the Air to Common Use: First Amendment Constraints on Enclosure of the Public Domain' (74 N.Y.U. L. REV. 1999) 354
See also *International News Serv.*, 248 U.S. at 250 (Brandeis, J. dissenting)

[29] James Vincent, 'How three French students used borrowed code to put the first AI portrait in Christie's' *The Verge, 23 October 2018) https://www.theverge.com/2018/10/23/18013190/ai-art-portrait-auction-christies-belamy-obvious-robbie-barrat-gans accessed 12 May 2019

[30] Ginsburg, Jane C. and Budiardjo, Luke Ali, Authors and Machines (August 5, 2018). Columbia Public Law Research Paper No. 14-597; Berkeley Technology Law Journal, Vol. 34, No. 2, 2019. Available at SSRN: https://ssrn.com/abstract=3233885

[31] Ginsburg & Budiardjo (n 30) and Gervais, Daniel J., The Machine As Author (March 25, 2019). Iowa Law Review, Vol. 105, 2019. Available at SSRN: https://ssrn.com/abstract=3359524. The machine itself is not the source of creativity.

[32] Paul Lambert, 'Computer Generated Works and Copyright: Selfies, Traps, Robots, AI and Machine Learning' (OSF, 8 July 2017) <osf.io/m93dr> accessed 12 May 2019

or business) that programmed the algorithm responsible for the creation of the work, will be the owner of this intellectual property right.

3. Arguments Against Copyright Protection

Doctrinally, the UK's CGW framework is incompatible with the European acquis and it has a potentially negative market impact (winner takes all, not a balancing effect).[33] There is just no evidence that supports the belief that exclusive IP rights on computer generated works are needed as an incentive to create, produce and invent. Additionally, the absence of both legal subjectivity and legal/corporate personhood is problematic, as we will see in section IV below. For AI Creations, this results in a no-ownership and public domain scenario. Dogmatically, CGW do not belong in copyright.[34] These works should not be monopolized.

William Fisher canvassed 4 normative sources of intellectual property, which can be used to justify granting copyright protection from an economic, cultural and philosophical perspective.[35] These normative sources (Welfare, Fairness, Culture and Social Planning Theory) do not apply easily to Machine Made Creations. Neither as a rationale for protection for the benefit of the AI Machine itself, nor the benefit of the AI Machine's programmer or the AI Machine's owner.[36]

Can protection of AI generated subject matter (literary, artistic and scientific makings) that would qualify for copyright if created -at least in part- by a human author, be justified by the need for investment protection?

First of all, the scope of economic rights, including remuneration rights (the right of a copyright holder to receive payment when his works are used), should reflect the justifications of copyright

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[33] Begoña González Otero & Joao Pedro Quintais, 'Before the Singularity: Copyright and the Challenges of Artificial Intelligence' (Kluwer Copyright Blog 2018) http://copyrightblog.kluweriplaw.com/2018/09/25/singularity-copyright-challenges-artificial-intelligence accessed 12 May 2019. See also Schafer (n 6). Stretching IP rights also poses a threat to basic scientific research (and thus innovation), see Reichman JH, Okediji RL. When Copyright Law and Science Collide: Empowering Digitally Integrated Research Methods on a Global Scale. *Minn Law Rev*. 2012;96(4):1362–1480. The European acquis or acquis communautaire is the accumulated legislation, legal acts, and jurisprudence which together constitute the body of European Union law.

[34] Jane Ginsburg, 'People Not Machines: Authorship and What It Means in the Berne Convention' (IIC - International Review of Intellectual Property and Competition Law 49. 10.1007/s40319-018-0670-x, 2018). See also James Grimmelmann, 'There's No Such Thing as a Computer-Authored Work - And It's a Good Thing, Too' (39 Columbia Journal of Law & the Arts 403 (2016), U of Maryland Legal Studies Research Paper No. 2016-06). For more scholarly literature on this subject, see Ana Ramalho, 2017, 'Will Robots Rule the (Artistic) World? A Proposed Model for the Legal Status of Creations by Artificial Intelligence Systems', Journal of Internet Law, vol. 21, no. 1, pp. 12-25, Andres Guadamuz, 'Do Androids Dream of Electric Copyright? Comparative Analysis of Originality in Artificial Intelligence Generated Works' (June 5, 2017). Intellectual Property Quarterly, 2017 (2), Annemarie Bridy, The Evolution of Authorship: Work Made by Code, (39 COLUM. J.L & ARTS 395 2016), Rosa Ballardini, 'AI-generated content: authorship and inventorship in the age of artificial intelligence'(2019), Bruce Boyden, 'Emergent Works' 39 Colum. J.L. & Arts 377 (2016), Alan Durham, 'Copyright and Information Theory: Toward an Alternative Model of Authorship' BYU Law Review, 2004, Jani Mccutcheon, 'The vanishing author in computer-generated works: A critical analysis of recent Australian case law', Melbourne University Law Review 2013 36. 915-969

[35] William Fisher, 'Theories of Intellectual Property', New Essays in the Legal and Political Theory of Property (Cambridge University Press 2001) 1-8. See also William Fisher, Theories of IP 2019.01.15 http://ccb.ff6.mwp.accessdomain.com/Maps/IPTheories.html accessed 12 May 2019, and William Fisher, CopyrightX: Lecture 1.1, The Foundations of Copyright Law: Introduction (20 January 2016) https://www.youtube.com/watch?v=CqkonSY__ic accessed 12 May 2019

[36] ibid. See also Hughes, 'The Philosophy of Intellectual Property', 77 The Georgetown Law Journal,. 287, 288 (1988)

protection.[37] This rule of thumb aims to avoid IP overprotection, avoid barricades for communicative use of creative works, avoid roadblocks for technological advancement and avoid market failure.[38]

Second, the need for economic incentives through copyright depends per sector. Innovation economics has made clear that -following the utilitarian approach- certain sectors need to be more incentivised through IP legislation, than others. According to Burk and Lemley, optimal IP rules should be derived from evidence and not from faith.[39] The authors argue that exclusive rights are performing different roles in different economic sectors.[40] This entails that IP policy makers should differentiate more explicitly between economic sectors.[41]

For example, there appears to be less need for governmental intervention to stimulate optimal innovation levels in the media and entertainment sector, than in the pharmaceutical industry. With this taxonomy -or classification- in mind, governments can choose from at least six strategies on how to respond to the risks of overprotection and underproduction in a certain sector.[42] These strategies are (1) governmental research, (2) grants, (3) prizes, (4) intellectual property laws, (5) legal reinforcement of self-help practices and (6) compelling actors to innovate in socially beneficial ways.[43]

Moreover, IP can be vested in the machine itself (instead of the output) which could then be licensed or sold/ commodified. Investments can also be protected by other legal instruments such as antitrust law, unfair competition law and trademark law.[44]

Third, an AI at the current state of the art does not need an incentive to create, nor recognition or reward for its endeavours. It simply does not need exclusive rights.

4. Arguments Pro Copyright Protection

Some commentators fear a lack of protection would limit AI machine developers and owners willingness to invest in innovation[45], or that valuable innovation could move to a different jurisdiction.[46] Others would not reject authorship in non-human entities, such as animals, companies or machines, per sé, or the possibility of non-human authorship in general.[47] Arguments in favour of

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[37] Hugenholtz & Kretschmer (n 12) 3

[38] Frederic Scherer, 'The innovation lottery', in Dreyfuss, Diane Zimmerman, Harry First (eds) *Expanding the Boundaries of Intellectual Property - Innovation Policy for the Knowledge Society* (OUP 2001) 20-21

[39] Dan Burk and Mark Lemley, *The Patent Crisis and How the Courts Can Solve It* (University of Chicago Press, 2009) 38. See also Mark Lemley, 'Faith-Based Intellectual Property' UCLA Law Review. 62. 1328-1346. 10.2139/ssrn.2587297 (2015), 22 https://www.researchgate.net/publication/282955515_Faith-Based_Intellectual_Property accessed 12 June 2019

[40] ibid.

[41] ibid.

[42] William Fisher, 'Regulating Innovation,' (2015) University of Chicago Law Review Online: Vol. 82: Iss. 1, Article 15, p 253-256 https://chicagounbound.uchicago.edu/uclrev_online/vol82/iss1/15 accessed 12 May 2019. See also Gervais (n 14) 5, and Brewster Kneen, 'Redefining 'property': Private Property, the Commons, and the Public Domain', (Seedling January 2004) 3 https://www.grain.org/en/article/392-redefining-property-private-property-the-commons-and-the-public-domain accessed 12 May 2019

[43] Fisher (n 42). See also William W. Fisher, 'Promises to Keep: Technology, Law, and the Future of Entertainment' (Stanford 2004) 199-201

[44] Otero & Quintais (n 33)

[45] ibid.

[46] Benjamin Sobel, 'Artificial Intelligence's Fair Use Crisis' (Columbia Journal of Law & the Arts 2017)

[47] Annemarie Bridy, The Evolution of Authorship: Work Made by Code, (39 COLUM. J.L & ARTS 395 2016), Annemarie Bridy, 'Coding Creativity: Copyright and the Artificially Intelligent Author' (STAN. TECH. L. REV. 5, 2012) <http://stlr.stanford.edu/pdf/bridy-coding-creativity.pdf> accessed 12 May 2019, Andres Guadamuz, 'Do

granting copyright status to AI Generated Creations focus in particular on the need to incentivise AI programmers, owners and users.[48]

Counterintuitively, extending copyright – and its paradigms of control and exclusivity[49]- could ultimately cause less available AI Generated Works for commercial and educational use, which is counterproductive to AI development in general. According to Gervais, the idea that value created by machines must be protected by copyright law is a normative error.[50] Besides that, creating incentives for machine productions could result in less human generated creations.[51]

5. Degree of Human Intervention

Determining who or what created a work is a question of attributing responsibility.[52] Allocation of copyrights in AI Generated Creations can only take place in case of justified human authorial claims. According to Deltorn, this requires a case by case analysis of the amount of human intervention related to original contribution and creative choices in a particular creation.[53]

Sufficient human intervention would result in an AI Assisted Creation i.e. a human-machine collaboration. To determine copyrightability, Gervais recently proposed the originality causation test.[54] This test follows creative choices and traces them back to either human programmers, owners, users or the machines themselves.

In case of pure AI Creations, no humans would be involved. Only autonomous agents -that crossed the autonomy threshold[55]- would contribute to the creative process. No (sufficient i.e. de minimis) degree of human responsibility for the creation, neither upstream as programmer nor downstream as a user, would be present.[56] No mental conception or physical execution to justify authorship.[57] No human involvement or intervention means no authorship. No authorship leads to public domain.[58]

Androids Dream of Electric Copyright? Comparative Analysis of Originality in Artificial Intelligence Generated Works' (Intellectual Property Quarterly, 2017 2)

[48] Kalin Hristov, 'Artificial Intelligence and the Copyright Dilemma' (IDEA: The IP Law Review, Vol. 57, No. 3, 2017), Russ Pearlman, 'Recognizing Artificial Intelligence (AI) as Authors and Inventors Under U.S. Intellectual Property Law', (24 Rich. J. L. & Tech. no. 2, 2018), Robert Denicola, 'Ex Machina: Copyright Protection for Computer-Generated Works', (69 Rutgers University Law Review 251, 2016), Celine Dee, 'Examining Copyright Protection of AI Generated Art', (Delphi - Interdisciplinary Review of Emerging Technologies, Volume 1, Lexxion, 2018) 31-37. See also Mark Perry & Thomas Margoni, 'From Music Tracks to Google Maps: Who Owns Computer Generated Works?' (Computer Law and Security Review, Vol. 26, pp. 621-629, 2010). The authors recommend a public domain scenario for Canada.

[49] Craig, Carys J., The Canadian Public Domain: What, Where, and to What End? (January 1, 2010). Canadian Journal of Law & Technology, Vol. 7, p. 221, 2010. Available at SSRN: https://ssrn.com/abstract=1567711

[50] Gervais (n 11)

[51] ibid.

[52] ibid.

[53] Deltorn, Jean-Marc and Macrez, Franck, Authorship in the Age of Machine learning and Artificial Intelligence (August 1, 2018). In: Sean M. O'Connor (ed.), The Oxford Handbook of Music Law and Policy, Oxford University Press, 2019 (Forthcoming) ; Centre for International Intellectual Property Studies (CEIPI) Research Paper No. 2018-10. Available at SSRN: https://ssrn.com/abstract=3261329 or http://dx.doi.org/10.2139/ssrn.3261329

[54] Gervais (n 31)

[55] ibid.

[56] Ginsburg & Budiardjo (n 30)

[57] ibid.

[58] The absence of copyright protection (including the risk of unauthorized third party commercial exploitation) can be compensated by technological measures, contracts and competition law. Authorless works also result in a public domain scenario.

