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Is 3D Technology a Curse or a Blessing for the Market of Contemporary Sculpture?

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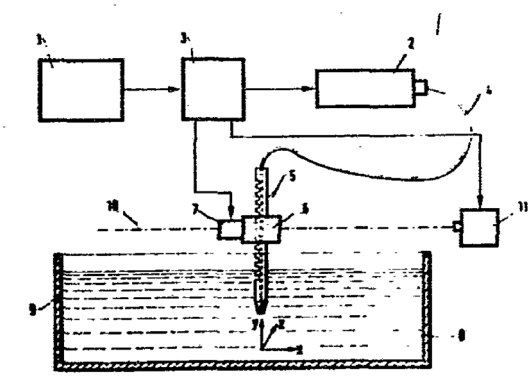
The history of sculpture and its market is intimately linked to the history of replication and artists' intellectual property rights. These rights – copyright or reproduction right, resale right, and moral right – were created and expanded in various countries during the course of the Industrial Revolution (Wiesinger 2023). In July 1984, the French firm Alcatel registered the first patent for a 3D printer with the INPI, the French national patent registry.↗ | Fig. 1 | The brainchild of engineers and academics Alain Le Méhauté, Olivier De Witte and Jean-Claude André, the device reproduced computerized shapes of industrial objects such as connecting rods in plastic. However, their invention's development was dropped by Alcatel when a patent for a similar technology was registered soon after in the United States by US engineer Charles Hull. From 1986, Hull developed his 3D printer commercially through the company he founded: 3D-Systems (Moussion 2014).



| Fig. 1 | France, Institut National de la Propriété Industrielle (INPI). Patent Registration Number 84 11241, July 16, 1984 (Detail)↗

At the same time, the market for modern and contemporary sculpture was in decline after a transatlantic boom. This boom, spurred by US collectors between 1946 and the late 1970s, had led European artists and their heirs to make and sell editions, mainly in bronze, of their latest models as well as their iconic pre-war artworks, which were very much in demand on the other side of the Atlantic. The 1980s saw an adverse reaction of American scholars and art critics to this practice, a reaction initially focused on the numerous posthumous Rodin casts donated to museums by the businessman and art collector Gerald B. Cantor. In France, this negative reaction was matched by art dealers' relentless effort to reduce the output of sculptures subject to resale tax and to exclude lucrative editions of modern and contemporary sculpture from the resale tax.

3D technology and the reproduction of antique sculpture

It is in the context of such opposition to the reproduction of sculpture that 3D printing, invented for industrial purposes, was applied to sculpture in France for the first time in 1989. This endeavor was part of an ambitious and well-funded research program initiated by the French Ministry of Culture in 1975 (Dalbéra 2013, 108–121). The application of science to art held popular appeal, spurred by a blockbuster exhibition held in Paris in 1980, *La vie mystérieuse des chefs-d'œuvre. La science au service de l'art.* | Fig. 2 |

| Fig. 2 | La vie mystérieuse des chefs-d'œuvre. La science au service de l'art. Exhibition Catalogue, Cover, Paris 1980

The *Saint-Maur Gallic Warrior* | Fig. 3 |, in brass and silver, had been unearthed in twenty-two pieces in the north of France in 1983 before it was purchased by the Musée départemental de l'Oise, Beauvais, in 1985 (inv. 85.16↗). It was reconstituted in 1986 with the assistance of Benoît Coignard, one of a family of sculptors earning a living as sculpture restorers. Thanks to the efforts of the Coignard family, the first 3D-printed replica of the reconstructed sculpture was unveiled at the French Ministry of Culture in 1991. It combined cutting-edge imaging technology developed by the France-Télécom Research Lab, a state-owned company, and an experimental stereolithography printing process conducted at the Centre National de la Recherche Scientifique in Nancy under the direction of Jean-Paul André who had been one of the inventors of the STL 3D printer in 1984 (Coignard 1998ff.).

