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Patent Law & Metaverse

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Abstract: The metaverse offers to users a lot of opportunities to develop inventions such as hardwares, softwares, tools and technologies enabling a completely realistic immersive experience. Inventions can be developed for and in the metaverse. Regarding such new technologies, any patent lawyer may raise the question of patentability: Under which conditions can an invention be patentable? The answer depends on the choice of law. Some inventions may be patentable according to major jurisdictions, providing that the patent applicant meets the legal requirements for patentability. But certain legal systems refuse to grant utility patents on the grounds of public order. This Chapter intends to analyse and discuss the patentability of inventions developed for and in the metaverse, with the understanding that utility patent issues are far more insightful than design patent ones.

Keywords: Metaverse; Inventions; Utility Patent; Design Patent; Patentability; Public Order.

INTRODUCTION

The metaverse has much to offer to users, who are able to engage in creative collaboration with other users via their own avatars (or virtual representations), thus to design, build, and own virtual real creations. There are three categories of metaverse: Online game platforms such as *Minecraft*, *Fortnite*, and *Roblox*, also known as ‘massively multiplayer online role-playing games’ or MMORPG; Social media platforms such as *Horizon Workrooms*, created by Meta, and *Second Life* known to be the first metaverse platform; And corporate or industrial metaverse platforms, designed for internal use only, like the one created by the French Corporation Dassault Group. *Roblox* is another online game platform which allows users to program and play games through a virtual currency called *Robux*. In contrast to a private or centralized version of a metaverse, a crypto metaverse is decentralized and based on blockchain technologies. No one person or entity owns or controls a decentralized metaverse, as compared with proprietary metaverses. Meta Platforms, Inc. and Microsoft are both pursuing proprietary metaverses, whereas *The Sandbox* and *Decentraland* are creating decentralized metaverse platforms that are developed and governed by the users.

A large number of metaverse platforms use extended reality technologies (XR) in the form of augmented reality (AR) technology, virtual reality (VR) system or mixed reality program (MR). In the first case, the metaverse places virtual objects in actual space: Such a technology is called augmented reality (AR). For example, Niantic, Inc., the publisher of the popular *Pokémon* game series, published *Pokémon Go*, an AR mobile game. Each user in *Pokémon Go* had its own avatar, which was placed in a virtual map corresponding to a realworld geographic location. As users walked around, so did their avatars. The mobile game also offered an AR mode, which displayed different *Pokémon* appearing in the realworld environment by superimposing them on the view taken in with the camera on a user’s device. Ikea also uses AR technology allowing

consumers to place virtual copies of *Ikea* furniture in a room to test how they look and if they fit with existing furniture. In contrast, in the second case, the user may be placed in an immersive experience of a virtual world to potentially interact with others: Such technology is known as virtual reality (VR). With this VR system, metaverse users can attend virtual shows, like the live one staged by Young Thug, Chainsmokers, and David Guetta in *Horizon Worlds*. The VR headset—the *Oculus Rift*—offered a new, immersive portal to virtual worlds and metaverses. This is what *Second Life* offered back in 2003, and what the metaverses are trying to offer today and promises to offer in the future. In February 2019, *Fortnite*, one of the most popular online video games, where players would build forts and defend them against attacks of zombie armies or travel to distant virtual worlds, began to evolve from its game playing roots into a more immersive shared experience, with its first ever live concert by the band *Marshmello*, attended by over 10 million players. *Fortnite*'s virtual world (or metaverse) showcases that the opportunity for virtual shared experiences in the metaverse is constantly evolving. Some technologies allow physical and virtual objects co-exist in mixed reality environments (MR) and interact in real time. Mixed reality that incorporates haptic technology has sometimes been referred to as visuo-haptic mixed reality. Mixed reality has been used in applications across fields including design, education, entertainment, military training, healthcare, product content management, and human-in-the-loop operation of robots. The movie *Ready Player One*,¹ directed by Steven Spielberg in 2018, provides a perfect overview of the effects of haptic technology. The film featured people entering an interactive virtual world called *Oasis*, using goggles like the Oculus Rift.25 and body armor which provides them with haptic feedback, so that when the avatar is hit in *Oasis*, its user feels it in the real world.