IV. Legal Personhood and Legal Agenthood

Copyrights can only be owned by legal subjects i.e. persons or companies. An AI machine itself cannot own copyright on its AI Made Creations because an AI system has no legal personality and does not possess legal subjectivity. AI systems qualify as legal object. This applies to both physical goods such as smart robots (hardware) and intangible goods such as deep learning algorithms (software).

Machines equipped with AI are therefore not carriers of legal rights, obligations and capacities. They cannot independently participate in legal transactions. They have no constitutional rights. They cannot perform unilateral or multilateral legal acts. As we have seen, this has consequences for whether or not intellectual property rights arise: whether AI Made Creations would fall into the propertized domain or the public domain. The absence of legal subjectivity also has consequences for insurance and liability for damage: an AI system cannot be held responsible, liable or appear in court.

This section describes the absence of legal status for machines and explores possibilities for the construction of such a status.

1. AI is a Legal Object

Both natural persons and corporations are legal subjects. Corporations have legal personhood vested in them (corporate personhood). AI is not a legal entity but a legal object. A legal object cannot create copyrightable works, invent patentable technical applications or own intellectual property. It cannot sign license deals or employment contracts. It cannot accept responsibility. Only legal subjects can. Therefore, AI cannot own IP rights to its AI Made Creations. This path would lead us -if the AI developer or owner cannot claim IP rights- to the public domain.

With AI becoming smarter at an exponential pace, it is conceivable that at a certain point in time there will be a social, moral or political need for the granting of a certain legal status to autonomous, sentient AI's. Acknowledgement by law, directive or treaty of machines as carriers of rights and duties could – in theory – help resolving liability, insurance and employment related issues. I briefly discuss some existing doctrines from which inspiration can be drawn in the construction of *sui iuris* or *sui generis* legal subjectivity.[59]

2. Roman Property Paradigm

Traditionally, human beings and property are viewed as legal entities on the two opposite sides of a continuum.[60] Animals and embryos are somewhere in between. Embryo's occupy a temporal category in this continuum, until the point of brainbirth of the unborn child. An infant does not have legal capacities because the law does not attach any consequence to his or her psychological intention. 'The bio-ethical nature of the parent-child relationship simply means that as product of a biological process the embryos are included in their parents' legal subjectivity.'[61] We see a similar

[59] Legal subjectivity for advanced, future AI systems could result in the entity (co-)owning IP rights, appearing in court, signing insurance contracts, accepting liability and paying damages.

[60] Robbie Robinson, 'The Legal Nature of the Embryo: Legal Subject or Legal Object?' (Potchefstroom Electronic Law Journal, Vol. 21, 2018)

[61] ibid. According to Robinson, neither USA law nor European law provides an acceptable explanation regarding the legal nature of embryo's.

responsibility driven concept -developed by Romans- for quality liability for animals. In some jurisdictions, animals share qualities of both legal object and legal subject.[62]

The Roman property paradigm distinguished various dimensions of private and public property, exclusive and non-exclusive rights, including the concepts of *res mancipi*, *res universitatis*, *res publicae*, *res communis omnia* and *res divini iuris*.[63] *Res mancipi* are 'those things which might be sold and alienated, or the property of them transferred from one person to another.'[64] *Res universitatis* refers to things owned by a public or private group in its corporate capacity.[65] *Res publicae* (public domain) refers to things open to the public by operation of law.[66] Contrastingly, *res communes omnia* (the commons) refers to things incapable by their nature of being exclusively owned -thus common to all- such as oceans, light or birds in the air.[67] *Res divini juris* refers to things that cannot be owned publicly or privately because of their divine status.[68]

Analogue to children from Roman parents, along with animals and slaves on Italian territory, smart robots would likely fall into the *res mancipe* category.[69]

3. Dependent and Independent Personhood

Chopra & White argue that – although autonomous artificial agents are programmed and humans not – there is no a priori reason to exclude smart robots from *sui iuris* legal personhood.[70] It is argued that in some circumstances (to pragmatically solve practical legal issues), artificial agents could be treated as legal subjects and that this attribution of rights, obligations and responsibilities is not an all or nothing matter.[71] To this end, Chopra & White distinguish between dependent and independent legal personhood.[72]

Dependent legal persons (such as an animal or an unborn child) can only act through the agency of another legal person in exercising its legal rights.[73] An AI becomes a candidate for dependent personhood the moment it engages in legal acts.[74] And interacts with societies networks of social and economic relations.[75] Such as self-driving cars.

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[62] Such as the Dutch system, see Ton Hartlief, 'Van knappe koppen en hun uitvindingen', (NJB Vooraf, 2018/878, afl. 18)
[63] Fiona Macmillan, 'Arts festivals: Property, heritage or more?' in K Bowrey & M Handler (eds), *Law and Creativity in the Age of the Entertainment Franchise* (Cambridge University Press, 2013). See also Macmillan, Fiona, 'Many analogies, some metaphors, little imagination: the public domain in intellectual space' (2010)
[64] *A Law Dictionary, Adapted to the Constitution and Laws of the United States. By John Bouvier.*. S.v. "Res mancipi." https://legal-dictionary.thefreedictionary.com/Res+mancipi Accessed 12 June 2019
[65] Macmillan (n 63) and Kneen (n 42)
[66] ibid.
[67] ibid.
[68] ibid.
[69] William Smith, *A dictionary of Greek and Roman antiquities* (London, Printed for Taylor and Walton, 1842) 590
[70] White, Laurence & Chopra, Samir, A Legal Theory for Autonomous Artificial Agents, (University of Michigan Press 2011).
[71] ibid.
[72] ibid.
[73] ibid.
[74] Chopra, Samir & White, Laurence, 'Artificial Agents: Philosophical and Legal Perspectives', 2007
[75] ibid.

Fully independent legal persons are not bound by such constraints.[76] Independent legal personhood could -in theory- be awarded to AI the moment they become sentient and have moral agency.[77] This includes according independent legal subjectivity of hypothetical savant machines with sufficient cognitive abilities that are not designed by humans but by autonomous machines.[78] Such as spontaneous intelligence.[79]

White recently made a slightly different distinction: that between an existential construct versus a relational construct of human personhood.[80] A relational construct in which personhood is a dynamic, provisional state of value defined by society, could be relevant for AI.[81] This postulate could play an important role in innovating and augmenting personhood, and constructing legal status of artificial agents.

4. Legal Agenthood

According to Pagallo, policy makers should discard any hypothesis of granting AI robots full legal personhood in the foreseeable future.[82] The state of the art in AI, the level of consciousness and legal autonomy of autonomous agents do not justify awarding legal personhood. Instead, policy makers should experiment with establishing new forms of legal agenthood in cases of complex distributed responsibility, accountability and liability for the activities of AI robots in contracts and business law.[83] The notion of legal agenthood refers to the legal status as accountable agents establishing rights and obligations in civil law.[84] Legal agency of smart machines could be considered as a source of responsibility for other agents in the system.[85] The introduction of legal agenthood for AI should prevent risks of robotic liability shield and of autonomous agents as unaccountable rights violators.[86]

Granting legal agenthood to AI systems would technically not be enough for it to own IP rights – this requires legal subjectivity.

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[76] White & Chopra (n 70)

[77] Chopra & White (n 74). See also Mireille Hildebrandt, Jeanne Gaakeer, Human Law and Computer Law: Comparative Perspectives (Springer, 2013) 60-61 Moral agency is the ability to discern right from wrong and to be held accountable for one's own actions and moral judgements.

[78] Woodrow Barfield, Ugo Pagallo, Research Handbook on the Law of Artificial Intelligence, (EEP 2018) 370

[79] Jiahong Chen and Paul Burgess, 'The boundaries of legal personhood: how spontaneous intelligence can problematise differences between humans, artificial intelligence, companies and animals.' P. Artif Intell Law (2019) 27: 73. https://doi.org/10.1007/s10506-018-9229-x.

[80] Laurence White, Personhood: An essential characteristic of the human species, Linacre Q. 2013 Feb; 80(1): 74–97.

[81] ibid. See also Chopra, Samir & White, Laurence, 'Artificial Agents - Personhood in Law and Philosophy' (2004) 635-639.

[82] Ugo Pagallo, 'Vital, Sophia, and Co.—The Quest for the Legal Personhood of Robots' Information. 9. 230. 10.3390/info9090230 (2018) https://www.researchgate.net/publication/327567440_Vital_Sophia_and_Co-The_Quest_for_the_Legal_Personhood_of_Robots accessed 12 June 2019. See also 'OPEN LETTER TO THE EUROPEAN COMMISSION ARTIFICIAL INTELLIGENCE AND ROBOTICS', http://www.robotics-openletter.eu/ accessed 12 June 2019. The Open Letter responds to the 2017 Resolution of the EU Parliament on 'electronic personhood' of smart robots and states that 'From an ethical and legal perspective, creating a legal personality for a robot is inappropriate whatever the legal status model.'

[83] ibid. Pagallo warns not to confuse legal personhood with legal agenthood and argues that debates on legal personhood for AI should not be politicized.

[84] Ugo Pagallo, 'Apples, oranges, robots: four misunderstandings in today's debate on the legal status of AI systems' 376 Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences (2018) http://doi.org/10.1098/rsta.2018.0168

[85] Sandra Passinhas, 'Robotics and Law: A Survey', (2018) http://ceur-ws.org/Vol-2059/paper7.pdf accessed 12 June 2019

[86] Pagallo (n 82). The author suggest the constitution of a Peculium.

5. Science Fiction

The moment that artificial intelligence becomes aware of itself and may pursue its own goals is what we call the Singularity. The question is whether Robo Sapiens will be interested in universal human rights and intellectual property after the Singularity.

Hollywood's relentless flow of dystopian sci-fi movies (Metropolis, Bladerunner, 2001 A Space Odyssey) predicts strange and complex societal changes, in which AI often plays the leading part. *Deus ex Machina* is coming to either elevate humanity or eradicate us all. Robot overlords, genetically enhanced post-humans[87], cerebral computers and half-organic, half-mechanical *Machinenmenschen*[88] will walk the earth. When the Singularity comes it will open a Pandora's Box of urgent existential challenges, such as the Superintelligence Control Problem[89] and the Dominant Species Problem.[90] Who will be granted legal status may well be Robo Sapiens decision, not ours.[91]

V. Patents on AI Inventions

Leonardo Da Vinci's *robot*, in the appearance of a mechanical knight, was a humanoid automaton designed around the year 1495.[92] The world's first statutory patents were granted in Venice in 1474 but Leonardo's Robot was -reportedly- never patented.[93] This section addresses the question whether AI Inventions can and ought be patented.

1. Objectives

Patent law aims to stimulate technological innovation by providing a limited monopoly to inventors such that they can get compensation for their investment. It seeks to provide society with in depth information on how inventions need to be practiced such that people can use and build upon them efficiently once the 20 year patent term is over. The patent system intends to incentivise the detailed disclosure of innovative ideas and optimize the allocation of R&D capacity, by granting exclusive rights to the inventor. It intends to encourage inventors to disclose, produce and market their invention with the expectation of return on investment. At the same time, it aims at inventors improve upon and design around earlier patents.

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[87] Jos de Mul, *Cyberspace Odyssey: Towards a Virtual Ontology and Anthropology,* (Cambridge Scholars Publishing, 2010) 257-258

[88] The *Maschinenmensch* (German for "robot" or literally "machine-person") is a film character in Fritz Lang's masterpiece 'Metropolis,' (Wikipedia) https://en.wikipedia.org/wiki/Maschinenmensch accessed 12 May 2019. As a side note, Amara's law states that we tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run.

[89] James Grimmelmann, 'Copyright for Literate Robots' (101 Iowa Law Review 657 (2016) U of Maryland Legal Studies Research Paper No. 2015-16) 678. The Superintelligence Control Problem refers to the existential risk that a superintelligent agent refuses to permit its programmers to modify it after launch, and decides to follow its own agenda which might be harmful to human kind. See https://en.wikipedia.org/wiki/AI_control_problem accessed 12 June 2019

[90] Patrick Hubbard, ''Do Androids Dream?': Personhood and Intelligent Artifacts', (Temple Law Review, Vol. 83, 2010) 450. The Dominant Species Problem refers to AI being mankind's final invention that self-improves and self-replicates until it replaces humans as the dominant species on planet earth.

[91] Koops, E. J., Hildebrandt, M., & Jaquet-Chiffelle, D. O., 'Bridging the accountability gap: Rights for new entities in the information society?' (Minnesota journal of law, science & technology, 11(2), 2010) 561

[92] See https://en.wikipedia.org/wiki/Leonardo%27s_robot accessed 12 May 2019

[93] Craig Nard and Andrew Morriss, 'Constitutionalizing Patents: From Venice to Philadelphia', (Faculty Publications.587, 2006)

As copyrights, patents can be (cross-)licensed, sold or waived. Patent protection and enforcement are regulated -*inter alia*- by international treaties and national laws.[94] As copyrights, patents are territorial rights.