3D technology and the creation of sculpture

3D printing was not invented to be applied to art or used by artists, but since the 1960s art and computer technology have often crossed paths. As soon as 3D printers appeared on the market in 1989, they caught the attention of sculptors, especially those who had been experimenting with 3D imagery since the 1980s using Computer Aided Design and Computer Generated Design software. In the mid-1990s, some artists began to design and print sculpture in 3D. The first instance, to my knowledge, of a museum exhibition dedicated entirely to such creations is the 1997 exhibition "Digital Psyche" at the newly opened Kemper Museum of Contemporary Art in Kansas City, Missouri, USA. Four of the five sculptures exhibited were created as digital files, then sent via the internet to Indianapolis, Indiana, to be printed. The fifth sculpture was a laser print of digital reductions of heads initially modeled in clay. The Kemper Museum exhibition was mentioned in an article by George Fifield | Fig. 4 |, the then-adjunct curator of media arts at the DeCordova Museum and Sculpture Park in Lincoln, Massachusetts, USA. Fifield remarked that "As photography changed the meaning of painting, 3D technology will change the role of the artist's hand" (Fifield 1998, 59–62).

| Fig. 3 | Saint-Maur Gallic Warrior, early 1st century AD. Brass and silver. Beauvais, Musée départemental de l'Oise. Discovered 1983, purchased 1985. Inv. Nr. 85.16. Foto: © J.-L. Bouché, Musée départemental de l'Oise, Beauvais↗

will model the original 12 heads, life-size, out of clay, then scan them and print out the reduced versions. Then they will use those three-dimensional "prints" to cast multiple metal reproductions. The Z-Corporation's output lends itself to investment casting as the wax-coated cellulose it is made of burns out under heat with a minimum of ash.

Besides the Z402™ 3-D printer by Z Corporation of Somerville, Massachusetts, the most intriguing "concept modelers" are the Actua 2100 system by 3D Systems, Inc. of Valencia, California, the Genisys system by Stratasys, Inc. of Eden Prairie, Minnesota, and the ModelMaker II System by Sanders Prototype, Inc. in Milford, New Hampshire.

The Z Corporation machine uses a powder technology developed by M.I.T. to build its objects. It lays down material like a laser printer. It builds the positive form with a cellulose (carbohydrate) powder which binds together as it is built up in layers and it fills the negative space with an inert powder that does not fuse. The completed object is then removed from within a cube of the fine dry powder when finished. It is the quickest and least expensive of the machines.

After printing, the objects can then be soaked with wax or epoxy. When soaked in wax, they can be used in a lost-wax process for investment casting with many materials, including bronze or aluminium. The cellulose and other powders are non-toxic and cost about 65 cents per cubic inch. The largest size this machine can print is about eight inches by eight inches by ten inches, built up in layers of one-seven-thousandths of an inch. An interesting result of this process is that there is no time penalty for complexity. A complicated shape with many internal twists and turns is printed in the same time as a solid block of the same size.

The other concept modelers use spray nozzle technology, similar to an ink jet printer, to build up their objects. Because there is no negative space support, these machines must build additional support structures within the objects. The Genisys system produces models from a high-strength polyester compound which it sprays from an extrusion nozzle. The parts are sturdy, but because they are polyester, they are not usable for investment or lost-wax casting. The support structure it builds while being constructed is easily broken off of the part. The Genisys resolution of .013 of an inch is a bit coarse. The Actua 2100 uses a thermo-polymer (wax) material, called ThermoJet 65, to build its parts. It also builds its models using a technique like ink jet printing, applied in three dimensions. Ninety-six jets oriented in a linear array build up the models in successive layers. The surface may be very rough and needs a lot of work to finish it, mostly because of the support structure. The thermo wax is also quite brittle, but it is very good for casting.

The machine with the finest resolution is, not surprisingly, one of the slowest. The ModelMaker II System by Sanders Prototype enjoys an incredible one-half-thousandths of an inch resolution. It also uses a thermo wax which is very good for lost wax casting and can be used for delicate parts like jewelery and pieces with fine detail. Its largest size is twelve by six by nine inches.

These machines come with software that is often capable of improving the final object by rotating it within the build envelope (the maximum scale for the printer) to minimize "stair-stepping" of layers, which occurs on diagonal surfaces during the printing. Parts may be also moved, copied, and deleted by the software before printing.

Objects may also be scaled by the software. Changing scale has always been a laborious task for sculptors.

As photography changed the meaning of painting, 3-D technology will change the role of the artist's hand.