Obviously, the metaverse is also an ideal advertising space for corporations, with virtual billboards being seen by millions of people. Such an immersive world brings with it both new opportunities and new challenges for intellectual property, especially patents. The legal issue concerns the patentability of creations made in the virtual worlds such as *Decentraland* and *The Sandbox*. Are inventions made in the metaverse patentable?

Patents come in two forms: utility patents covering novel and useful inventions, and design patents covering ornamental design. Creations made in the metaverse could be granted both utility or design patents. Indeed, designers may patent only creations which are qualified as inventions. However, the notion of invention is not legally defined. For example, neither the Paris Convention for the Protection of Industrial Property,² nor the Patent Cooperation Treaty³ provide a definition of 'invention'. The European Patent Convention only gives a negative definition when expressly excluding discoveries, scientific theories and mathematical methods, aesthetic creations, schemes, rules and methods for performing mental acts, playing games or doing business, programs for computers and presentations of information.⁴ Western legislators have not made any attempts to define the term 'invention'. The legal definition was left to scholars and the courts through a number of case law tried to aid what constitutes invention.⁵ According to French Professor Michel Vivant, "there is invention each time an intellectual process, whatever it is, allows to end in an innovation being supported on knowledge stemming

¹ *Ready Player One*, directed by Steven Spielberg, Warner Bros. Pictures 2018.

² Paris Convention for the Protection of Industrial Property, 20 March 1883, in force 3 June 1984.

³ Patent Cooperation Treaty, Washington, 19 June 1970, in force 1 June 1978, known as PCT.

⁴ Article 52(2) of the European Patent Convention, 5 October 1973, in force 7 October 1977.

⁵ *United Mattress Machinery Co. v. Handy Button Machine Co.*, 207 F.2d 1, 5 (3d Cir. Del. 1953).

from hard sciences.”⁶ Invention is also defined by U.S. case law to include “any new and useful process, machine, manufacture or composition of matter and thus is broad enough to include method patents.”⁷ In short, the World Intellectual Property Organization (WIPO) defines the invention as “a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem.”⁸ Regarding the conditions for patentability, “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.”⁹ The usefulness of the invention is a criterion specific to U.S. patent law. According to 35 U.S. Code § 101, “Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.”

In the past five years, metaverse-related patent applications covering hardware and software in a variety of technologies have exploded, indicating that the colonization of the metaverse is well under way. Many of the hardware patents are related to devices used to enter the metaverse, such as VR and AR glasses, while most of the software patents are also related to the user experience. Such observation leads us to distinguish between two types of inventions: (A) inventions developed for the metaverse and (B) inventions developed in the metaverse.

A. INVENTIONS DEVELOPED FOR THE METAVERSE

The metaverse is a digitally-enabled virtual reality environment. It uses AR and VR to enable users to interact with 3D digital objects. It can be explored by users using VR headsets and gloves as well as sensors. The most far-reaching vision of the metaverse is the development of brain-computer interfaces. These devices aim to replace screens and physical hardware. A few models include sensory inputs such as sound, smell, and touch. All of these devices and systems consist in inventions developed for the metaverse. Some of them are patentable, but some of them are not. Thus, the principle is the patentability of the inventions, but this principle is limited by the compliance with public policy.

a. Patentable inventions

In general terms, patents can be granted for either hardware components or for software processes. Generally speaking, if they provide a technical solution to a technical problem, then it is possible to patent them. As regards hardware patents, they are usually sought in relation to devices and gear that are used to enter into the metaverse, like VR or AR glasses, processors and storage mediums. Obtaining software patents for metaverse technologies is comparatively more complex. As to software-related patents, computer programs per se are not patentable, whereas computer-implemented methods are. If a software-based invention can be proven to have a technical application or implementation, then patents can be granted. Much of the software in the metaverse is used for simulation of either, the real world or virtual situations.

⁶ Michel Vivant, "La privatisation de l'information par la propriété intellectuelle", in *Revue internationale de droit économique* 2006/4 (t. XX, 4), p. 373.

⁷ *Cardiac Pacemakers, Inc. v. St. Jude Med., Inc.*, 576 F.3d 1348, 1362 (Fed. Cir. 2009).

⁸ <https://www.wipo.int/patents/en/>

⁹ European Patent Convention, Art. 52 (1).

For example, algorithms for generating and moving virtual shapes and scenes in a VR environment based on hand gestures are patented, as well as head motion, or line of sight of the user; systems for generating haptic feedback corresponding to users' interaction with virtual objects in a virtual environment; and methods for generating 3D avatars of the users, which emulate users' appearance and behavior, to name a few.