2. Rationales and Justifications

Traditionally, only novel, useful, inventive and non-obvious inventions can be patented. Section 101 of the US Patent Act states that subject matter eligible for patent granting consists of 'any new and useful process, machine, manufacture, or composition of matter'.[95] Article 52 of the European Patent Convention states that 'European patents shall be granted for any inventions, in all fields of technology, provided that they are new, involve an inventive step and are susceptible of industrial application.'[96]

Examples of non-patentable subject matter are ideas, principles, scientific theories, mathematic methods, aesthetic design, prior inventions that are already state of the art, copyrightable works, algorithms as such and software (being math).[97] However, software processes for security technology such as data encryption might survive the utility patent eligibility threshold.[98]

An invention should be non-obvious to a person having ordinary skill in the art (PHOSITA) i.e. somebody with average professional knowledge in the subject area of a particular invention. The first applicant, not the first inventor, gets the patent, provided formal and material requirements are met. Patent owners are granted exclusive rights to prevent others from making, selling using or importing the patented invention. Patent law requires a (human) inventor. Only legal subjects can own patents. For AI Inventions, this results in a no-ownership and public domain scenario.[99]

Patent rationales and justifications do not apply well to inventive machines. Inventive machines need not stand on the shoulders of giants. Natural rights, moral and economic incentive rationales are irrelevant in case of AI Inventions.[100] This is due to the absence of human beings in the 'automated' inventing process, which would -in theory- make it easier and less costly to invent as a company. The more costly the inventing process, the better defendable the patent grant to recover investment. This applies to both utility patents and design patents.

3. Industry Specific Patent Reforms

Commentators agree on the need for a reform and provide various approaches and solutions to address the reality of autonomous machine inventors. One avenue that scholars are pursuing is removing the human as a prerequisite or relevant factor for appropriation. This could result in official computer inventorship, including *sui generis* legal personhood[101] and preventing inventions from

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[94] Such as WIPO, TRIPS, EOP, Patent Act (35 U.S. Code)

[95] See: https://www.law.cornell.edu/uscode/text/35/101 accessed 12 June 2019

[96] See: https://www.epo.org/law-practice/legal-texts/html/epc/2016/e/ar52.html accessed 12 June 2019

[97] As copyright, the domain of patent law has seen a gradual expansion. See Lucie Guibault & Bernt Hugenholtz (eds), *The Future of the Public Domain: Identifying the Commons in Information Law* (Kluwer Law International 2006) 4 and Schellekens, 'De octrooieerbaarheid van computerprogramma's', (Ars Aqui, pp. 272–276, 2014)

[98] In the USA, the software patent eligibility treshold is known as the Alice-test (named after landmark decision *Alice Corp. v. CLS Bank International*).

[99] Erica Fraser, 'Computers as Inventors – Legal and Policy Implications of Artificial Intelligence on Patent Law', (13:3 SCRIPTed 305 https://script-ed.org/?p=3195, 2013)

[100] For a typology of rationales, see Andersen, Birgitte. (2003), 'The Rationales for Intellectual Property Rights: The Twenty-First Century Controversies'

[101] Ryan Abbott, 'I Think, Therefore I Invent: Creative Computers and the Future of Patent Law', (57 B.C.L. Rev. 1079, 2016) https://lawdigitalcommons.bc.edu/bclr/vol57/iss4/2 accessed 12 May 2019

falling into the public domain.[102] Other scholars advocate pragmatic methods that amount to raising patent threshold. Such as redefining definitions of the inventive step, non-obviousness, prior art, non-analogous art and harmonizing guidelines about who or what should be the person or entity ordinary skilled in the art.[103]

Since patent's exclusive rights perform different roles in different industries, patent policy makers should differentiate more explicitly between economic sectors and consider industry specific reforms.[104] Per sector, such as Health, Agrifood, Mobility, Finance and Energy, policy makers should implement a regime that strikes a balance between underprotection and overprotection.[105]

4. Sharing and Open Source

On the other side of the spectrum, Yanisky & Liu argue that traditional patent law has become outdated, inapplicable and irrelevant with respect to AI Inventions.[106] In their view, promoting innovation and public disclosure can be better achieved with other tools than granting patents. Tools such as electronic and cyber controls over inventions created by AI systems, license agreements and first-mover market advantages such as technology leadership.[107] Additionally, the authors argue in favour of making AI systems and inventions open source. Voluntary sharing of knowledge and open source data can strive toward the fundamental IP goals i.e. promoting welfare and sharing of information. I see this as a step forward compared with the one way street protection of the interests of the inventor or designer of that knowledge and information. Such sharing could also prevent patent trolling (by patent assertion entities and NPEs) and unwanted licensing behaviour.[108]

Another option to consider is a shorter protection duration of 3 to 10 years for AI Inventions (which is better suited to the exponential pace of innovation) in combination with compulsory licenses against payment set by law or arbitration. Or a super short duration similar to unregistered designs. Contrary to further expansion of patent scope and subject matter, this would result in a more limited monopoly including dissemination of knowledge. This solution could also be applied to AI Assisted Inventions and software patents.[109]

5. Abolishing Patent Protection for AI Inventions

IP on AI Inventions can be a roadblock for rapid technological progress and is therefore not beneficial for society. In general, the expansion of patentable subject matter to emerging technical fields hampers diffusion of technology and is detrimental to follow on innovation, employment and economic growth.[110] Expansion diminishes freedom to operate. Patents on AI Inventions such as new

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[102] Pearlman (n 48) 35

[103] Ana Ramalho, 'Patentability of AI-generated inventions: Is a reform of the patent system needed?', (2018) 26, Peter Blok, 'The inventor's new tool: Artificial Intelligence – how does it fit the European patent system?', (European Intellectual Property Review, 39(2), 2017), Abbott (n 101), Sonil Singhania and Sana Singh, 'Redefine intellectual property with artificial intelligence' (Singhania & Partners 2018),

[104] Burk & Lemley (n 39)

[105] Christopher Buccafusco, Mark Lemley and Jonathan Masur, 'Intelligent Design' (October 31, 2017), Duke Law Journal, Vol. 68, p. 75 (2018). Available at SSRN: https://ssrn.com/abstract=3062951

[106] Yanisky-Ravid, Shlomit and Liu, Xiaoqiong (Jackie), 'When Artificial Intelligence Systems Produce Inventions: The 3A Era and an Alternative Model for Patent Law', (39 Cardozo Law Review, 2215-2263 2018)

[107] ibid.

[108] ibid.

[109] It is not unthinkable that the humans who initiate the AI system that is used to produce the AI Assisted Invention, in certain sectors, would need some form of patent protection to be motivated make the necessary investments in time and money.

[110] OECD science, technology and industry outlook 2012 (OECD 2012) 195

medicine and personalized drugs are regarded as contrary to public interest.[111] The same may apply to scientific disciplines such as biotechnology, analytical chemistry, plant breeding, quantitative genetics and nutrigenomics, that integrate AI in their research programs.[112] There should be no plant variety rights on innovative crops invented by an AI system that crossed the autonomy threshold.

Moreover, there is no empirical data that supports the idea that incentives or (the expectation of) a return of investment are needed in case of 'pure' AI Inventions. There is also no evidence of a free riding problem in the sense that non-patented AI Inventions are not embraced by the market because of the fear that successful products might be copied freely by (human or AI) competitors.

The reality of autonomous computer systems supporting and even replacing humans in the invention process forces us to rethink the patent system, possibly even beyond rationales and justifications. Abolishing patent protection for AI Inventions[113] -including a formal public domain or open source status- appears to be the most innovation friendly option.

VI. Types of IP Rights on the AI Machine Itself

This section explains which IP rights can be vested in the various components of the AI system itself. These IP rights can be owned by legal subjects only. If, in the future, there would be a need to grant AI systems some form of legal personhood, these systems could own IP rights on other systems. If this ever happens, humans or corporations owning IP rights on AI systems that have legal personhood could be problematic, from a technical-legal point of view. Because IP rights cannot be vested in legal subjects.

Smart robots equipped with AI can be protected by different types of intellectual and industrial property rights, such as chip rights, design rights, trade secrets, patents and copyrights. Combination is the key.[114] Each right protects something different. People or companies own these rights. The datasets used or processed by the AI system can be subject to database rights, at least in the European Union, not USA or Asia.[115] The software, the way in which the AI is trained, the algorithm and the neural network each may contain IP rights. Even though the objectives of the patent system and the copyright system differ in part, patent and copyright could be substitutes for each other in providing incentives for AI development. Maximization of intellectual property on AI can only be realised using a mixture of rights.

An AI system globally consists of input data, software and hardware. From a legal point of view we can distinguish at least 7 relevant components: the computer program including the software source code and algorithms (1), the training data corpus (2), the neural network (3), the machine learning process (4), the AI applications (5), the hardware (6) and the inference model (7).

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[111] Pascale Boulet, Christopher Garrison & Ellen 't Hoen, 'Drug patents under the spotlight**.** Sharing practical knowledge about pharmaceutical patents' (Medecins Sans Frontieres 2003) 5

[112] Tom Fleischman, 'Plant breeder taps latest technology to feed the world' (Cornell Chronicle, October 31, 2018) https://news.cornell.edu/stories/2018/10/plant-breeder-taps-latest-technology-feed-world accessed 12 June 2019

[113] Yanisky & Liu (n 106)

[114] Jean-Marc Deltorn, 'Disentangling deep learning and copyrights' (AMI 2018/5) 178

[115] Bernt Hugenholtz, 'Something Completely Different: Europe's Sui Generis Database Right', in: Susy Frankel & Daniel Gervais (eds.), *The Internet and the Emerging Importance of New Forms of Intellectual Property* (2016), 205-222

1. Software Source Code and Algorithms

Software consists of several elements, each has its own structure, purpose and legal qualification. The software source code and firmware used in AI systems can be protected by copyright. Both TRIPS and WTC classify software as a literary work that is subject to copyright protection. However, algorithms, functionality, principles and ideas are not protected.[116] The EU Software Directive prohibit copyright protection on functionality. As in the EU, copyright protection of software functionality is unavailable in the US.[117] This ensues from the idea/expression dichotomy. Only the expression of a computer program is protected. 'Mathematical formulae will therefore generally form part of the public domain, to the extent that their expression in the form of software is not covered by copyright.'[118] An idea can be 'safeguarded' by making an i-Depot (in the Benelux). This works like a time-stamp.

Should software functionality be eligible for patent? Arguments for and against patentability of software and computer implemented inventions mainly focus on economic implications.[119] On one hand, patent protection of software functionality could offer start-ups and SME's market protection against bigger players. On the other hand, those same market entrants could be disproportionally affected by patent trolls, which hinders innovation and the creation of new jobs.[120] Besides that, creative aspects of software (not functionality) are already protected by copyright.

2. Training Corpus

A refined or labelled training corpus can be protected by a *sui generis* database right[121] in countries such as The Netherlands and France, or by a neighbouring right in other EU countries such as Germany and the Nordics (not in the USA).[122] The criterion for database protection of training corpora is the systematic modelling and organizing of information. This implies an investment in time, energy and money. Methodically transforming raw data in high quality data, including a substantial investment fulfils this criterium for protection. Originality and creativity are not required (sweat of the brow doctrine).

Besides that, raw data can – both in Europe and the USA, in theory be protected by trade secret legislation.[123] Additionally, in the USA (beyond the scope of IP law), raw data can be protected by cybersecurity law. The unauthorized access of online data could also be a violation of tort law, privacy legislation and criminal law.

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[116] Daniel Gervais and Estelle Derclaye, 'The scope of computer program protection after SAS: are we closer to answers?' 34(8) European Intellectual Property Review, 565 (2012) (pp. 565-572)

[117] Pamela Samuelson, 'Functionality and Expression in Computer Programs: Refining the Tests for Software Copyright Infringement' (January 31, 2017). Berkeley Technology Law Journal, Forthcoming. Available at SSRN: https://ssrn.com/abstract=2909152

[118] 'Public Domain' Wikipedia, https://en.wikipedia.org/wiki/Public_domain accessed 12 May 2019

[119] See: https://en.wikipedia.org/wiki/Software_patent_debate#Protection_for_small_companies accessed 12 June 2019

[120] ibid.

[121] The training data might need to be cleared first.

[122] Hugenholtz (n 115) Note that the method of protection is not completely harmonized in the EU.