But besides convenience, scale has great power as an aesthetic force. Helmick, for instance, is enthusiastic about using software scaling to create sculptural perspective. He describes his desire to print an object with a 3-D printer, then scale it down 95 percent, print that, scale it down again and on and on. By lining up a series of these pieces, it would appear that they are getting larger as a viewer moves toward them. Nick Capasso, associate curator at the DeCordova Museum and Sculpture Park in Lincoln, Massachusetts, is hopeful that, "If scale becomes effortless, it will encourage more artists to consider scale as an aesthetic device."

Capasso is also intrigued by the issues concerning the speedy reproduction of objects that these machines allow. Without casting, exact reproductions of identical objects can be made as long as one keeps supplying the machines with material. "If you can have 500 identical objects without having to sweat, that opens up a world of possibilities

Left: Three-dimensional body scan printed on the Z402™ 3-D printer. Starch, cellulose, and wax, 9.5 in. tall.

| Fig. 4 | George Fifield, Printing in 3D: Digital Sculpture, in: Sculpture, May–June 1998, p. 62

Photography may or may not have changed the meaning of painting, but what is certain is that photography and 3D technology have one thing in common: both are tools that use a recording mechanism which requires technical training, and both beget physical productions where the human hand is not visible, except to the connoisseur. Unfortunately, most judges are not connoisseurs, which explains many difficulties this new type of art tends to encounter in court. Almost two centuries after the invention of photography, too many judges still cling to the idea that the artist's hand on the final product is the proof of the authenticity of the artwork – or worse, its originality. For lovers of sculpture this is, of course, heresy, since sculpture has always required intermediary craftsmen; moreover, sculpture as a medium has long since evolved separately from the manual skills of the artist.

For the courts, however, it is difficult to grasp the originality of an artwork when the artist creates a model as a file and does not oversee the final product. It is as if the artist's imprint of his/her personality, which is the case-law test of originality for sculpture in France since 1862, were the artist's fingerprint. The 1862 case is particularly relevant as it applied to sculptures reproduced by a machine, the Collas-Barbedienne replication machine (see the article by Buket Altinoba in this *Special Issue*, 447ff.↗). The court concluded that the recourse to machines voided the imprint of its personality, hence obliterating the protection granted only to the "production of geniuses"

| Fig. 5 | Xavier Veilhan, Le Lion, 2006. Polystyrène, résine polyester, fibre de verre, acier, 190 × 320 × 132 cm. Collection privée. © Veilhan / Bonn, VG Bild-Kunst 2025. Photo © David Fugere↗

| Fig. 6 | Richard Orlinski, Lyon Matte resin Blue, undated, from 2006 onwards. © Bonn, VG Bild-Kunst 2025. Various models on the Galleries' Website↗

as stated by the seminal 1793 French law on artists' rights (France, Cour de Cassation, 16.5.1862, in: Wiesinger 2023, 253). Under French law, ideas are not protected, nor is style. Since manual materiality is the traditional norm for art, it can be difficult for artists to argue in court when they use computerised analytical forms. This was quite obvious in a 2014 case which opposed two artists, Xavier Veilhan and Richard Orlinski. Veilhan had made a name for himself in the art world since the 1990s as the author of faceted monochrome sculptures of larger-than-life humans and animals. | Fig. 5 | In 2006 Orlinski, a newcomer to art who enjoyed considerable financial backing and friends in the jet-set and political world, started exhibiting sculptures resembling those of Veilhan. | Fig. 6 | In 2012, he exhibited a monumental faceted animal at the entrance of the prestigious Paris art fair, FIAC, near the Champs Elysées. Though not part of the fair, Orlinski's sculpture was widely reproduced in social media and the art press; many visitors confused it with a work by Veilhan, including the director of the National Museum of Modern Art in Paris, who later testified to this fact. The following year, during the same art fair, a huge exhibition of what looked like Veilhan knock-offs created by Orlinski was organized in the lobby of a nearby five-star hotel. The sculptures were produced in various sizes for medium-range prices. Concerned about the growing confusion with his own work and the potential damage to his reputation in art circles, Veilhan and his dealer decided to sue Orlinski and his dealers. However, the outcome was not what Veilhan expected: he lost on all counts. The 2014 court's decision affirmed that the "use of the computer in the technique of production of the artwork is indeed a component of Mr Veilhan's creation but it does not reflect his personality since it is only used to apply his aesthetical choices" (France, Paris, Tribunal de grande instance, 13/16933, 21.3.2014). To the court, the choice of the computer and its specific effects as an art tool was irrelevant. The court even lauded Orlinski for making these sculptures and their reproductions available to a larger audience than the expensive ones produced by Veilhan, who was scolded by the judges for catering only to institutions and rich collectors.

