EDITORIAL

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Artificial intelligence, natural stupidity or artificial stupidity: who is today the winner in orthopaedics? What is true and what is fraud? What legal barriers exist for scientific writing?

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Natural stupidity of the orthopaedic surgeon: I have a problem: I do not really know what artificial intelligence is

At school, we learn calculating and drawing. In orthopaedics, it is useful: I find it relatively intelligent. It is often said that an orthopaedist is strong as an ox and agile as a chimpanzee, but neither can calculate.

Is it because the calculator has become ordinary that we really talk about artificial intelligence now; as the calculator has become an object of our daily life (on our phone), we prohibit it from being really intelligent; because we can explain to ourselves that a series of operations is not intelligent. So what ultimately differentiates artificial intelligence from a supercomputer: Is it a new intelligence?

It would undoubtedly be rather skull stuffing, a bit like the first navigation systems in surgery before robots.

Is she a fairy? Is the AI fairy at the bedside of orthopaedic patients?

For medical imaging, computing is not exactly new, but we can still say that with advances in algorithms, what we can call artificial intelligence, progress has been made. One option consists of combining digital models of the patient, whether in anatomy or physiology, with physical mathematical models to obtain a digital and personalised representation of the patient. That could be a personalised digital patient or an e-patient or a digital twin. The parameters and models of this replica are then used by digital medicine algorithms designed to aid diagnosis, aid therapy or even aid surgery as in robotics.

You miss a single pixel and everything is unlearned: is the "AI fairy" superficial?

How an orthopaedist should recognise a bone and a prosthesis comes down to knowing how to identify the contours of the cortex of the medulla, the drawing of a prosthesis and so on; any person who never studied medicine is able to recognise a prosthesis on a knee because abstraction comes naturally to the human brain.

This is not the same for neural networks and artificial intelligence which are made of building blocks called neurons connected in various ways. When connecting these neurons, the engineers make many choices and try how many layers of neurons are necessary for the network. The challenge is to recognise particular objects on images. The image enters the system at the first layer. At the next layer, the network can have neurons that simply detect the contours in the image, and then, the next one combines curve shape and texture for the bone, and the last one processes shape and texture to conclude the nature of the object: It is knee prosthesis! (Fig. 1).

Knee prostheses are not the same and there are differences in designs in the same way as not all bones have the same texture and the same contour and artificial intelligence can make mistakes even for such crude recognitions.

If artificial intelligence is currently capable of recognising knee prosthesis, it is not capable of diagnosing loosening of a knee prosthesis. Slight modifications introduced into the images by unsealing could fool artificial intelligence,

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Fig. 1 A digital painting by Ph. Hernigou made with help of AI

where the human eye is not fooled. Sometimes the modification of a single pixel can be enough to confuse artificial intelligence.

Is it creativity for orthopaedic journals?

It is obvious that publishers and authors of scientific articles are raw material suppliers for the artificial intelligence industry. AI needs reliable, recent and quality content from publishers and editors. Therefore, the giants of artificial intelligence inevitably require publishers at some point, even if, for the moment, they are undoubtedly relatively autonomous.

As artificial intelligence feeds in part on their content, the question will quickly become the following: how can the "orthopaedic academic world" try to negotiate a form of financial compensation for the use of orthopaedic articles? What strategy should be adopted after the new wave of generative artificial intelligence able to create texts and images from PubMed articles? A problem is occurring for publishers, whoever they may be.

Who should complain? The author who pays for open access, the Editor who selects the best papers or the publisher who sees the journal's content looted?

The "New York Times" filed complaint against Open AI and its partner Microsoft on December 27, 2023; this is undoubtedly the first conflict recorded with an American platform. Whatever they may be, professional organisations will ask themselves the question of their negotiation in a more (or less) grouped method. Complaints may emerge first from publishers deeming their content looted, and the publishers will try to negotiate contracts between a Press Group and an artificial intelligence manufacturer first.

It is also probably pretty evident that artificial intelligence groups have a paradoxical doublespeak. It is indeed difficult to know what belongs to artificial intelligence and what does not. Publishers will have to dialogue with the designer of the conversational chat robot GPT which in its version 4 is capable of analysing numerous articles from PubMed to create a new one without it being obvious whether the article is an original or an article created by artificial intelligence. It is also apparent that negotiations as the legal angle of attack are not as obvious as it might seem.

Charnley publication detected as written by AI: artificial intelligence or artificial stupidity

For the record, software detectors currently detect publications made by artificial intelligence rather than by human. These detectors have limitations that have been well evaluated. The most recent and efficient only detects 40% of texts written by artificial intelligence; 60%, despite being written by AI, are being recognised as written by humans.