[123] Drexl, Josef, 'Designing Competitive Markets for Industrial Data - Between Propertisation and Access' (October 31, 2016). Max Planck Institute for Innovation & Competition Research Paper No. 16-13. Yonida Koukio, 'The (R)evolutionary Impact of AI-Generated Work and Big Data on Intellectual Property Law and Commercialization' (IP Osgoode, 2018). Thomas Hoeren, 'A New Approach to Data Property?' (AMI 2018 / 2)

3. Neural Network, Machine Learning Process, AI-Applications, and Hardware

The neural network topology can be protected by a patent, which protects technical inventions for up to 20 years. A generative adversarial network (GAN) that consists of a generative and a discriminative neural network (or algorithm) that contest with each other, can be patented.[124] The same applies to the machine learning process and the AI applications: these are patentable (art. 64 lid 2 EPC). New inventions related to Digital Twin technology -which can be used to create self-learning and updating digital simulation models (replica's) of products, systems, production processes, complete lifecycle performance, cities and even plants, animals and persons- can be patented as well.

The hardware design, schematics and circuits can also be protected by patent or a computer chip right. Examples of computer chip right subject matter are neuromorphic chips, nano-biological chips, memristors, fibre optic chips and quantum computers.

4. Inference Model

Inference models can be protected by a trade secret (EU Trade Secret Directive 2018). However, this IP right doesn't protect against reverse engineering. The resulting legislative gap can be remedied by excluding reverse engineering by contract.[125] A machine learning model uses what it has learned about other objects in the training data to infer, deduct or predict an outcome.[126] The inference model applies these learned logical relationships to new objects or problems. The inference model cannot be protected by copyright since its purpose is to obtain a technical result. Even if the inference model has been encoded in a database, protection by a database right under copyright regime could be problematic because of the absence of originality and creativity.[127] *Sui generis* database protection could again be the solution here, in Europe at least. It remains to be seen if inference engines can be protected by patents – if useful at all.

Lawmakers, courts and patent office's ought to do a continuous re-evaluation of whether the patent system's supporting rationales and justifications remain appropriate,[128] and proactively update their evidence based policies and examinations.[129]

In this context, the European Patent Organisation (EPO) recently amended its guidelines and implemented new sections on AI, mathematical methods, algorithms and blockchain.[130] Flexibility in addressing the mathematical idea/expression dichotomy as well as allocating competent divisions and interdisciplinary staff at EPO can take away important hurdles for patent protection of 4th Industrial Revolution applications.[131]

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[124] 'A Beginner's Guide to Generative Adversarial Networks (GANs)', Skymind AI, https://skymind.ai/wiki/generative-adversarial-network-gan accessed 12 May 2019

[125] Between licensor and licensee, or developer/owner and user.

[126] Jason Lohr, 'Litigating intellectual property issues: The impact of AI and machine learning' (Hogan Lovells, 2019)

[127] Football Dataco Ltd e.a. vs Yahoo! UK Ltd e.a., http://curia.europa.eu/juris/liste.jsf?&num=C-604/10. See also Deltorn (n 114)

[128] Fraser (n 99)

[129] Jean-Marc Deltorn, Andrew Thean, Markus Volkmer, 'The examination of computer implemented inventions and artificial intelligence inventions at the European Patent Office' (4IPCouncil 2019)

[130] ibid. Deltorn, Thean, & Volkmer (n 129)

[131] European Patent Office (EPO), 'Patents and the Fourth Industrial Revolution - The inventions behind digital transformation' (2017)

5. AI-Systems: Shift Towards Trade Secrets

Legal uncertainty about the patentability of AI systems is causing a shift towards trade secrets, in order to protect investments and monetize AI applications. On top of that, prior art cannot be documented in AI Inventions. Because of cloud computing and the AI black box there is no way to determine if there is patent (or trade secret) infringement.[132] This is simply invisible for humans. The shift from patents towards trade secrets results in a disincentive to disclose ideas and information.

Since the definition of a trade secret is so broad in the new EU Trade Secrets Directive, it potentially includes any data, including personal customer/user data and newly created data handled by a European commercial entity.[133] This large scope means that derived and inferred data can be classified under the Trade Secrets Directive, which impedes dissemination of information.[134]

6. Design Rights, Trademark, Tradename and Trade Dress

PCB artwork, layouts and hardware modelling can be protected by design right in Europe, which is valid for 5 years and can be extended 4 times until the max of 25 years has been reached. This industrial IP right protects the visual appearance of a product. In the USA, functional aspects of design can be protected by a design patent, which has a lower threshold than utility patents and a duration of only 15 years.[135] Non-functional creative aspects of design can be protected by copyright.

Product design, software interfaces and website design can – in the US and UK- also be protected by trade dress. Trade dress aims to protect consumers from using or buying products that imitate the shape, look and feel and packaging of the original.[136] Once granted, trade dress rights last in perpetuity, which hinders competition and innovation.[137]

Finally, the name and logo of an AI machine or product can be registered as a trademark. In order to create a strong AI brand, registration of the trade name and the domain name are also recommended.

All in all there are sufficient IP instruments to protect the various components of AI systems.[138] There would even be some protection overlaps because of theoretical cumulation of patents, copyrights, trade secrets and database rights.[139] New layers of rights do not seem to be opportune.

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[132] Lohr (n 126). See also Jason Lohr, '*Artificial intelligence drives new thinking on patent rights,* LimeGreen IP News (15 July 2016), via: http://www.limegreenipnews.com/2016/07/artificial-intelligence-drives-new-thinking-on-patent-rights/ accessed 12 May 2019. Note that DLT could be of some help to make AI transparent.

[133] Wachter, Sandra and Mittelstadt, Brent, 'A Right to Reasonable Inferences: Re-Thinking Data Protection Law in the Age of Big Data and AI' (October 05, 2018). Columbia Business Law Review, 2019(1).

[134] ibid. Wachter warns for tension between business interests protected by the Directive and private interests such as data protection and privacy. As a remedy she proposes a novel right to reasonable inferences i.e. a personal data protection right that protects against unreasonable machine learning inferences.

[135] Buccafusco, Lemley & Masur (n 105)

[136] ibid.

[137] ibid.

[138] Exhaustion of certain aspects of patent rights and copyrights on sold instantiations or copies may apply. See also Shubha Ghosh and Irene Calbol, '*Exhausting Intellectual Property Rights: A Comparative Law and Policy Analysis',* (CUP 2018), 101

[139] See also Deltorn, Jean-Marc and Macrez, Franck, Authorship in the Age of Machine learning and Artificial Intelligence (August 1, 2018). In: Sean M. O'Connor (ed.), The Oxford Handbook of Music Law and Policy, Oxford University Press, 2019 (Forthcoming) ; Centre for International Intellectual Property Studies (CEIPI) Research Paper No. 2018-10. Available at SSRN: https://ssrn.com/abstract=3261329

VII. Clearance of Training Data

Good quality shared data is a sine qua non for successful AI.[140] The use of training corpora for AI systems usually has two relevant IP dimensions. This section covers third party ownership rights on the input data and ownership of the processed output data.

1. Clearance of the Input Data

If the input data (open or closed data) contains works that are protected by copyright, or by database rights -and no text and datamining exception applies- prior permission to use and process (for both commercial, non-commercial and scientific objectives) must be obtained from the various owners of those rights. The feeding qualifies as a reproduction of works, and requires a license.[141] This type of licensing is called clearance. Clearance can be obtained individually or (in some cases) collectively.

2. European Database Rights on Augmented Data

The second aspect of training data is the emergence of IP rights on this methodically organized collection of snippets of information using a computer. In Europe, this can be either a database right or a *sui generis* database right or both, which have a duration of 15 years.[142] Each substantial update of the database results in a new database right. However, to prevent an unending monopoly, old content may be used freely after expiry of the initial 15 year term.

A database right can be qualified as either a neighbouring right, or a true *sui generis* IP right, but not as a full copyright.[143] Copyright provides protection of original creative expression aspects of arranging a database. A *sui generis* database right protects substantial investments made and has characteristics of a property right. In the USA -after landmark decision Feist- no *sui generis* database rights exist on labelled datasets.[144]

The rationale of this IP right 'of its own kind' is the protection of investments made in the data by EU based legal persons or corporations. Systematically refining and augmenting data, including a substantial investment made by the maker, qualifies for a database right. The maker of the database, usually a rich data company, is the owner of these rights.

The same applies to the (European) maker of a Digital Twin. The output data of the Digital Twin's AI and machine learning process, qualifies for a *sui generis* database right. An AI system (such as a Digital Twin) that generated or provided the output data (i.e. created the database) cannot own the *sui generis* database rights because it has no legal personhood. Only legal subjects can. A (human) database maker should have clearance from individual owners of input data as well, if necessary.

3. Stimulate Innovation: Ex ante Compulsory License or Open Source

Introducing an ex ante compulsory license for competitors of database producers would be in line with exceptions to other IP rights. This applies all the more to single source databases that obtain

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[140] See also https://ec.europa.eu/knowledge4policy/ai-watch/topic/data-cornerstone-ai-%E2%80%93-toward-common-european-data-space_en accessed 12 May 2019. The need for training data may change when AI gets stronger.

[141] See also Grimmelmann (n 89). Access to out-of-commerce works held by cultural heritage institutions also requires clearance. In Europe, this license can be obtained from collective rights organisations (art. 8 DSM Directive).

[142] DIRECTIVE 96/9/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 March 1996 on the legal protection of databases, article 10

[143] Hugenholtz (n 115)

[144] ibid.

detailed individual consumer preferences, purchase behaviour and sales records through a single, integrated system of data collection via internet and television. Limiting the monopoly on datasets will stimulate innovation, facilitate global harmonisation and make follow-on investments less expensive. This license could provide legal certainty to both users of the database, such as AI-developers, and producers of the database, such as rich data companies.[145] There exists no empirical data that supports the believe that the introduction of a compulsory license would reduce investments made in AI development.

Database rights can also be voluntarily waived by the owner of the database. This has the same legal effect as a CC0 form for copyright or a patent waiver. The result is the database being transferred to public domain. Making the data open source is another option.

4. TDM Exception

Text and Datamining (TDM) can infringe on copyrights' reproduction right and database rights' extraction right (the latter EU only). This Sword of Damocles leads to legal uncertainty for researchers and hinders research output. Aiming to remove legal roadblocks and facilitate innovation, the DSM Directive introduced a new fair use alike exception for text and datamining. [146] The TDM exception or limitation has been consolidated in article 3 and 4 of the final text of the DSM Directive, and have to be understood as 'measures to adapt exceptions and limitations to the digital and cross-border environment'.[147] Article 3 and 4 apply to non-profit scientific research only.[148] Archiving one legal copy of the obtained datasets is permitted. The TDM exception is a good start. However, a broadly scoped, mandatory TDM exception covering all types of data including news media would have facilitated accelerated progress more effectively.

5. Data Ownership: No Need for Another Layer of Rights

Data is the new oil – it must first be refined to be useful. For over a decade now, big tech has harvested the data riches. Does labelling and augmenting data justify an absolute data property right, a (neighbouring) data producer right or a *sui generis* database right for non-creative databases? Are IP incentives needed to share the high quality data needed for successful AI? Economic analysis has shown that there are no convincing economic arguments for the introduction of a new IP right,

[145] Beunen, A., *Protection for Databases: The European Database Directive and its Effects in the Netherlands, France and the United Kingdom* (Wolf Legal Publishers, 2007)

[146] Geiger, Christophe and Frosio, Giancarlo and Bulayenko, Oleksandr, 'The Exception for Text and Data Mining (TDM) in the Proposed Directive on Copyright in the Digital Single Market - Legal Aspects' (March 2, 2018). Centre for International Intellectual Property Studies (CEIPI) Research Paper No. 2018-02. Similar problems exist in the USA, where health research, science, data, and research results are trapped in silos, preventing accelerated progress and greater reach to patients. See Joe Biden, 'Inspiring a New Generation to Defy the Bounds of Innovation: A Moonshot to Cure Cancer', https://medium.com/cancer-moonshot/inspiring-a-new-generation-to-defy-the-bounds-of-innovation-a-moonshot-to-cure-cancer-fbdf71d01c2e (2016)

[147] DIRECTIVE (EU) 2019/790 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 April 2019 on copyright and related rights in the Digital Single Market and amending Directives 96/9/EC and 2001/29/EC https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32019L0790&from=EN

[148] The education exception/*onderwijsexceptie* does not cover text and data mining.

especially due to the lack of an incentive problem for the production and analysis of data.[149] Raw non personal machine-generated data are not protected by any intellectual property rights.[150]

According to Hoeren, the discussion about an absolute property right for data is obscure.[151] Information should not be enclosed.[152] Information is free as the air for common use.[153] There is no need for another layer of rights. The world needs an accessible dataversum with freedom to express, operate and develop.[154]

6. Focus on Design of Data Sharing Models

A better strategy to foster data sharing, data collaboration and access to unbiased (analysis of) data is to focus on the actual design of data sharing models.[155] Our energy should be directed to the actual creation of normative governance models which preserve human rights and privacy.[156] Models that work for both developed and underdeveloped countries.[157]

The goal should be a global open data sharing community with competing firms.[158] There is a strong need for comprehensive, cross sectoral data reuse policies.[159] Such as standards for interoperability. Even more so in case databases are produced by public bodies, in the exercise of their public task. An effective legal instrument to achieve this is the compulsory license for parties that wish to use data, in combination with fair remuneration for parties that legally harvested, transformed, refined, augmented or control the data. Like a statutory fee.[160] A comprehensive open data policy will result in a network effect, which means even more people and businesses will be comfortable sharing

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[149] Kerber, Wolfgang, 'A New (Intellectual) Property Right for Non-Personal Data? An Economic Analysis' (October 24, 2016). Gewerblicher Rechtsschutz und Urheberrecht, Internationaler Teil (GRUR Int), 11/2016, 989-999. See also Landes, William M., and Richard A. Posner. "An Economic Analysis of Copyright Law." The Journal of Legal Studies, vol. 18, no. 2, 1989, pp. 325–363. JSTOR, www.jstor.org/stable/3085624

[150] For an in depth analysis of IP rights for private data see Otero, 'Evaluating the EC Private Data Sharing Principles: Setting a Mantra for Artificial Intelligence Nirvana?' (4IPCouncil, 2018), for non personal machine generated data Hugenholtz, 'Data Property: Unwelcome Guest in the House of IP (2017), Ramalho, 'Data Producer's Right: Power, Perils & Pitfalls' (Paper presented at Better Regulation for Copyright, Brussels, Belgium 2017) and Max Planck Institute, 'Position Statement of the Max Planck Institute for Innovation and Competition of 26 April 2017 on the European Commission's "Public consultation on Building the European Data Economy"', appropriation of data, trade secrets and liability Hoeren (n 123) and Drexl (n 123).