3D technology and the reproduction of modern and contemporary sculpture

Since its inception, 3D printing technology has been observed with mixed feelings by those involved in the market for modern and contemporary sculpture, be they artists or dealers. On the one hand, 3D printing was a welcome tool to open new markets. On the other hand, it was a curse, as it made it easier to reproduce sculptures. Artists feared potential violations of their authors' rights, and dealers anticipated a loss of value for the multiplied artworks. Additionally, 3D printing was hailed as an objective method to identify unauthorized reproductions and counterfeits; at the same time, it was feared as a tool enabling counterfeiters to enhance their output and make it indistinguishable from the real artwork.

The efforts of some members of the French section of the Paris-based, UNESCO-affiliated AIAP (International Association of Visual Artists) are characteristic of this dual and contradictory approach. In 1995, the 14th General Assembly of the AIAP was held in Tlaxcala, Mexico. The main topic of the conference was what was then called "new technologies". The focus was on communication, especially the means for artists to make their work known on the web through images and thus reach an alleged global clientele. The aforementioned Coignard family was very active in the AIAP at the time, through one of the founding and most active associative members of the French AIAP group, the "syndicat national des sculpteurs", whose president was Benoît Coignard.

The Coignards pushed the idea broached in Mexico further and envisioned a new way of commercialising sculpture internationally, based on their previous experiments with the *Gallic Warrior*. They created a consortium to market contemporary bronze sculpture online through an international network of foundries that would receive digital files via a secure protocol, print the models, and cast them. Even though the

Coignards were aware that the quality of 3D-scanners was still in infancy, the group of little-known sculptors surrounding them hoped to reach a larger clientele by bypassing those who had shunned them: fancy art galleries, prestigious museums, and trend-setting collectors.

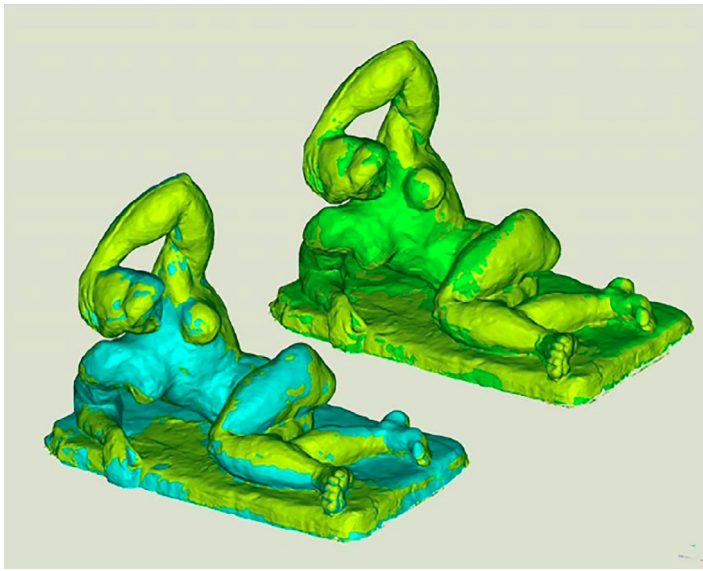
In April 1997, at a meeting of European Commission ministers in Bonn on "Global market, electronic commerce and copyright", the Coignards spearheaded an experiment financed by the European Commission to demonstrate "the possibilities of electronic trade for small businesses". A plaster sculpture by Roland Coignard, *Centaur,* was cast in bronze by the Coubertin foundry near Paris, then 3D-scanned by the firm Mensi; the data was transferred to Bonn by the Centre de Transfert de Technologie du Mans using a security protocol developed ad hoc by Euritis to prevent piracy; then the model was printed in Bonn by 3D-Systems, and ultimately the sculpture was cast in bronze in a German foundry. According to the Coignards, the resulting sculpture was offered by the European Commission to the mayor of Bonn, though I have been unable to locate it (Coignard 1998ff.). In June 1997, UNESCO held a "World Congress on the Implementation of the Recommendation Concerning the Status of the Artist" in Paris. The French section of the AIAP's proposal was that UNESCO should support what it called a "Worldwide communication system for the plastic arts under the aegis of AIAP/UNESCO"↗, and that it should join the call for projects launched by the European Commission in April. (European Commission 1997)