Following Articles 2(c) and 3 of the European Patent Convention, a computer program claimed 'as such' is excluded from patentability. In IBM Case,¹⁰ the Board of Appeals for the European Patent Office (EPO) concluded that "computer programs as such" referred only to those that were non-technical in character. It does not make any difference whether a computer program is claimed by itself or as a record on a carrier. In short, software-based inventions are patentable provided that they have technical character, if they cause a technical effect when run on a computer.¹¹

In 2014, the U.S. Supreme Court, in its *Alice Corp. v. CLS Bank International* decision,¹² provided additional considerations for software-related inventions. In particular, the U.S. Supreme Court warned that software inventions directed to mere 'abstract ideas' are not 'patent-eligible' (i.e., cannot be patented). What is an 'abstract idea' exactly? Unfortunately, the Supreme Court did not provide a bright-line test, and lower U.S. courts continue to grapple with the definition. The Supreme Court, in *Alice*, did provide a general test: We know that it is not enough to claim a generic computer with an overbroad idea. In the words of the Supreme Court: "[S]tating an abstract idea while adding the words 'apply it [with a computer]' is not enough for patent eligibility." Since the *Alice* decision, however, the Federal Circuit, a specialized court that reviews all patent-related appeals in the U.S., has routinely found software-related inventions patentable. For example, post-*Alice*, the Federal Circuit stated: "We do not read *Alice* to broadly hold that all improvements in computer-related technology are inherently abstract".¹³

A review of Federal Circuit decisions reveals that a best practice to demonstrate patent-eligibility is to focus on how a software-related invention provides a 'specific improvement' over the 'prior art' (i.e., existing technology). Such a strategy includes the description of an improvement in the patent specification, the distinction between the improvement and the prior art, and the recital of the improvement in the patent claims. The Federal Circuit has routinely found patents as eligible that use this strategy.¹⁴ Fortunately, because software typically executes on some type of underlying computing device (e.g., such as a smartphone, a laptop, a server, a cloud platform, etc.), an inventor can typically describe how a given software-related invention provides one or more improvements to the underlying computing device. Examples of 'improvements' include the following describing: Increasing the speed or efficiency of the underlying computing device; Reducing the processing requirement or memory usage of the

¹⁰ Case T 1173/97.

¹¹ *Microsoft/Clipboard formats* (T-424/03).

¹² *Alice Corp. v. CLS Bank International*, 573 U.S. 208 (2014).

¹³ *Enfish, LLC v. Microsoft Corp. et al.*, 822 F.3d 1327 (Fed. Cir. May 12, 2016), refusing to create "a categorical ban on software patents".

¹⁴ *Core Wireless v. LG Electronics*, 880 F.3d 1356 (Fed. Cir. Jan. 25, 2019), analyzing an invention directed to a graphic user interface (GUI) software invention and identifying a pattern for "improvement" (based patents, stating that: "[I]ike the improved systems claimed in *Enfish*, *Thales*, *Visual Memory*, and *Finjan*, these claims recite a specific improvement over prior systems, resulting in an improved user interface for electronic devices.").

underlying computing device; Increased security; Improved computer network communication and/or operation; Describing a specific improvement over the prior art (existing technology).

Indeed, the difference relies on whether the industrial application requirement is fulfilled, in the sense that if the computer program brings a technical solution to a technical problem, it can be patentable. Patent claims must emphasize technical improvements of the technology, incorporate technical steps that can be argued as non-abstract, and ensure that a specification sets out a problem-solution combination that can be tied to a practical application. When preparing a patent application for a software or a computer-implemented invention, a best practice includes describing, in the patent specification, how the software or computer-implemented invention improves an underlying computing device. And of course, the invention needs to comply with the usual requirements for patent registration: Novelty, inventive step, and industrial application.¹⁵

Many patented inventions concern cryptocurrencies and blockchain, AR and VR headsets, and other technologies prevalent in the metaverse. Here are some examples of patented inventions:

Meta has filed patent applications to alter the users' experience in the metaverse, by allowing them to customise the objects and locations that can be found in the metaverse. Other patentable inventions includes an 'avatar personalisation engine' that reproduce the appearance of a real person into an avatar, only by using one picture. Moreover, another patent was filed by the company, consisting of a device that is able to track the users' facial expression and based on the response, will adapt the content displayed. Therefore, the objective pursued by those inventions seems to be designed to allow advertisers to launch more targeted advertisements of their products in the metaverse.