[151] Hoeren (n 123)

[152] Benkler (n 28). Secret information excluded.

[153] Hugenholtz (n 115) The economic freedom to conduct a business sets limit to intellectual property rights and is one of the rationales underlying the idea/expression dichotomy.

[154] This calls for a clear-cut interpretation of the definition of trade secrets in the new EU Trade Secrets Directive by the courts.

[155] Mining unbiased data insights provides different perspectives on data, instead of just the biased one. It leads to more valuable discoveries and completer answers. See: Swathy Rengarajan, 'Biased and unbiased data and why they matter' (IBM 2017). https://www.ibm.com/blogs/business-analytics/biased-unbiased-data-matter/ accessed 12 June 2019

[156] Drexl (n 123), Otero (n 150)

[157] Yasodara Córdova, Padmashree Gehl Sampath and Lorrayne Porciuncula, 'Can Data Become Part of a Development Strategy?' (Berkman Klein Center For Internet & Society 2019) https://cyber.harvard.edu/story/2019-04/can-data-become-part-development-strategy accessed 12 May 2019

[158] Otero (n 150)

[159] John Wilbanks; & Stephen H Friend, 'First, design for data sharing', (Nature, 2016)

[160] See Guillermo Mier y Concha, 'Is Big Data a game changer for IP rights?' Maastricht Law Blogs 2019 https://www.maastrichtuniversity.nl/blog/2019/01/big-data-game-changer-ip-rights accessed 12 May 2019, Sobel (n 46), Hoeren (n 123) and Ramalho (n 150)

data.[161] This network effect will be an incentive to share.[162] The benefits of an open data policy, such as transparency and strengthening economic growth must be weighed against disadvantages such as misinterpretation and misuse of data, perceived competitive disadvantages and privacy concerns.[163]

VIII. An Articulated Public Domain for AI Made Creations and Inventions

The public domain is an important objective of copyright. A vital public domain enables democracy, innovation, cultural diversity, prosperity and a participative society. Too little public domain hinders innovation and free expression.[164] Too much copyright is bad for our economy and democracy (as is too little). A robust public domain is an essential requirement for cultural, social and economic development, a healthy democratic society and a sustainable information ecology.[165]

This section proposes a new public domain model for AI Creations and Inventions: *Res Publicae ex Machina* (Public Property from the Machine). This articulated model builds upon the Roman multi-layered property paradigm. It configures machine made non-exclusive property as a public domain status and includes an official PD mark.

1. Revitalizing the Public Domain

It is crucial to realize the benefits of openness to innovation and culture.[166] Moreover, considerations of the democratic requirements of (fundamental rights such as) freedom of expression and access to information should augment the economic definitions of the public domain.[167] Revitalizing the public domain also means regenerating the human right to freedom of speech and expression. Both the three-step test and its open ended exceptions and limitations and the fair use doctrine mirror the importance of the fundamental right to freedom of speech, and ought to be seen as an affirmative aspect of the public domain at large.[168]

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[161] On open data also see Van Eechoud, 'A publisher's intellectual property right: Implications for freedom of expression, authors and open content policies', (OFE Academic Paper 2017) 41 and Lawrence Lessig, *Code and Other Laws of Cyberspace* (Code 2.0 2006)

[162] Peter Stone, Rodney Brooks, Erik Brynjolfsson, Ryan Calo, Oren Etzioni, Greg Hager, Julia Hirschberg, Shivaram Kalyanakrishnan, Ece Kamar, Sarit Kraus, Kevin Leyton-Brown, David Parkes, William Press, AnnaLee Saxenian, Julie Shah, Milind Tambe, and Astro Teller. "Artificial Intelligence and Life in 2030." One Hundred Year Study on Artificial Intelligence: Report of the 2015-2016 Study Panel, Stanford University, Stanford, CA, September 2016. Doc: http://ai100.stanford.edu/2016-report Accessed 12 May 2019. Incumbents who benefit the most from status quo will lobby against open data policy. These settled market players -either from Europe, USA or Asia- should adopt an apollonian attitude in ideology and corporate philosophy. See section X.2

[163] Anneke Zuiderwijk and Marijn Janssen, 'The negative effects of open government data - Investigating the dark side of open data', ACM International Conference Proceeding Series (2014) 10.1145/2612733.2612761.

[164] Netanel, Neil Weinstock, 'Why Has Copyright Expanded? Analysis and Critique', in NEW DIRECTIONS IN COPYRIGHT LAW, Vol. 6, Fiona Macmillan, ed., Edward Elgar, 2008; UCLA School of Law Research Paper No. 07-34, Benkler, Yochai. (2003). Through the Looking Glass: Alice and the Constitutional Foundations of the Public Domain. Law and Contemporary Problems. 66

[165] Hugenholtz & Guibault (n 23), Samuelson (n 23)

[166] James Boyle, The Public Domain: Enclosing the Commons of the Mind, (Orange Grove Books 2008) 236

[167] Erickson, Kristofer, Defining the Public Domain in Economic Terms – Approaches and Consequences for Policy (May 9, 2016). Etikk i praksis. Nordic Journal of Applied Ethics 2016(1) pp. 61-74.

[168] David Lange, Reimagining the Public Domain, 66 *Law and Contemporary Problems* 463-484 (Winter 2003) https://scholarship.law.duke.edu/lcp/vol66/iss1/13, Erickson (n 167), Goldstein & Hugenholtz (n 8),

Empirical research concludes that companies are innovating with public domain material despite the absence of exclusive rights in the source material.[169] Overgrazing, overuse and underinvestment does not seem to be a concern. According to empirical study there is no tragedy of the commons.[170]

The boundary between private, monopolized domain and public, freely accessible domain has increasingly shifted towards enclosure and commodification in recent decades. This shift is caused by the ongoing horizontal expansion of IP that new technology brings with it. Disruptive innovation is 'an innovation that creates a new market and value network and eventually disrupts an existing market and value network, displacing established market-leading firms, products, and alliances'.[171] For every new disrupting tech, policy makers tend to invent a new layer of rights.

It is however a misunderstanding that more exclusive rights will automatically bring more innovation.[172] The opposite may be true in many cases: that intellectual property rights slow down innovation by putting myriad necessary licenses as roadblocks in the way of subsequent innovation.[173] Patent, copyright and database thickets result in 'a dense web of overlapping intellectual property rights that a company must hack its way through in order to actually commercialize new technology'.[174]

The IP thickets phenomenon has been extensively evidenced in academic literature.[175] In my own legal practice, I see the negative effect of an impenetrable forest of layers of rights on rapid innovation on a daily basis. This trend hinders smooth market entry and innovative performance of enterprises. It causes legal uncertainty and reluctance to entering into technology areas affected by thickets. Overprotection of information leads to market barriers for tech companies big and small.

It is key not to enclose the intangible commons of the mind, nor to monopolize the information commons. Information is a non-rivalrous resource.[176] Each information product or snippet is raw material for future innovation.[177] The most spectacular innovation our society has ever seen is built on an architecture that mixes freedom and control.[178] An innovation architecture that searches for an optimum after a balanced assessment of interests involved. An articulated public domain stimulates productive synergistic interactions.[179] To preserve an optimal level of overall societal progress, the erosion of the public domain must be reversed.

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[169] Erickson (n 167)
[170] Garret Hardin, The Tragedy of the Commons, (Science, 1968). See also Rose, Carol M., 'The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades and Ecosystems' *Minnesota Law Review*. 964 (1998)
[171] Joseph L. Bower, and Clayton M. Christensen, 'Disruptive technologies: catching the wave.' (Harvard Business Review 1995). See also Ab Rahman, Airini & Abdul Hamid, Umar Zakir & Chin, Thoo, 'Emerging Technologies with Disruptive Effects: A Review' (PERINTIS eJournal 2017-7) 111-128
[172] Boyle (n 166)
[173] ibid.
[174] 'Patent thicket' from Wikipedia: https://en.wikipedia.org/wiki/Patent_thicket accessed 12 June 2019
[175] James Bessen, 'Patent Thickets: Strategic Patenting of Complex Technologies' (SSRN Electronic Journal 2004) 10.2139/ssrn.327760. See also Cockburn, Iain & J. MacGarvie, Megan & Müller, Elisabeth, 'Patent Thickets, Licensing and Innovative Performance. Industrial and Corporate Change' (2010) 19. 899-925. 10.2139/ssrn.1328844 and Hall, Bronwyn & Helmers, Christian & Graevenitz, Georg & Bondibene, Chiara, 'A Study of Patent Thickets' (2013) 10.2139/ssrn.2467992.
[176] Lawrence Lessig, The Architecture of Innovation, 51 Duke Law Journal 1783-1801 (2002) 1798
[177] Boyle, James, The Second Enclosure Movement and the Construction of the Public Domain. Law and Contemporary Problems, Vol. 66, pp. 33-74, Winter-Spring 2003
[178] Lessig (n 176)
[179] Macmillan (n 63)

2. Res Publicae ex Machina: Public Property from the Machine

What would be the most feasible strategy to realise a vital public domain? When attempting to revitalize, refine and articulate the public domain, we can draw inspiration from Roman Law. The Romans invented public domain. They had more property options than we do nowadays: their public domain consisted of various forms of non-exclusive property. According to Boyle there can be many public domains.[180] Technological advancement in our present time allows for a more complex, yet more efficient, regulatory property regime by separating the traditional bundle of property rights into its different components.[181] This differentiation will lead to useful and effective propertization, as to a greater public domain.

Roman categories of non-exclusive property relevant for AI Made Creations are: *res communes, res communes omnium, res publicae, res nullius, res divini iuris, res universitatis* and *res patrimonium*. These can be considered as antonyms of exclusive property i.e. *res privatae*.[182] Building on the multi-layered property paradigm a new model of AI specific propertization can be imagined. An explicit public domain regime for AI Made Creations in the form of *Res Publicae ex Machina*: Public Property from the Machine.

This article proposes the following model:

- res publicae as species within the genus public domain.

- res publicae ex machina as species within the genus res publicae.

- res publicae digitalis (ex machina) as species within the genus res publicae ex machina.

+ formal AI public domain (PD) mark by a government institution, territory worldwide.

That should cover legal public domain status of both physical and intangible AI Creations and Inventions. They will be enshrined in a permissionless space where creativity and inventiveness can realm. The introduction of Public Property from the Machine is a *Pareto improvement*; many actors benefit from it while nobody -at least no legal person- will suffer from it.[183] If this model -or legal categorisation[184]- is adopted, no clearance ex ante or remuneration ex post would be necessary. No licenses and no infringement. Derivative works would be allowed without the need for permission or equitable compensation (no Copyleft).

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[180] Boyle (n 177). See also Waelde, Charlotte & Macqueen, Hector 'Intellectual property: The many faces of the public domain' (EEP 2007).