3D technology as a tool to rid the art market of counterfeits

In October 1997, the Coignards attended a symposium on art restoration and digital technology in Châlons-sur-Saône, organised by the French chapter of the London-based International Institute for Conservation. In their contribution, the Coignards envisioned a future in which international databases of 3D-images of sculpture would enable the comparative study of artworks to help law enforcement personnel monitor the market and prevent illegal sales of cultural artifacts, especially counterfeits (Benoît/Coignard 1997, 247–260).

Incidentally, such a database of artworks, with an emphasis on modern and contemporary creations, was not a new idea: there had been no less than seven legislative and administrative initiatives in France between 1904 and 1959 to create a registry of "authentic" artworks. In 1925, due to several public scandals related to the sale of fakes and forgeries of modern paintings, a special bureau was even installed at the Ministry in Charge of the Fine Arts to create such a registry but the decision was never implemented.

Sculpture has always been difficult to register. At the end of the 1990s, 3D recording seemed to offer an adequate solution to fight illicit reproduction for the first time. Indeed, it was an improvement to provide the courts and the art market with objective measurements, able to demonstrate, for instance, the difference between an authentic bronze and a bronze



| Fig. 7 | Overlapped laser-scanned computer models of three casts of Henri Matisse, Reclining Nude I (Aurora): One from the Baltimore Museum of Art, one from the Museum of Modern Art, and one from the Albright-Knox Gallery. The BMA's cast (green in both pairs) is the same size as the Museum of Modern Art's (blue) and the Albright-Knox's cast (yellow). Ann Boulton, Altered States: Henri Matisse's sculpture Aurora, in: Objects Specialty Group Postprints 14, 2007↗

obtained illegally by casting a bronze sculpture (a process known as *surmoulage,* resulting in reduced dimensions).

Comparative studies of three-dimensional objects were started to be applied to the various editions of 19th and 20th century French sculpture that had found their way *en masse* into US museums, in order to verify their authenticity (Raphael 2013). A particularly illustrative example of the unexpected consequences of such research is the study conducted in 2007 by the Baltimore Museum of Art with the firm Direct Dimensions on six casts of *Reclining Nude I (Aurora)* by Henri Matisse, modeled in clay in 1907. Among these six casts, three bronzes and a terracotta were known to have been cast between 1912 and 1951, and two bronzes were deemed by curators and experts to be *surmoulage* counterfeits from the 1930s, including one in the Museum of Modern Art in New York. | Fig. 7 | However, it turned out that the MoMA cast was not smaller than that in the Baltimore Museum of Art, which had an impeccable provenance, having been bought from the artist himself in 1931, and that the cast in the Nasher Sculpture Center's collection in Dallas, sold through the Pierre Matisse Gallery during the lifetime of the dealer's father in 1951, was 4 % smaller, the difference in size being most visible in the feet (Boulton 2007).

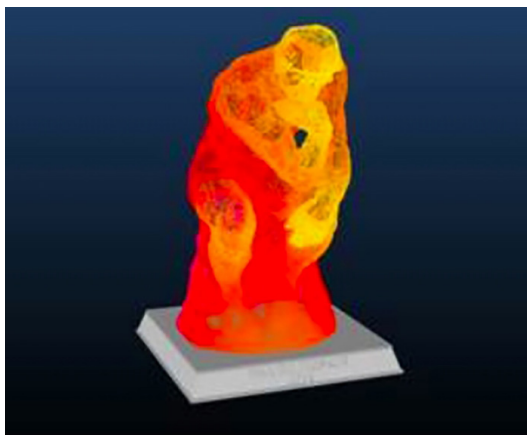
As research has shown, after World War II it was not uncommon for sculptors to use an existing bronze as a model to cast another, either because the original pre-war plaster models were lost or because they had been destroyed. Artists also reworked older models, unbeknownst to buyers, and molds of popular models were regularly remade. Such practices made the international database envisioned by the Coignards much less useful to identify counterfeits by their dimensions, and they gave powerful arguments to counterfeiters facing judges. Inversely, 3D scanning and printing facilitated the correction by counterfeiters of the *surmoulage* size prior to bronze casting, to anticipate shrinking. Thus, 3D technologies proved to be less useful as a tool to sanitise the market than it had been heralded before.