Even more paradoxical is that having submitted a text written by Charnley on total hip arthroplasty, it was detected as being a text written by artificial intelligence. I do not know if this would have been flattering for Charnley, but it is undoubtedly one of the limits of the method. In the same way, portions of Shakespeare's text are detected as having been written by artificial intelligence! These two authors

were perhaps ahead of their time and more intelligent than we suspect: they were pioneers and created artificial intelligence hidden in their library. Conversely, artificial intelligences are much more artificial than intelligent in reality.

When the AI snake bites its tail. More artificial than intelligent!

Speaking about the two authors who are exceptionally well known, their writings were more or less copied in other articles or other books, and that ultimately, they are detected by artificial intelligence in their copies. These two authors were recognised for their intelligence but no one had labelled them with the adjective "artificial"; it will perhaps be necessary to define in the future whether the term immortal is synonymous with artificial! And to restrict copyright for prehistoric painters.

Everyone is speaking a double standard. Of course, the publishers hope for support from the public authorities, but we must not have too many illusions. All governments say they are committed to respecting copyright. Still, they are also necessarily favourable to innovation. They will want probably not take restrictive measures for all the artificial intelligence startups that will flourish in every country in the world.

Artificial intelligence and job destruction in the orthopaedic edition

What is complicated is that the deployment of artificial artillery-sat does not obey historical logic like agricultural jobs, which went to industry, then industrial jobs, which go to services. The spill is an effect of productivity gains released by technical progress in theory and also mechanisation, which affected agriculture at the end of the eighteenth century, then robotics for industry at the end of the twentieth century.

In the mid-1970s, with the tertiarization of the economy, jobs were lost in industry and new activities were created, accompanying technical progress and requiring more remarkable qualifications. In orthopaedic newspapers, printing services and adjustment of printing machines have been replaced by jobs in IT and undoubtedly network management for publishers to create industrial groups with the retraining of a certain number of people from traditional printing work to IT and digital editions.

But artificial intelligence will dampen the optimistic thesis according to which jobs destroyed by technical progress give rise to new, better qualified jobs, for several reasons:

first, there are no quaternary sectors in our economies, for the moment. The spill cannot be carried out to another sector. Concretely, in a way, there is a bottleneck. This bottleneck is very clearly visible for all structures that are used to offer correction of texts published in English by authors whose native language is not English. These jobs will disappear because artificial intelligence does just as well, if not better, in translation.

The spill today mainly concerns the tertiary sector where salaries are on average already high and economies of scale are limited, which will weaken the creation of jobs linked to artificial intelligence; finally, the number of jobs that will disappear will be much more important than the new very high-end jobs which will seek to incorporate artificial intelligence into the edition of orthopaedic journals.

We are, therefore, at a turning point in the economic logic that has operated since the twentieth century of the nineteenth century. The question now concerns the place of work in our society. Will there be enough work for everyone in a few years since the AI can replace the author, the reviewer, the language corrector, the editor and probably the publisher?

What makes it revolutionary, the stupidity or the intelligence of artificial intelligence?

So how can we ensure that AI does not create artificial stupidity? Artificial intelligence today is intensive computing with deep learning and big data, with a system related to an economic platform. This economy does not allow the possibility of producing the wealth it captures. Computational technologies—artificial intelligence in the broadest sense—are only useful on one condition: that they do not destroy the social system, but rather enable it to be rebuilt.

This may create a misunderstanding: when explaining that AI is revolutionary, people imagine the emergence of an AI with artificial consciousness, Hollywood-style. Quite the opposite may be also true. What makes AI revolutionary is its "stupidity". AI creates monopolies that are difficult to regulate, giving immense power to the GAFAs. AI could be as drugs: "The digital giants use AI to make their applications addictive, which enables them to collect the necessary mountains of data: this loop is self-perpetuating". In short, the addictive manipulation of our brains accelerates the efficiency of AIs: "The dumber an AI is, the more data it needs, the more our addiction is necessary". AI creates an ultra-complex world, half-real and half-virtual, "which requires extremely gifted human mediators". This will lead to an explosion in inequality, as "AI tamers become extremely wealthy". The world of AI is only readable by humans with a high level of conceptual intelligence: "Regulating Big Data

requires multi-disciplinary experts, who can handle IT, law and neuroscience… People capable of managing this politico-technological complexity are becoming the new aristocracy"; there is the risk that this aristocracy goes so far as to propose bypassing the democratisation of big data.

It will be difficult to create an "AI-friendly" world: as AI understands nothing, has no common sense and no critical mind, "we have to translate the world for it by tagging it, which accelerates the fusion of the real and the digital".