[181] Salzberger, Eli M., Economic Analysis of the Public Domain. THE FUTURE OF THE PUBLIC DOMAIN, Ch. III, pp. 27-59, Kluwer Law International, 2006

[182] Andreas Rahmatian, Copyright and Creativity: The Making of Property Rights in Creative Works (EEP 2011) 105

[183] van der Noll, Rob & van Gompel, Stef & Guibault, Lucie & Weda, Jarst & Poort, Joost & Akker, Ilan & Breemen, Kelly & Theeuwes, Jules, 'Flexible Copyright. The Law and Economics of Introducing an Open Norm in the Netherlands' 10.13140/RG.2.1.1691.6563 (IViR 2012) 63. It might even be a *Pareto superior move* in the sense that everybody involved is better off. See Lessig (n 161) 14

[184] On legal categorisation, conceptualisation and the legal recognition of res through the legal concept of real rights, see Rahmatian, Andreas, Intellectual Property and the Concept of Dematerialised Property (May 31, 2011). MODERN STUDIES IN PROPERTY LAW, Vol. 6, S. Bright, ed., (Hart Publishing, 2011) 21

Either Ginsburg's absence of upstream or downstream human involvement model, or Gervais' originality causation test can serve as public domain/copyright threshold criterium.[185] A complementary test can be found in the application of norms of Fishers' 4 theories of IP.[186]

3. Official AI PD Mark

According to Lange, public domain should be configured as a status, independently and affirmatively recognized in law.[187] As a positive space that offers affirmative protection against private appropriation.[188] Formalizing worldwide public domain status for AI Generated Works and Inventions would restore and expand the public domain for the common good.

A practical tool to formalize the legal concept of *Res Publicae ex Machina*, can be an official PD mark issued by a central government institution.[189] Since IP rights are territorial rights, this PD mark should be issued per country, per continent or even worldwide.[190] Confusion in the industry and uncertainty among the general public about AI & IP rights potentially leads to conflicts.[191] The proposed PD mark will help businesses and research institutions understand their core rights and thereby tackle the uncertainty that discourages AI start-ups and industry's development in general. The simpler, the more effective this permission free zone will be.[192]

An example of an AI Invention that qualifies as Public Property from the Machine and thus could be awarded with official Public Domain Mark status, is a flu vaccine autonomously brewed by an Australian pharmabot called SAM (Smart Algorithms for Medical Discovery).[193]

4. AI Assisted Creations

Authorial autonomy is declining in AI Assisted Creations. AI Assisted Works are born from hybrid human-machine collaboration. These joint works are exceedingly far away from the romantic notion of ex nihilo creation.[194] The presence of justified incentives could mean that AI Assisted Works will not meet the threshold criteria for public domain status – they would be granted conventional

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[185] Ginsburg, Jane C. and Budiardjo, Luke Ali, Authors and Machines (August 5, 2018). Columbia Public Law Research Paper No. 14-597; Berkeley Technology Law Journal, Vol. 34, No. 2, 2019. Available at SSRN: https://ssrn.com/abstract=3233885 and Gervais (n 31)

[186] This '4 Theories Test' gives different results for AI Assisted Creations and pure AI Generated Creations.

[187] Lange, (n 168)

[188] Ronan, Deazley, Rethinking copyright: history, theory, language (Edward Elgar Publishing 2006) p. 104

[189] Boyle (n 166) Successful commons always have some form of governance. See also Lessig, (n 176) 1799

[190] Such as the European patent, issued by the OHIM in Alicante, Spain.

[191] Yanisky-Ravid, Shlomit and Velez-Hernandez, Luis Antonio, Copyrightability of Artworks Produced by Creative Robots, Driven by Artificial Intelligence Systems and the Concept of Originality: The Formality - Objective Model (March 30, 2017). Minnesota Journal of Law, Science & Technology, Forthcoming. Available at SSRN: https://ssrn.com/abstract=2943778

[192] Lessig (n 16) 58 This also prevents unequal distribution.

[193] Kristin Houser, 'First Human Drug Developed Solely by AI Is a Vaccine' (Futurism, 15 July 2019), https://futurism.com/the-byte/first-human-drug-ai-flu-vaccine Accessed 16 July 2019. If the vaccine passes clinical trials, this opens the door for more AI developed medicines.

[194] See Bechtold, Stefan and Buccafusco, Christopher J. and Sprigman, Christopher Jon, Innovation Heuristics: Experiments on Sequential Creativity in Intellectual Property (December 15, 2015). Indiana Law Journal, 2016, Forthcoming; Cardozo Legal Studies Research Paper No. 475, and Sobel (n 46)

copyright or patent protection.[195] As mentioned, certain sectors lack clear economic justification for protection via IP rights, with or without AI.[196]

Ginsburg recently identified four IP relevant human-machine relationships.[197] Based on this approach, authorship on AI Assisted Creations can be allocated by ordinary users and AI programmers (the persons who designed the machine, wrote the software or trained the algorithm), or a combination of the two. In case legal actors such as the designer, owner or user cannot claim authorship, a creation remains authorless, and thus public domain. This would be the case if neither party can predict, foresee or control the machine enabled output.[198] In other words, if no human can claim to be sufficiently involved in the conception and execution of an autonomous entities' creation.

5. Human-Machine Collaboration Example

For illustrative purposes I produced an AI Assisted song, which can be streamed on Spotify.[199] This cinematic retrowave track was created by a human author using hardware (computer, synths, midi-controllers, soundcard), software, smart algorithmic tools, non-exclusive licensed samples and public domain samples (NASA recordings from Russian astronauts in the international space station). Because of built-in randomness in tailor made virtual software synthesizers and smart VST effect processors, each render (mix or master) of the song is slightly different. Using the same settings. Almost as if the system is 'alive'.

One can hear a female vocalist singing ''Beam Me Up, Take Me To Another Galaxy''. Counterintuitively, this quasi recitando, parlando section does not feature a human being, but a robot who's voice was made, tuned and refined (humanized) using voice generative software. Auditory anthropomorphism. She -or rather ''it''- has no recording rights, performance rights, copyrights or neighbouring rights on her performance or lyrics. Doctrinally, because she is a legal object[200] and she made no creative choices. Neither did the other machines used in the production of the song. There was no need to sign a record deal or a songwriter split sheet with this 'faithful agent' before the worldwide digital release of this track.

Furthermore, software user licenses prevent the allocation of copyrights in the master recording or the underlying music composition on behalf of the upstream programmers of the source code of the various software tools involved in the production of the track. This AI Assisted Creation is no *Res Publicae ex Machina.* The complete rainbow of rights layers vested in this human/machine collaboration (creative choices resulting in originality have been made) are owned by the composer and the producer of the song.

6. Shorter Copyright Duration

For AI Assisted Works limited copyright regimes could be imagined, with a short protection term of 15 years.[201] Another option for AI Assisted Works worth mentioning is a paying public domain, as

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[195] See also Ginsburg (n 34). Courts could (inter alia) use the human involvement model and/or the originality causation test to resolve conflicts about public domains status of AI Assisted Creations.
[196] Scherer (n 38), Fisher (n 42), Burk & Lemley (n 39)
[197] Ginsburg & Budiardo (n 30) The authors also proposed a very interesting conception-and-execution theory of authorship.
[198] ibid.
[199] Ulatek – Beam Me Up. Spotify link: https://open.spotify.com/album/50Jvh35koJUWxiJ2k9bNvs?si=LzXHc4wMQ_-MfuhTyFg2tg
[200] A smart VST (Virtual Studio Technology) instrument (a machine) has no legal personhood. It is a legal object.
[201] Jennifer Jenkins, In Ambiguous Battle: The Promise (And Pathos) Of Public Domain Day, 2014, 12 *Duke Law & Technology Review* 1-24 (2013). See also Pollock, Rufus, Forever Minus a Day? Calculating Optimal Copyright Term (July 19, 2009). Review of Economic Research on Copyright Issues, Vol. 6, No. 1, pp. 35-60, 2009, Landes,

supported by Victor Hugo during the development of the Berne Convention.[202] This solution aims to respect the author's moral rights and resembles the practical effect of neighbouring rights and the protection of derivative works. Another solution might draw inspiration from trademark law, database law and the Statute of Ann: an initial copyright protection term of 10 years that can be optionally renewed until a maximum duration of 50 to 70 years has been reached.[203] A final solution is to create zones of freedom, that simulate features of the public domain.[204]

Examples of private initiatives to pull information out of the enclosed domain -and in doing so restoring the public domain- are the Creative Commons movement, the Open Source concept, the Data Commons which enables R&D across and within datasets and the GNU General Public License. These initiatives use contractual tools (licenses) to establish privately constructed commons and maximize user rights, (usually not completely abandoning property rights)[205] such as access to scholarship and free software.[206]

IX. Ethics

When reflecting upon AI & IP, moral principles should not be absent.[207] Because of the elusiveness and transformative power of artificial intelligence, it is essential to include the safeguarding of fundamental freedoms and equal rights in the discussion about the application and implementation of smart robotics and AI systems in our society. This section explains the importance of ethics within the context of AI.

1. French Revolution Values

Humans are responsible for the role that artificial intelligence plays in society. Machines must become our supporters, not our opponents. Our allies, not our adversaries. Robots should be like a third hand to human kind.[208] It is key that -if technically possible- the fundamental norms and ethical values from the French Revolution of 1791, Equality, Freedom and Brotherhood, are programmed into the design of autonomous intelligent machines from the first line of code.

William M. and Posner, Richard A., Indefinitely Renewable Copyright (August 1, 2002). U Chicago Law & Economics, Olin Working Paper No. 154 and Boyle (n 166)

[202] Guibault, Lucie. (2006). Wrapping information in contract: how does it affect the public domain? in L. Guibault & P.B. Hugenholtz (eds), *The Future of the Public Domain*, 87–104 (Kluwer Law International 2006) 89

[203] The UK Copyright Act 1710 prescribed a copyright term of 14 years, with a provision for renewal for a similar term, during which only the author and the printers to whom they chose to license their works could publish the author's creations, see https://en.wikipedia.org/wiki/Statute_of_Anne

[204] Jenkins (n 201)

[205] Rahmatian (n 184)

[206] Jenkins (n 201) One could even take it a step further and argue that AI outputs are cultural heritage and thus belong in the public domain.

[207] For ethical norms in IP research, see: Robin Feldman, Mark Lemley, Jonathan Masur, Arti Kaur Rai, 'Open Letter on Ethical Norms in Intellectual Property Scholarship' (January 12, 2016). Stanford Public Law Working Paper No. 2714416; Duke I&E Research Paper No. 16-7; Duke Law School Public Law & Legal Theory Series No. 2016-9. Available at SSRN: https://ssrn.com/abstract=2714416

[208] For challenges regarding the development of intelligent autonomous machines see: P. Werkhoven, M. Neerincx and L. Kester. 2018. 'Telling autonomous systems what to do', In European Conference on Cognitive Ergonomics 2018 Proceedings, 8 pages.

2. Trustworthy AI

Europe has the lead in the ethical side of AI. The EC is -following the example set by IEEE and MIT- making serious work of accountable and ethical AI by Design.[209] Ethical AI by Design is about integrating ethical thinking in AI engineering practice.[210] It is about understanding and managing the ethical dimensions of AI development and implementation. Europe's efforts are directed to Trustworthy AI. The 2018 EU flagship report on AI identified the need for a clear ethical framework and guidelines on responsible AI design that should be compatible with the EU principles and regulatory frameworks.[211]

Furthermore, an independent High-Level Expert Group on Artificial Intelligence (HLEG) was setup by the European Commission, which drafted European ethics guidelines for AI. Building upon the shared values in the Treaties and the Charter. The HLEG's goal is 'to create a culture of "Trustworthy AI for Europe", whereby the benefits of AI can be reaped by all in a manner that ensures respect for our foundational values: fundamental rights, democracy and the rule of law.'[212]

Trustworthy AI has three components, which have to be met throughout the system's entire life cycle: legal, ethical and robust. The resulting Trustworthy AI assessment list can be used as technical/ethical/legal code of conduct in the same manner as the Dutch AI Impact Assessment.[213]

In the words of the HLEG[214], AI applications should respect seven key requirements to be considered trustworthy:

1 Human agency and oversight

Including fundamental rights, human agency and human oversight

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[209] For efforts in the USA, see 'Explainable Artificial Intelligence: Can We Hold Machines Accountable? A Q&A with Professors Surden and Kaminski', https://www.colorado.edu/law/2019/04/29/explainable-artificial-intelligence-can-we-hold-machines-accountable-qa-professors-surden, and Kush R. Varshney, 'Introducing AI Fairness 360', (IBM 2018) https://www.ibm.com/blogs/research/2018/09/ai-fairness-360/ accessed 12 May 2019

[210] See for example Kim Martinau, 'Ethical AI by Design', (MIT 2019) https://alum.mit.edu/slice/ethical-ai-design accessed 12 June 2019 and The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems https://ethicsinaction.ieee.org/ accessed 12 June 2019

[211] Craglia M. (Ed.), Annoni A., Benczur P., Bertoldi P., Delipetrev P., De Prato G., Feijoo C., Fernandez Macias E., Gomez E., Iglesias M., Junklewitz H, López Cobo M., Martens B., Nascimento S., Nativi S., Polvora A., Sanchez I., Tolan S., Tuomi I., Vesnic Alujevic L., *Artificial Intelligence - A European Perspective*, EUR 29425 EN, (Publications Office, Luxembourg, 2018) 61.