Apple, Inc. filed in 2021 a patent application before the United States Patent and Trademark Office (USPTO) related to the metaverse, consisting in a technical solution that will allow to exclude individuals who have violated the interaction rules established. In other words, the technical solution designed by Apple will allow users to block an avatar that insulted or attacked another one, just like on social media platforms. In this way Apple seeks to obtain protection for its technical solution specifically for the metaverse.

A company called Immersion has patented six inventions covering what are called haptic effects, the process of feeling or touching virtual objects. Disney is reported to have obtained a patent in the US for a virtual world simulator.

Back in 2019, Nike obtained a patent for including blockchain technology to their physical sneakers, hence when a consumer would buy a pair of shoes, they would automatically obtain a token that stated the ownership of the product. In this way, the company sought to foster the authenticity of their shoes. Once purchased, the user will be able to virtually enjoy its brand-new Nike's *CryptoKicks* shoes in Nikeland, the metaverse created by the company.

The issue of patentability of interoperability or compatibility between two or more different metaverse platforms may also be raised. This is not currently the case, and it will be interesting to see who ultimately decides the standards for interoperability: Meta or the marketplace in

¹⁵ Article 52(1) of the European Patent Convention: "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".

general. In the meantime, it can already be stated that interoperability and compatibility systems are patentable as they cause a technical effect. A key aspect of interoperability is standard-setting and the use of patents necessary to implement such standards, which can lead to disputes between market players on the determination of FRAND (fair, reasonable and non-discriminatory) terms for the licensing of standard-essential patents.

Hardware-related and software-related inventions are patentable as long as they are licit, that is, they are not formally excluded from patentability. That would be the exception to patentability.

b. Exceptions to patentability

Some legislations expressly prohibit the granting of patents over certain types of inventions. Following Article 53 of European Patent Convention, European patents shall not be granted in respect of inventions the commercial exploitation of which would be contrary to 'ordre public' or morality; Such an exploitation shall not be deemed to be so contrary merely because it is prohibited by law or regulation in some or all of the Contracting States.

For example, most patent offices would refuse to grant utility patents over inventions which are contrary to human dignity or disregard the dignity of a creature, or in any other way contrary to public order or morality, as well as over methods of cloning human beings, and methods of modifying the genetic identity of the human being.

The Court of Justice of the European Union (CJEU), in its *Brüstle* decision, excludes an invention from patentability where the technical teaching which is the subject-matter of the patent application requires the prior destruction of human embryos or their use as base material, whatever the stage at which that takes place and even if the description of the technical teaching claimed does not refer to the use of human embryos.¹⁶ Mr *Brüstle* was the holder of a German patent, which concerns isolated and purified neural precursor cells, processes for their production from embryonic stem cells and the use of neural precursor cells for the treatment of neural defects. It was claimed in the patent specification filed by Mr *Brüstle* that the transplantation of brain cells into the nervous system is a promising method of treatment of numerous neurological diseases. The first clinical applications have already been developed, in particular for patients suffering from Parkinson's disease. In order to remedy such neural defects, it is necessary to transplant immature precursor cells, still capable of developing. In essence, that type of cell exists only during the brain's development phase. The use of cerebral tissue from human embryos raises significant ethical questions and means that it is not possible to meet the need for the precursor cells which are required to provide publicly available cell treatment. According to the CJEU, Mr *Brüstle*'s invention did not fulfill the legal requirements for patentability, in its last condition: The non-compliance with public order.

Public policy infringement could also be blamed to Palmer Luckey, Oculus founder who claims he designed a new VR headset that actually kills you if you die in a game. Famous VR developer Palmer Luckey recently developed a virtual reality headset rigged with bombs such that, if you lose the game, the headset explodes and kills the user. Palmer Luckey said the device was inspired by *Sword Art Online*, the Japanese novel series-turned-anime in which players are

¹⁶ Case C-34/10, *Oliver Brüstle v. Greenpeace e.V.*, Judgment of the Court (Grand Chamber) of 18 October 2011.