3D technology and the limitations of editions of sculpture

Since the 1980s, many dealers, art critics and curators have promoted the scarcity of casts as the only solution to the problem of counterfeiting. Some have devised ways to impose this restriction on artists and their heirs. In France, Benoît Coignard, as president of the obscure Syndicat national des sculpteurs (National Union of Sculptors), spurred and signed an agreement with bronze foundries in 1991 to limit the number of casts entitled to be called "original" sculptures to twelve, bringing about a confusion between authentic and original.

However, good quality reproductions, fostered by the continuous improvements in scanning and printing technologies and, for example, casting in silicon bronze↗, are a blessing for the global dissemination of works by modern artists entering the public domain. Indeed, one should not forget that the counterpart of the exclusive protection granted by the copyright system or the author's rights system is the limited amount of time this monopoly of reproduction is granted to artists and their heirs. Once the work is in the public domain, it belongs to all. Only the artist's moral right to the respect of the integrity of his/her work remains in perpetuity – at least in theory.

In France the moral right to sculpture was introduced by case law in 1894, in a case where a sculpture had



| Fig. 8 | Direct Dimensions' 3D scan of Auguste Rodin's "Thinker". The Baltimore Museum of Art Collection↗

been cut in three, modified, and reproduced by a dealer without the sculptor's knowledge. In a major reversal of the existing case law, the French court decided that such practices, until then quite common for sculpture, had to stop and that the agreement of the sculptor was required before any alteration of his creation (Wiesinger 2023, 458–460). However, what we've been witnessing since the 1980s is an over-interpretation of any alteration to include any minuscule variation invisible to the naked eye. In such cases, moral rights seem to be hijacked in order to artificially extend the monopoly of reproduction.

A pertinent example of this unfortunate drift is the lawsuit opposing Cosmo Wenman, a US citizen, and the Rodin museum in Paris. In July 2014, the Baltimore Museum of Art proudly advertised the pursuit of a partnership with Direct Dimensions: They had 3D-scanned their large version of the *Thinker* by Rodin, one of only twenty-one such casts in existence in the world and they intended to share the scan for free on their website (Cairns 2014). | Fig. 8 | The offer was not in breach of any right, as Rodin's work had been in the public domain since 1982. However, the offer was rescinded and the Baltimore museum directed Cosmo Wenman's inquiries for the reasons to the Rodin Museum in Paris. Faced with the lack of response from the Paris museum, Wenman made a request to the French Freedom of Information Commission to get access to the correspondence between the two museums. He then requested that the Rodin Museum, as state-owned institution, make public the 3D scans of plasters in its possession. When the museum refused, Wenman sued. The proceedings are still pending (Wenman 2024). An interesting aspect of the case is that the Musée Rodin accused Wenman of planning to denaturate the work of Rodin by selling

The Rattlesnake
From $599.00

The Rattlesnake digital bronze reproduction
$20,750.00

| Fig. 9 | Frederic Remington Art Museum Shop, Website. Screenshots↗

reproductions in reduction. Wenman replied that the reductions on sale at the museum's shop were of dubious quality, and that the true respect of the moral right of the artist was to make available to everybody reproductions that were as faithful as possible to the artwork the artist created, and that 3D scans excel at this purpose. To illustrate the public service rendered by 3D technology to the diffusion of sculptures in the public domain, one can turn to Frederick Remington and the Remington Art Museum shop that offers replicas made with and without the assistance of 3D scanners. | Fig. 9 | For complicated and detailed sculptures like Remington's, which are not easy to mold nor to replicate, the difference between a copy and a 3D reproduction is obvious. On the other hand, 3D technology's improvements and the impossibility to monitor the global circulation of digital files represent a danger for artists whose work becomes popular and happens to be easy to reproduce, who choose not to offer a line of affordable products for sale and/or do not trademark their name.

Since the mid-1980s, 3D technology has turned out to be neither a blessing nor a curse for the modern and contemporary sculpture market that some critics have envisioned. Rather than being fought, 3D technology should now be embraced for the new possibilities it brings. Moreover, it should fuel the long overdue reflection on the evolution of the management of artists' rights as well as the status of the public domain for sculpture.

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