[212] High-Level Expert Group on Artificial Intelligence, 'ETHICS GUIDELINES FOR TRUSTWORTHY AI' (European Commission, 8 April 2019). See https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=60419 Accessed 12 May 2019. It is important that the time and energy invested in ethical AI does not slow down rapid technological advancement, innovation and AI implementation, but instead increases business competitiveness.

[213] See AI Impact Assessment | Netherlands, https://airecht.nl/blog/2018/ai-impact-assessment-netherlands The AI Impact Assessment offers AI developing companies, data scientists and software programmers a concrete code of conduct with which AI can be safely implemented. The AIIA is carried out by multidisciplinary teams. See also Mauritz Kop, 'AI Impact Assessment & Code of Conduct' https://ec.europa.eu/futurium/en/ethics-guidelines-trustworthy-ai/ai-impact-assessment-code-conduct Futurium, EU AI Alliance Best Practices Exchange (European Commission), 29 May 2019.

[214] High-Level Expert Group on Artificial Intelligence, 'ETHICS GUIDELINES FOR TRUSTWORTHY AI' (European Commission, 8 April 2019) (n 212) Note that these guidelines are non-binding and do not create new legal obligations. Instead, they create a moral obligation.

2 Technical robustness and safety

Including resilience to attack and security, fall back plan and general safety, accuracy, reliability and reproducibility

3 Privacy and data governance

Including respect for privacy, quality and integrity of data, and access to data

4 Transparency

Including traceability, explainability and communication

5 Diversity, non-discrimination and fairness

Including the avoidance of unfair bias, accessibility and universal design, and stakeholder participation

6 Societal and environmental wellbeing

Including sustainability and environmental friendliness, social impact, society and democracy

7 Accountability

Including auditability, minimisation and reporting of negative impact, trade-offs and redress.

X. AI & IP Policy: Regulating Disruptive Innovation

Intellectual property law has become the new battleground for ideas on how societies should deal with transformative change caused by disruptive tech.[215] While trying to fill legislative gaps when laws cannot keep up with the pace of innovation, lawyers are becoming the policy makers. In this context, this section presents 10 thoughts and policy suggestions on social, inclusive and innovation friendly AI and data regulation. I start with a short legal policy vision of the direction I feel we should take.

1. AI & IP for Dummies

More or less protection for the owner of IP rights has both advantages and disadvantages. More protection could stimulate costly and labour-intensive innovation, because that protection is offered as a reward. But the opposite, open access, also has social benefits. The degree of IP protection is therefore based on a consideration of pros and cons, and thus has a legal-political character.

IP law policy aims to implement a regime that strikes a balance between underprotection and overprotection of IP rights. A regime that searches for an innovation optimum. That this is not an easy task can be illustrated by IP history, which shows a pendulum swing that cycles between

[215] Peter Phillips, *Governing Transformative Technological Innovation: Who's in Charge?* (Edward Elgar Publishing 2007) 94-97. See also Giandomenico Majone, 'The Rise of the Regulatory State in Europe', West European Politics, 17, Iss. 3, (1994) 77-101. See also Feldman, Lemley, Masur & Rai (n 207). The concise nature of civil law code makes it difficult to draft. This potentially slows down the process of change, which has a negative effect on forces promoting transformative change.

underprotection and overprotection.[216] Right now, we are in a stage of overprotection.[217] In other words, intellectual property rights are getting too stretched. Besides that, IP law is poorly structured.

This is not good because disruptive technologies such as AI, blockchain and big data require a balanced, innovation friendly regime. Solutions to resolve negative effects that overprotection has are available. These include on the one hand technology-neutral open standards, exceptions or limitations such as the American fair use principle, with more breathing room for both consumers and online platforms. One the other hand the introduction of an articulated public domain for AI Creations and Inventions (*Res Publicae ex Machina*). In general, we need more flexible IP laws and more open access. IP overprotection leads to market barriers for start-ups and SME's and hinders international trade.

When expressing preference for open access, AI & IP policy makers should ask themselves 2 questions:

1. To what extent can the assessment of the magnitude of the advantages and disadvantages of more open access versus more layers of IP rights be substantiated?

This could -*inter alia*- be substantiated by sector specific empirical research.

2. And how and why do I weigh the pros and cons of this substantiation, and thus arrive at a preference for more open access?

The goal should be at least a *Pareto optimum/equilibrium*, and preferably a *Pareto improvement.*

2. 10 AI Related Policy Suggestions

First of all, In order to have a sensible -short to medium term- policy discussion about IP law in the context of emerging tech, it is important to demystify AI, resist anthropomorphisation and avoid speculation about the distant future. The state of the art is that we do not have Strong or General AI yet. What we have today is weak, pattern based AI that is reaching task specific performance.[218] It is a suite of tools that can be used for computer deductive reasoning and machine learning.

Second, the unchartered terrain of IP and AI law makes it possible for legislators to harmonize the acquis for AI internationally. For example, by introducing an official PD mark for AI Creations and Inventions (*Res Publicae ex Machina)*. A harmonized, global acquis prevents forum shopping to countries such as the UK, Australia and Japan and promotes legal certainty. It is vital that countries stop stretching IP rights at the expense of public domain and fundamental rights such as the right to information, as enshrined in the EU Charter and the USA Constitution.

Third, AI related IP law policy should recognize the social value of disruptive technology and resist protecting settled market players who benefit from status quo.[219] IP law should not create barriers for new market entrants.

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[216] Michelle Riley and David Haas, 'Intellectual Property Thought Leader Interview With Mark Lemley' (2016) https://www.stout.com/es-es/insights/article/intellectual-property-thought-leader-interview-mark-lemley

[217] This can be illustrated by impenetrable forests of layers of rights, IP thickets and rainbows of rights as discussed earlier in this article.

[218] Human superiority in chess, Go and poker has ended. Lawyers and policy makers should anticipate on AI getting stronger. See also: Noam Brown and Tuomas Sandholm 'Superhuman AI for multiplayer poker' (Science 2019) https://science.sciencemag.org/content/early/2019/07/10/science.aay2400 accessed 11 July 2019

[219] Mark Lemley and Mark McKenna, 'Unfair Disruption (February 28, 2019). Stanford Law and Economics Olin Working Paper No. 532; Notre Dame Legal Studies Paper No. 1926. Available at SSRN:

Fourth, AI governance should be human centred.[220] Global governance of AI and data should focus less on data ownership and more on data usage. Balancing privacy against innovation is a challenge. If we regulate data use in accordance with clear values about privacy and fundamental equality rights, the general public will be able to be confident about the flow of this data. People will have a feeling of being in control, and more trust in institutions on the web.[221] We need guidelines for a global governance framework and data architecture that integrate universal principles of fairness and sustainability to advance the growth and well-being of all countries and people.[222] The pros of such data usage regulation outweigh the cons of doing nothing. A decentralized cloud based on block chain principles could mitigate privacy concerns, data uncertainty, and a feeling of control loss. Only in this way privacy and access to information seem to be able to live together in cyberspace.

Fifth, countries should use instruments such as competition law, anti-trust law, contract law, consumer privacy protection[223], tax law[224], as well as penalty's and fines[225] to balance the effects of disruptive innovation and enable fair-trading conditions between digital platforms and users. Because of disproportionately large market power, ubiquitous mega platforms are becoming more important actors in the global arena than nation-states. This conflicts with consumer welfare. Copyright cannot correct skewness[226] (but should not make it worse), but competition law can.[227] A helpful option in bringing back harmony on the markets would be to ensure trading between a dominant digital platform and others on a FRAND basis (Fair, Reasonable and Non-Discriminatory). [228] Voluntary FRAND licensing is a proven mechanism that is relied on in both commercial contracts and regulation.[229]

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https://ssrn.com/abstract=3344605. Incumbents try to prevent market disruption using doctrines such as unfair competition, utility patent, antitrust and unjust enrichment. These tactics hinder innovation.

[220] See Floridi, Luciano, Soft Ethics and the Governance of the Digital and the General Data Protection Regulation (October 15, 2018). See also Stankovic, Gupta, Rossert, Myers and Nicoli (n 18)

[221] Dan Costa, 'Lawrence Lessig Is Fired Up About Campaign Corruption, Dangers of AI', PCMag 2018 https://www.pcmag.com/article/358802/lawrence-lessig-is-fired-up-about-campaign-corruption-dange accessed 12 May 2019

[222] Córdova (n 157)

[223] Michael Kearns, 'Data Intimacy, Machine Learning, and Consumer Privacy' (Penn Law CTIC Research Paper, 2018). See also Jack Balkin, 'The Path of Robotics Law' (May 10, 2015). Yale Law School, Public Law Research Paper No. 536, Ryan Calo, 'Robotics and the Lessons of Cyberlaw (February 28, 2014)', California Law Review, Vol. 103, No. 3, pp. 513-63 (2015) and Giancarlo Frosio, 'Why Keep a Dog and Bark Yourself? From Intermediary Liability to Responsibility' 26(1) Oxford International Journal of Law and Information Technology 1-33 (2018), Robert van den Hoven van Genderen, 'Privacy and Data Protection in the Age of Pervasive Technologies in AI and Robotics', European Data Protection Law Review. 3. 338-352 (2017), and M.J. Vetzo, J.H. Gerards & R. Nehmelman, *Algoritmes en grondrechten*, Den Haag: Boom Juridisch 2018.

[224] Mier y Concha (n 160) The author suggests a data tax.

[225] Fisher (n 42)

[226] Scherer (n 38)

[227] See also Drexl (n 123) and J.H. Reichman & Paul F. Uhlir, Database Protection at the Crossroads: Recent Development and Their Impact on Science and Technology, 14 Berkeley Tech. L.J. 793 (1999)\

[228] Heim & Nikolic, 'A FRAND Regime for Dominant Digital Platforms' (4IP Council 2 April 2019). On SEP licensing, interoperability and standardisation see: Ginevra Bruzzone and Sara Capozzi, 'Collaborative standardisation and SEP licensing: a EU Policy perspective' in Gabriella Muscolo & Marina Tavassi (eds) The Interplay Between Competition Law and Intellectual Property: An International Perspective, Kluwer Law International (March 2019)

[229] Heim & Nikolic (n 228)

Sixth, online behemoth platforms should adopt an apollonian attitude in world view, corporate ideology, philosophy of life and art.[230] With the apollonian, derived from the name of Apollo, the Greek god of the arts, one indicates everything that -compared to the dionysic in world view, doctrine and art- bears the characteristics of the static, balanced intellect and that which strives for size, order and harmony. It is an attitude on which reason, boundary and balance have their stamp.[231]

Seventh, encouraging smart, cross-sectoral public-private collaboration i.e. co-operation and synergy based on the triple helix model. With a focus on areas such as healthcare, energy, education and the facilitating role of the government. Multidisciplinary cooperation involving science and education, business, government and social representatives to jointly map the legal and ethical challenges, risks and opportunities of AI in the infosphere. The keywords here are inclusiveness, knowledge infrastructure, an innovation-friendly entrepreneurial environment and an economy based on joint knowledge and thinking. Best practices and sector-specific governance codes of conduct established through cross-sectoral public-private collaboration are important options for managing the transformative power of AI.

Eighth, synergetic effects with other merging tech such as blockchain, quantum computing and neuromorphic computing should be encouraged. Encouraging AI + Blockchain pilots is important, since these technologies can reinforce each other. DLT can fix traditional database-centric shortcomings. According to Mcconaghy, blockchain can transform and boost AI the way big data did before.[232] Blockchains' characteristics (decentralized / shared control, immutable / audit trails, and native assets / exchanges) encourage data sharing, and lead to better and new data models and more trustworthy AI predictions. Additionally, blockchain can be used control the upstream of one's data/ It can also be used as a tamper proof IP registration tool.[233]

Ninth, AI certification and standardization (such as ISO, ANSI, IEEE/IEC, compatibility and interoperability of IoT devices) should preferably not be done by private parties with commercial objectives, but by independent public bodies.[234] For instance in healthcare, enforcement should be carried out by a government agency/public body such as Farmatec in The Netherlands, via a multidisciplinary approach. Thus by healthcare experts, IT experts, ethicists and privacy experts together, coordinated by this central body. Instead of enforcement by notified bodies who have commercial interests when they issue a CE-marking. Similarly to the way the FDA (Food and Drug Administration) operates in the United States.

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[230] Terms, introduced by F.W. Nietzsche (1844-1900) in his Die Geburt der Tragödie aus dem Geiste der Musik (1872), and inspired by the philosophy of A. Schopenhauer (1788-1860). What would this -in concrete terms- mean for such platforms? A good start would be paying taxes and respecting consumer privacy.