trapped in an online role-playing game where death in the game means death in the real world because of the killer ‘NerveGear’ headset they wear. “The idea of tying your real life to your virtual avatar has always fascinated me – you instantly raise the stakes to the maximum level and force people to fundamentally rethink how they interact with the virtual world and the players inside it,” Luckey wrote in a now-viral blog post. “Only the threat of serious consequences can make a game feel real to you and every other person in the game.” Luckey explained that the device is connected to “three explosive charge modules” that are tied to a “narrow-band photosensor that can detect when the screen flashes red at a specific frequency.” “When an appropriate game-over screen is displayed, the charges fire, instantly destroying the brain of the user,” he said. Way back in 2002, two German designers developed a form of *Pong* that painfully shocked users when they lost. The console, titled the “*Painstation*”, was, hopefully like Luckey’s user-killing VR headset, more of an art project than a real product destined for market.

Luckey’s new creepy User-Killing VR Headset invention would never be patentable under jurisdictions that prohibit patentability of inventions contrary to public policy. But in some states, such legal prohibition does not exist. For example, the U.S. Patent Act (35 U.S. Code) does not provide any exception to patentability. The USPTO once rejected ‘immoral’ inventions. American courts once invalidated patents that seemed morally questionable, such as patents directed to making cheap tobacco look expensive and patents directed to putting imitation seams into stockings to make them look more expensive. That legal doctrine applied by the USPTO and the Courts (that is, the so-called doctrine of ‘Moral Utility’) is long-since gone, and now virtually all matter of trickery can be included in a patent application. Historically, the idea that ‘immoral’ inventions were unpatentable was a tenet of U.S. patent law. The rationale for such a rule originated from the idea that immoral inventions were not ‘useful’ as required by 35 U.S.C. § 101.¹⁷

Controversial inventions are very much patent-eligible today. *Juicy Whip, Inc. v. Orange Bang, Inc.*¹⁸ killed the doctrine of ‘Moral Utility’. The patent at issue in *Juicy Whip*, was related to a beverage dispenser “with an associated simulated visual display of beverage.”¹⁹ Specifically, the invention (the 405 Patent) comprised a display bowl filled with “a permanent sterile and stable fluid simulating the color and texture of a beverage to be dispensed,” but actually dispensed beverages from hidden tanks of “pressurized water and concentrate.” The claim explained that this display bowl acted as a “powerful merchandising tool for stimulating impulse buying.” Defendants *Orange Bang, Inc.* and *Unique Beverage Dispensers, Inc.*, argued that the patent was invalid because the ‘405 Patent’ described an immoral invention that lacked utility. The Federal Circuit disagreed, finding that “[t]he requirement of ‘utility’ in patent law is not a directive to the Patent and Trademark Office or the courts to serve as arbiters of deceptive trade practices.” After all, the Federal Circuit held that “Congress never intended that the patent laws should displace the police powers of the States, meaning by that term those powers by which the health, good order, peace and general welfare of the community are promoted.” In this ruling, the Federal Circuit explicitly declined to follow *Rickard*²⁰ and *Aristo*

¹⁷ *Bedford v. Hunt*, 3 F. Cas. 37 (C.C.D. Mass. 1817); see also *Lowell v. Lewis*, 15 F. Cas. 1018, 1019 (C.C.D. Mass. 1817) (finding that inventions “injurious to the well-being, good policy, or sound morals of society” are unpatentable).

¹⁸ *Juicy Whip, Inc. v. Orange Bang, Inc.*, 185 F.3d 1364 (Fed. Cir. 1999).

¹⁹ U.S. Patent No. 5,575,405 (filed Apr. 18, 1996).

²⁰ *Rickard v. Du Bon*, 97 F. 96 (C.C.D. Conn. 1899), *aff’d* *Rickard v. Du Bon*, 103 F. 868 (2d Cir. 1900).

Hosiery,²¹ asserting that those cases did not “represent[] the correct view of the doctrine of utility under the Patent Act of 1952.” American authors seem to agree with the overturning.²²

Nowadays, the USPTO’s utility requirement is mostly used as a weapon against inventions that are outright inoperative (e.g., an invention that doesn’t work at all for any purpose) and/or unbelievable (e.g., a perpetual motion machine). In other words, if Luckey wanted to, he could absolutely file a patent application for his user-killing VR device (though it might not fare so well against existing prior art, especially given how much Luckey admits his ideas came from anime).

After examining inventions developed for the metaverse, we can raise a second kind of patent issue: what would happen with the inventions that are generated in the metaverse? What would happen with inventions that are created by an avatar in the metaverse and that can be used both in the metaverse itself as well as in the real world? Could those inventions be patentable?