The integration of AI technologies into the process of writing scientific papers has streamlined workflows, improved efficiency and enhanced the overall quality of research output. The AI is making impact on the scientific paper writing by several levers:

The literature review and information retrieval is easier by automated literature searches made by AI-powered tools scanning vast databases and retrieving relevant articles, papers and research studies in both official published data and in the "grey literature" such as university thesis or student work. This accelerates and updates in "real time" the review process. The citation management is possible using AI tools that assist researchers in managing citations and automatically generating citation lists in various formats. This saves time and reduces citation errors.

The artificial intelligence could automatically generate abstracts for a scientific work and for publication. The AI algorithms can analyse the main content of a research paper and generate concise and accurate abstracts. This is a precious feature for researchers looking to quickly understand the key findings of a paper.

The AI-powered summarisation tools can analyse lengthy articles and condense them into shorter, more digestible summaries. Researchers can use these summaries to quickly grasp the main points of relevant studies without having to read through the entire text.

The proofreading and editing became easier using AI-driven grammar and style checking tools. These tools analyse the text for grammatical errors, punctuation issues and adherence to specific writing styles, ensuring that the final manuscript is well-written and conforms to established standards.

The AI-based plagiarism detection tools scan the manuscript against a vast database of existing academic content to identify and highlight any potential instances of plagiarism. This ensures the originality and integrity of the research.

The AI algorithms can assist researchers in analysing and interpreting complex datasets. From statistical analysis to data visualisation, AI tools provide insights that can be seamlessly integrated into the research paper.

Translation services are extremely useful for international collaborations; AI-powered translation services can help overcome language barriers, allowing researchers to collaborate and understand relevant literature from around the world.

The journal selection assistance can be oriented by AI tools in recommending suitable journals for manuscript submission based on the topic, keywords and the style of the paper. This helps researchers target the right audience and increases the chances of successful publication.

The collaborative writing tools could be enhanced by the AI platforms that facilitate real-time collaboration amongst researchers, allowing them to co-author papers efficiently. These platforms often include features like version control, comments and suggestions.

The integration of AI into scientific paper writing has revolutionised the research process. By automating time-consuming tasks, improving accuracy and enhancing collaboration, AI technologies contribute to more efficient and impactful scientific communication. As technology continues to advance, the role of AI in scientific writing is likely to expand, further supporting researchers in their quest for knowledge dissemination and discovery.

In the current era of computers, digital transformation and governance, anyone with access to the internet has free access to artificial intelligence (AI) applications to write and to translate books and papers and to generate research, as well as and to construct scientific manuscripts [1–3]. However, with the widespread use of internet, plagiarism may have increased; the use of internet opens convenient opportunities for students to find and copy information, as well as to connect with ghost-writers, ghost-authors and gift-authors [4]. Yet, the internet also provides enhanced opportunities for detection of plagiarism and scientific misconduct [4, 5].

Various definitions and types of plagiarism have been reported such as clone, ctrl-c, find-replace, remix, recycle, hybrid, mash up, error 404, aggregator, re-tweet, citation plagiarism, citation amnesia, disregard syndrome or bibliographic negligence. Stigler's law of eponymy states that fundamental discoveries are named after the person who made them famous, not the person who made them first, and these are often not the same person [6–9]. Additionally, plagiarism has been rising from before to after the internet era [10]. Previous studies found that more than half of all students had inappropriately referenced paraphrased material, but less than half of the same cohort of students understood that this constituted plagiarism or fraud [11, 12].

Although there is no absolute or universally accepted definition of plagiarism, it should be clarified to authors and scientists that plagiarism is not only about copy-and-pasting text without putting in quotes or adding citation of the original report, but it is more importantly an ethical issue about attributing ideas that belong to someone else [10]. AI implementation in medicine including Orthopaedics is not without ethical and medico-legal considerations; it is not clear how medico-legal issues will apply to AI such as

when a physician will make a wrong diagnosis based on an AI application, an autonomous AI surgical robot will experience a surgical complication or synthetic data generation will ends with scientific misconduct [13].

AI in education—authorship and teaching

Currently, there is a growing amount of research papers with the application of AI in medical writing and editing [2, 14–17]. AI technology is currently used to translate books, to check the writing for clarity and spelling and to evaluate for misconduct mainly plagiarism and collateral issues in authorship. Although some AI software is capable to write novel research, AI methods cannot be listed as authors in papers [1, 3], and cannot replace teachers in current education process.

The AI chatbot ChatGPT was released in November 2022; its gratuity and easy access have brought the capabilities of such tools, known as large language models (LLM), to a mass audience [18]. The major concern in the research community is that students and scientists could deceitfully pass off LLM-written text as their own, or use LLM in a simplistic fashion such as to conduct an incomplete literature review and produce unreliable work. To avoid accreditation of such software with formal authorship, some publishers have put rules about using LLM. Springer Nature journals have formulated the following two principles: first, no LLM tool will be accepted as a credited author on a research paper; and second, researchers using LLM tools should document this use in the methods or acknowledgements sections [18]. As AI writing improves and AI writing software becomes freely available as open-source software, the concern regarding the originality, integrity and appropriate citation of written papers will be increased. Unfortunately, in the game of the impact factor and pressure to publish by authors/universities, authors will seek for automation of publication using AI writing technologies in order to succeed professionally.