[231] Algemeen Letterkundig Lexicon, available via DBNL (KB), https://www.dbnl.org/tekst/dela012alge01_01/dela012alge01_01_02017.php, Accessed 12 May 2019. With regard to the arts, the term 'apollonian' refers to light and comprehensibility, reason, symmetry, beauty and healing. According to Nietzsche, neither the apollonian nor the dyonisian ever prevails, due to each containing the other in an eternal balance. See also: https://en.wikipedia.org/wiki/The_Birth_of_Tragedy#The_book.

[232] Trent McConaghy, 'How Blockchains could transform Artificial Intelligence' (2016) https://dataconomy.com/2016/12/blockchains-for-artificial-intelligence/ accessed 12 May 2019

[233] ibid.

[234] See for example ISO/IEC JTC 1/SC 42, 'Standardisation in the area of artificial intelligence' https://www.iso.org/committee/6794475.html accessed 12 July 2019

Finally, machine learning can assist humans in making the best laws possible in a democracy, if the system is fed with proper data.[235] The result could be better rules in the form of computable laws, designed and reinforced by a digital government as a platform. Rules as Code (RaC). In case of IP law, there are just to many variables and stakeholders to deal with. Besides that, IP rationales are not working properly in the internet age and copyright law is currently poorly structured.

Computable law-making is already happening in NSW Australia, where multidisciplinary RaC teams are drafting and publishing rules from legislation, regulation and policy. In a human and machine consumable form.[236] Clear benefits of laws augmented by machine learning are improved policy outcome, consistency of application, less room for misinterpretation, faster deployment, increased legal certainty and public trust.[237]

3. HLEG Policy and Investment Recommendations

On 26 June 2019 the HLEG presented its Policy and Investment Recommendations for Trustworthy AI to the European Commission and Member States.[238] The document contains 33 recommendations, including 11 key takeaways, that can guide European AI towards sustainability, growth and competitiveness. The 11 key takeaways are:[239]

1. Empower and protect humans and society

2. Take up a tailored approach to the AI landscape

3. Secure a Single European Market for Trustworthy AI

4. Enable AI ecosystems through Sectoral Multi-Stakeholder Alliances

5. Foster the European data economy

6. Exploit the multi-faceted role of the public sector

7. Strengthen and unite Europe's research capabilities

8. Nurture education to the Fourth Power

9. Adopt a risk-based governance approach to AI and an ensure an appropriate regulatory framework

10. Stimulate an open and lucrative investment environment

11. Embrace a holistic way of working, combing a 10-year vision with a rolling action plan

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[235] Yanisky & Liu (n 106), Lohr (n 126). See also Harry Surden, 'Machine Learning and Law' (March 26, 2014). Washington Law Review, Vol. 89, No. 1, 2014.
[236] See Stanford FutureLaw Conference 2019 | Government as a Platform https://youtu.be/5EgO7WtMXYA accessed 12 May 2019
[237] ibid. Reasonableness, fairness, proportionality and tailor made solutions could be a challenge in early stage computable laws.
[238] High-Level Expert Group on Artificial Intelligence, 'POLICY AND INVESTMENT RECOMMENDATIONS FOR TRUSTWORTHY AI' (European Commission, 26 June 2019). See https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=60343 Accessed 27 June 2019.
[239] ibid.

The embracement of self-regulation flanked by risk based, proportional bottom up governance that doesn't stifle innovation but instead creates trust, awareness and legal certainty reflects an important shift in European AI Policy. In this innovation friendly approach, best practices and codes of conduct will play a prominent role.

XI. Conclusion

This article considers intellectual property rights as part of the overarching normative concept of information law. As such, IP law should contribute to a legal framework that best serves the information society, while respecting fundamental rights and freedoms.

As the cyberspace environment develops and expands, legal perceptions and rules need to evolve.[240] Copyright must be reconstructed into a framework of well-structured economic rights, where fair use that doesn't hinder scientific progress and human creators (authors and inventors) making a living is possible.[241] A system that would maximize creativity and diversity, freedom of expression and prosperity.

This article concludes that human authorship remains the normative organ point of intellectual property law and that (for now) smart robots have no -and ought to have no- legal personhood. The normative sources of theories of intellectual property are all weak rationales when applied to AI. Moreover, it is argued that AI does not need IP incentives. Extending copyrights slows down innovation, cultural diversity and even fundamental freedoms, and adding extra layers to the existing rainbow of IP rights is not a good solution to balance the societal impact of technological progress. Furthermore, extension is not useful since there are already enough IP instruments available.[242] Legislative gaps -if any- can be remedied by contracts, technological measures and generous application of fair use and the three step test.

Traditionally, human beings and property (such as AI systems and smart robots) are viewed as legal entities on the two opposite sides of a continuum. The article describes the absence of legal status for machines (which are legal objects) and explores possibilities for the construction of such a status in the form of dependent and independent legal personhood as well as legal agenthood.

The reality of autonomous computer systems supporting and even replacing humans in the invention process forces us to rethink the patent system, possibly even beyond rationales and justifications. Abolishing patent protection for AI Inventions[243] -including a formal public domain or open source status- appears to be the most innovation friendly option.

The article explains which IP rights can be vested in the various components of the AI system itself. An AI system globally consists of input data, software and hardware. From a legal point of view we can distinguish at least 7 relevant components: the computer program including the software source code and algorithms (1), the training data corpus (2), the neural network (3), the machine learning process (4), the AI applications (5), the hardware (6) and the inference model (7).

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[240] Lawrence Lessig, The Law of the Horse: What Cyberlaw Might Teach, 113 Harvard Law Review 501-549 (1999)

[241] Gervais (n 14)

[242] See also Deltorn, Jean-Marc and Macrez, Franck, Authorship in the Age of Machine learning and Artificial Intelligence (August 1, 2018). In: Sean M. O'Connor (ed.), The Oxford Handbook of Music Law and Policy, Oxford University Press, 2019 (Forthcoming) ; Centre for International Intellectual Property Studies (CEIPI) Research Paper No. 2018-10. Available at SSRN: https://ssrn.com/abstract=3261329

[243] Yanisky & Liu (n 106)

IP rights on these components can be owned by legal subjects only. The article argues that legal uncertainty about the patentability of AI systems is causing a shift towards trade secrets, in order to protect investments and monetize AI applications. Furthermore, it concludes that there are sufficient IP instruments to protect the various components of AI systems.[244] Even some protection overlaps exist because of theoretical cumulation of patents, copyrights, trade secrets and database rights.[245] New layers of rights do not seem to be opportune.

If, in the future, there would be a need to grant AI systems some form of legal personhood, these systems could own IP rights on other systems. If this ever happens, humans or corporations owning IP rights on AI systems that have legal personhood could be problematic, from a technical-legal point of view. Because IP rights cannot be vested in legal subjects.

Good quality shared data is (still) a *sine qua non* for successful AI.[246] The use of training corpora for AI systems usually has two relevant IP dimensions. The article discusses (clearance of) third party ownership rights on the input data and ownership of the processed output data. Economic analysis has shown that there are no convincing economic arguments for the introduction of a new IP right on data or a data producer property right, especially due to the lack of an incentive problem for the production and analysis of data.[247]

Parts of the Roman multi-layered property paradigm can be relevant for AI. Society can benefit from a newly proposed public domain model for AI Creations and Inventions that crossed the autonomy threshold: *Res Publicae ex Machina* (Public Property from the Machine), which should include an official (government issued) PD mark. The introduction of the legal concept of Public Property from the Machine is a *Pareto improvement*; many actors benefit from it while nobody -at least no legal person- will suffer from it.

For illustrative purposes, the article includes a human-machine collaboration example. The examined AI Assisted Creation (a sound recording of a musical work) can be streamed online and does not qualify as Public Property from the Machine. The article also describes a pure AI Invention that qualifies as Public Property from the Machine and thus could be awarded with official PD mark status: a flu vaccine autonomously brewed by an AI called SAM.

Lawyers and scholars who specialize in intellectual property law should strive for the highest achievable ethical standards in IP research and practice.[248] When reflecting upon AI & IP, moral principles should not be absent. The article explains the importance of ethics for the development and implementation of AI and discusses Europe's efforts towards Trustworthy AI. Trustworthy AI has

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[244] Exhaustion of certain aspects of patent rights and copyrights on sold instantiations or copies may apply. See also Shubha Ghosh and Irene Calbol, '*Exhausting Intellectual Property Rights: A Comparative Law and Policy Analysis',* (CUP 2018), 101

[245] See also Deltorn, Jean-Marc and Macrez, Franck, Authorship in the Age of Machine learning and Artificial Intelligence (August 1, 2018). In: Sean M. O'Connor (ed.), The Oxford Handbook of Music Law and Policy, Oxford University Press, 2019 (Forthcoming) ; Centre for International Intellectual Property Studies (CEIPI) Research Paper No. 2018-10. Available at SSRN: https://ssrn.com/abstract=3261329

[246] See also https://ec.europa.eu/knowledge4policy/ai-watch/topic/data-cornerstone-ai-%E2%80%93-toward-common-european-data-space_en accessed 12 May 2019. The need for training data may change when AI gets stronger.

[247] Kerber, Wolfgang, 'A New (Intellectual) Property Right for Non-Personal Data? An Economic Analysis' (October 24, 2016). Gewerblicher Rechtsschutz und Urheberrecht, Internationaler Teil (GRUR Int), 11/2016, 989-999. See also Landes, William M., and Richard A. Posner. "An Economic Analysis of Copyright Law." The Journal of Legal Studies, vol. 18, no. 2, 1989, pp. 325–363. JSTOR, www.jstor.org/stable/3085624

[248] See note 206

three components, which have to be met throughout the system's entire life cycle: legal, ethical and robust.

IP law policy aims to implement a regime that strikes a balance between underprotection and overprotection of IP rights. A regime that searches for an innovation optimum. More or less protection for the owner of IP rights has both advantages and disadvantages. More protection could stimulate costly and labour-intensive innovation, because that protection is offered as a reward. But the opposite, open access, also has social benefits. The degree of IP protection is therefore based on a consideration of pros and cons. The assessment of the magnitude of the advantages and disadvantages of more or less protection should be properly substantiated.

Finally, a small collection of AI related policy suggestions and recommendations include:

1. In order to have a sensible short to medium term policy discussion about IP law in the context of emerging tech, it is important to demystify AI, resist anthropomorphisation and avoid speculation about the distant future.

2. The unchartered terrain of IP and AI law offers legislators an important chance to harmonize the acquis for AI on an international level. In general, the article contends there should be less focus on enforcement and monopolization, more on access and remuneration.

3. Additionally, AI related IP law policy should recognize the social value of disruptive technology and resist protecting settled market players who benefit from status quo.[249] IP law should not create barriers for new market entrants.

4. That AI governance should be human centred. Global governance of data and the infosphere should focus less on data ownership and more on data usage.

5. Countries should use instruments such as competition law, anti-trust law, contract law, tax law as well as technological measures, to balance the effects of disruptive innovation and enable fair-trading conditions between digital platforms and users.

6. Online mega platforms should adopt an apollonian attitude in corporate ideology, world view and philosophy of life.

7. Smart cross-sectoral public-private collaboration based on the triple helix model should be encouraged since this co-operative, multidisciplinary approach has strong synergetic effects.

8. Synergetic effects with other emerging tech such as DLT, quantum computing, 3d integrated circuits, memristors and parallel, brain-inspired computing should be maximized. Blockchain can be used as a tamper proof IP registration tool and fix traditional database-centric shortcomings.[250]

A symbiosis between blockchain and AI as a fundament for trusted, secure decentralized shared datasets that preserve privacy is a promising AI pilot accelerator.[251] FIAR datasets are interoperable, increase public trust and deliver the much sought after hi-quality training corpora for public and private AI initiatives.

[249] Lemley & McKenna (n 219)
[250] McConaghy, (n 232)
[251] Thomas Hardjono Alexander Lipton Alex "Sandy" Pentland, 'Towards a Design Philosophy for Interoperable Blockchain Systems', MIT Connection Science Massachusetts Institute of Technology Cambridge, MA May 16, 2018. See also https://www.trust.mit.edu/

9. AI certification and standardization (such as ISO, ANSI, IEEE/IEC) should preferably not be done by private parties with commercial objectives, but by independent public bodies.

10. Lastly, machine learning can assist humans in designing better rules in the form of computable laws. The EU should learn from less successful legislative attempts including trade secret law discouraging information disseminations, copyright reform infringing on human rights and the *sui generis* database right leading to trade imbalances. In scenarios where protracted legislative processes hinder rapid innovation, legal sandboxes should be considered. It is argued that computational laws can achieve more consistent, effective and transparent legislation with the help of machine learning. This human-machine hybrid collaboration would lead to increased legal certainty and public trust.

*** *fin* ***