B. INVENTIONS DEVELOPED IN THE METAVERSE

It is possible that an avatar evolving in a metaverse platform happens to invent a new virtual technology. The question is: Would such a virtual invention be patentable? What if the invention infringes actual valid patent? It may be affirmed that since such inventions are virtual and not real, they could not be patentable, unless they produce technical effect, thus the infringement would not be punishable.

a. Non patentability

If an avatar user happens to develop an invention in the metaverse, it would be virtual and not real. Since inventions developed in the metaverse would be virtual, would they be protected with an intellectual property right on the grounds of design patent? Following Article 3(a) and (b) of Community Design Regulation (CDR),²³ ‘design’ means the appearance of the whole or a part of a product resulting from the features of, in particular, the lines, contours, colours, shape, texture and/or materials of the product itself and/or its ornamentation; And ‘product’ means any industrial or handicraft item, including inter alia parts intended to be assembled into a complex product, packaging, get-up, graphic symbols and typographic typefaces, but excluding computer programs. The CDR should be interpreted as meaning that a patentable design must be a physical shape in 3D form.

In fact, metaverse design patent cases should be identified as ‘computer program products’ in the specification so as to be distinguishable from physical product design patent cases. ‘Design’ means a new design of the shape, pattern, or a combination thereof, as well as a combination of the color, shape and pattern, of the entirety or a portion of a ‘product’, which creates an aesthetic feeling and is fit for industrial application. Consequently, the first thing to consider is whether

²¹ Scott Williams, Inc. v. Aristo Hosiery Co., 7 F.2d 1003 (2d Cir. 1925).

²² Kirk A. Sigmon, “Pay to Play: Video Game Monetization Patents and the Doctrine of Moral Utility”, in *Georgetown Law Technology Review*, 72 (2021): “After all, granting a patent covering a useless invention is unlikely to be of much harm to society, whereas denying a patent to an ultimately useful invention might significantly harm the inventors’ ability to realize the value of their invention”.

²³ Council Regulation (EC) No 6/2002, 12 December 2001 on Community designs (OJ EC No L 3 of 5.1.2002, p. 1).

the ‘products’ in the virtual world of the metaverse belong to the design products defined by design patent laws. Virtual products in the metaverse do not seem to be considered a design product as defined by design patent laws. This is because neither are these virtual products a kind of industrial product after all, nor are they designs suitable for industrial applications even if they can bring users good experiences in the metaverse. Product designs in the metaverse, on the other hand, are not considered to be able to achieve mass production in the conventional sense. Thus, Nike’s *CryptoKicks* would not be patentable, despite the meeting of the novelty criterion.

b. Patentability of inventions producing technical effect

Dwiss, a Swiss watch microbrand, offered for sale NFTs allowing their holders to design their own and unique virtual watches. What if the company could offer to conceive a physical version of the NFT version of the watch? It is likely to consider that only the physical aspect of watches would be patentable under design patent law. Of course, if the virtual watch involves a new virtual inventive step, only the physical version would be patentable under utility patent law. However, inventors like Palmer Luckey may have the brilliant idea to develop a software that can cause technical effect sensed by users in their real life. It has been demonstrated that such software-related inventions are patentable.

So far, virtual reality does not entail any physical consequence in real life. But what if the invention developed in the metaverse produces virtual technical effect? Indeed, some softwares and websites enable users to create virtual artifacts, tools and weapons that can be imported in a MMORPG such as *Fortnite*. Like in the movie *Ready Player One*,²⁴ users can invent artifacts giving their avatars new super powers making them gain a competitive edge in the game. Would a new virtual pair of shoes enhancing the avatar’s strength, a super powered virtual grenade, an orb, a virtual magical key, a new weapon that has never been designed, be patentable? It has been demonstrated that a software-based invention allowing users to block an avatar in a game is patentable because the result is legally considered as a technical effect. An analogical reasoning, permits to patent virtual tools producing technical effects.