The term post-plagiarism has been coined to describe an era in human society in which advanced technologies, including artificial intelligence, and neurotechnology, including brain-computer interfaces, are a normal part of life, including how we teach, learn and interact daily. In this era, ethics and integrity are intensely important [19]. Hybrid writing co-authored by human and AI will becoming prevalent and will soon become the norm; the probability of accurately detecting whether this text was written by human or by AI will gradually diminish; human creativity is expected to enhance, not to be threatened by AI; AI will not replace physicians, but medical professionals who use AI will replace those who do not

[16, 20, 21]; AI will help transcend language barriers and copy-and-paste text without appropriate credits will diminish [19].

Current educational practices meet cutting-edge technology including AI with advanced machine learning algorithms, synthetic data generation, digital textbooks and smart tutoring systems. In this setting, AI is expected to make things easier and more efficient for the teachers. AI provides for scalable and accessible education such as online courses with enrolment of a large amount of learners, as well as for customization and personalization of learning experiences. However, AI will not replace teachers, but rather it is a powerful tool that should be embraced by teachers to provide support and enhance teaching, make administrative tasks more efficient and personalise learning experiences. Teachers should implement AI tools and integrate them into their lessons and research to enhance learning. Teachers have role models in education systems, offering emotional relationship, inspiration, mentoring and leadership in education. AI can be a supportive tool for teachers to provide automated grading and feedback systems, data-driven instructional decisions, intelligent tutoring systems and adaptive learning platforms, and virtual reality and simulations for experiential learning [22].

Importantly, education is a deeply human experience that thrives on interactive connection and collaboration; it is not just about acquiring knowledge, but it is about shaping young minds, instilling values and nurturing human connections [23]. Teachers should encourage their students to be critical consumers about the results of their interactions with AI as well as about the bias, inequity and exploitation that may be a part of the tools they are using. Teacher intelligence is far more effective in fostering human connections, providing real-time adaptability and promoting critical thinking and creativity, emotional intelligence, trust and ethics [24].

AI in publishing—implications for copyright

Creating papers using AI could have very important implications for the copyright laws. These papers could in theory be deemed free of copyright because they are not created by a human author. Two legal options have been reported for work where human interaction was minimal or non-existent: either deny copyright protection or attribute authorship to the creator of the software. There are indications that the laws of many countries are not amenable to non-human copyright. In the USA, the Copyright Office has declared that it will "register an original work of authorship, provided that the work was created by a human being". In Europe, the Court of Justice of the European Union (CJEU) has also declared that copyright only applies to original works, and that originality must reflect the "author's own intellectual

creation". This is usually understood as meaning that an original work must reflect the author's personality, which clearly means that a human author is necessary for a copyright work to exist. The second option, that of giving authorship to the programmer, is evident in a few countries such as Hong Kong, India, Ireland, New Zealand and the UK. This approach is best encapsulated in UK copyright law, which states: "In the case of a literary, dramatic, musical or artistic work which is computer-generated, the author shall be taken to be the person by whom the arrangements necessary for the creation of the work are undertaken". Things are likely to become more complex as use of AI is becoming more widespread and computers are getting better at producing creative works [25].

On March 15, 2023, the US Copyright Office announced that works created with the assistance of AI may be copyrightable, provided the work involves sufficient human authorship. Only material that is the product of human creativity is eligible for copyright registration under US law; works created by AI without human intervention or involvement still cannot be copyrighted, as they fail to meet the human authorship requirement. Copyright applicants must disclose when their work includes AI-generated material, and previously filed applications that do not disclose the use of AI must be corrected [26].

At *International Orthopaedics*, we observe that AI is becoming part of medicine, medical writing and publishing. We aim to publish quality research, and we encourage novel methods to conduct research provided that they are clearly described and detailed explained [13]. We embrace AI hoping to drive medical writing and editing forward, to deliver valuable insights in medical research and published science. We consider the evolution of technology and AI as an opportunity for higher education, and we are using AI software to detect plagiarism and fraud of submitted papers in writing, illustrations, referencing and authorship. We concur that this software could make errors and we pay attention not to accuse the authors for high false positive rates. However, we inform the authors for the results of screening and positive plagiarism, and we encourage them for quality papers with appropriate citations. We believe that the only effective method to understand original work is authors' acknowledgment of AI implementation in writing and education for academic integrity, and we encourage authors for honest and ethical research with transparent methods and appropriate citations.

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