Here is a more realistic example: Kerbal Space Program is a space flight simulation video game developed by Mexican studio Squad for Linux, OS X, Windows, PlayStation 4, PlayStation 5, Xbox Series X/S and Xbox One. In the game, players direct a nascent space program, staffed and crewed by green humanoid aliens known as ‘Kerbals’. The game features a realistic orbital physics engine, allowing for various real-life orbital maneuvers such as Hohmann transfer orbits and orbital rendezvous. From the space center, players can build various vehicles such as rockets, aircrafts, spaceplanes, and rovers from a provided set of components. Constructed craft can be launched from the space center’s launch pad or runway to accomplish various tasks while avoiding partial or catastrophic failure, such as lack of fuel or structural failure. Players control flight with little assistance to keep their rocket oriented. Provided it maintains sufficient thrust and fuel, a virtual spacecraft can enter orbit or even travel to other virtual celestial bodies. Missions involve goals such as reaching a certain altitude, escaping the atmosphere, reaching a stable orbit, landing on a certain planetary body, rescuing stranded astronauts, capturing

²⁴ *Ready Player One*, directed by Steven Spielberg, Warner Bros. Pictures 2018.

asteroids, and creating space stations and surface bases. Players may also set challenges for each other on the game's forums.

Since the creation of virtual rockets, aircrafts, spaceplanes, and rovers must meet all the real-life physical and atmospheric conditions, the issue of their patentability is of crucial importance. What if an aircraft manufacturer actually builds a physical engine which is the exact replica of a virtual engine designed by a game player in Kerbal Space Program? Non-patentability of the virtual version of the invention would be unfair if the manufacturer is entitled to patent the physical version, unless the latter does not meet the novelty criterion on prior art grounds. Then the manufacturer could not be granted the patent. Thus the legislator should allow the patentability of virtual inventions which produce technical effect, even if the result remains in the metaverse.

As a consequence, virtual inventions developed in the metaverse could not be covered either with a utility patent nor with a design patent, unless they produce technical effects in real life or in the metaverse. What about virtual patent infringement?

c. Virtual patent infringement

Consider a virtual headset created by an avatar in a metaverse, which would be similar to a patented headset. From the perspective of a user in the virtual world, the virtual headset is operating in exactly the same way as the apparatus claim, with the exception of being in a virtual environment. However, the virtual headset does not actually exist. Seen from the real world, the virtual headset is a series of ones and zeros representing a headset in memory.

Should courts apply the U.S. doctrine of equivalents? Under the doctrine of equivalents, “a product or process that does not literally infringe upon the express terms of a patent claim may nonetheless be found to infringe if there is ‘equivalence’ between the elements of the accused product or process and the claimed elements of the patented invention”.²⁵ The doctrine of equivalents has deep roots in U.S. patent law. Infringement by equivalence “requires a showing that the difference between the claimed invention and the accused product [is] insubstantial.”²⁶ One way of proving insubstantial difference is the ‘Function-Way-Result’ test : “Showing on a limitation by limitation basis that the accused product performs substantially the same function in substantially the same way with substantially the same result as each claim limitation of the patented product.” The difficult question is whether each operates in an equivalent way. *Perkin-Elmer Corp. v. Westinghouse Elec. Corp.* stated that “a claimed invention and an accused device may perform substantially the same function and may achieve the same result will not make the latter an infringement under the doctrine of equivalents where [the accused device] performs the function and achieves the result in a substantially different way.”²⁷

Thus, it can be assumed that what we call virtual patent infringement could not be punishable, as the argued copy would simply consists in an image of the patented invention.

²⁵ *Warner-Jenkinson Co., Inc. v. Hilton Davis Chemical Co.*, 520 U.S. 17, 21, 29 (1997).

²⁶ *Crown Packaging Technology, Inc. v. Rexam Beverage Can Co.*, 559 F.3d 1308, 1312 (Fed. Cir. 2009).

²⁷ *Perkin-Elmer Corp. v. Westinghouse Elec. Corp.*, 822 F.2d 1528, 1531 n.6 (Fed. Cir. 1987).

CONCLUSION

Only inventions developed for the metaverse are patentable, on the grounds of both utility and design patents, whereas inventions developed in the metaverse would hardly be patentable, since they are only virtual, and as long as they do not cause technical effect in real life. For the same reason, it would be difficult to find a person guilty of patent infringement for having reproduced a virtual copy of a patented invention.

Meanwhile, major international companies such as Meta, Microsoft and NVIDIA have recently formed the Metaverse Standards Forum, aiming to standardize the metaverse industry. It is believed that countries or regions will gradually open up or further relax the conditions for metaverse design patent applications in response to this trend in the foreseeable future.