

Major Technological Questions

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A defining feature of the past two and a half centuries has been the extraordinary and unprecedented velocity of technological change. The rush of new technologies has affected every area of society including the law. Legal systems, even while promoting technological progress through legal structures such as intellectual property, have struggled to adapt to the enormous changes wrought by human creativity. One persistent question—indeed an issue of ever-growing importance as progress accelerates—is how to apply and adapt the law of the past to the new realities of the present and the future.

In this Essay, we approach that question with insight drawn from an emerging and important doctrine in the law governing federal statutory interpretation—the “major questions doctrine.” That doctrine requires existing statutes delegating power to an administrative agency to be interpreted as simply not addressing—and thus not authorizing agency action on—major economic and social issues unless the statutory language is relatively clear. The major questions doctrine thus prevents preexisting statutes from being viewed as controlling authority where the inference is weak that the Congress meant to make any decision on the issue, including even a decision to delegate the issue to an administrative agency.

This Essay argues that courts should adopt a similar posture where preexisting sources of law, including both statutes and case law, are invoked as controlling major new technological questions. For example, courts should be skeptical that an authorization for cryptocurrency regulation lies in a generally worded statute enacted three-quarters of a century before the rise of cryptocurrencies and their markets. Courts should also doubt that authoritative rules for artificial intelligence can be gleaned from the case law and statutes governing such issues as libel and copyright. Such skepticism helpfully allows statutory and common lawmakers to develop must needed experience with nascent technologies before making important regulatory decisions and restrains the dead hand of the past from thoughtlessly tyrannizing the present and future.

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I. INTRODUCTION

A familiar problem in constitutional law is the translation of provisions drafted long ago to modern technologies. The application of the First Amendment to television,¹ the Second Amendment to semiautomatic guns,² and the Fourth Amendment to GPS tracking devices,³ all require some assessment of how the

¹ *City of Los Angeles v. Preferred Commc'ns, Inc.*, 476 U.S. 488, 494 (1986) (holding that television programming “plainly implicate[s] First Amendment interests”).

² *Compare* *Herrera v. Raoul*, No. 23 CV 532, ___ F. Supp. 3rd ___, 2023 WL 3074799, at *18 (N.D. Ill. Apr. 25, 2023) (relying on the existence of “dramatic technological changes” to uphold the constitutionality of a ban on semiautomatic rifles with certain features) (quoting *New York State Rifle & Pistol Ass'n, Inc. v. Bruen*, 142 S. Ct. 2111, 2132 (2022)), *with* *Barnett v. Raoul*, No. 3:23-cv-00209-SPM, 2023 WL 3160285, at *12 (S.D. Ill. Apr. 28, 2023) (holding “the Second Amendment extends, prima facie, to all instruments that constitute bearable arms, even those that were not in existence at the time of the founding”) (citing *D.C. v. Heller*, 554 U.S. 570, 582 (2008)).

³ *U.S. v. Jones*, 565 U.S. 400, 404 (2012) (holding that “the Government’s installation of a GPS

text of the Constitution applies to modern conditions. The challenge transcends constitutional law. Sometimes statutes and the common law decisions apply to new technologies by design. The purpose of the Patent Act⁴ is to provide protection for new technologies; the Food, Drug, and Cosmetic Act⁵ addresses licensing of new foods, drugs, and cosmetics; and the Clean Air Act⁶ recognizes that the best technologies for controlling pollution may change over time.⁷ But there are also statutes and case law precedents that, read literally, could appear to apply to new technologies, yet the statutes and cases were not drafted with those new technologies in mind. The drafters of the Communications Act⁸ did not anticipate the Internet, for example, and the Securities Act⁹ and the Securities Exchange Act¹⁰ were not drafted with cryptocurrencies in mind. Artificial intelligence is an especially fecund source of such problems, because many common law principles and statutes do not anticipate that machines may engage in tasks previously thought to require human intellect.

The conventional legal approach to this problem is to ignore it or at least to treat it no differently from any other ambiguity in a statute or issue of first impression in common law. If, for example, there is a statute that, as previously interpreted, would appear to encompass a technology, then the technology is regulated or at least subject to regulation under the statute. If there is a common law principle that applies to some class related to a new technology—say, publishers for large language models—then the principle applies. And if the law is ambiguous, then administrative agencies may be entitled to seize upon this ambiguity to advance policies that they believe prudent.

At times, the result of this approach can be to hobble entrepreneurs introducing a new technology. It may be infeasible or highly impractical for adopters of a new technology to comply with a particular regulation. That may be a fine result if the existing regulatory structure already balances the potential benefits of the technology with its costs, as may occur when the technology is new but similar in relevant respects to earlier objects of regulation. The result, however, may be more problematic when the benefits and costs of a particular

device on a target's vehicle, and its use of that device to monitor the vehicle's movements, constitutes a "search" for purposes of the Fourth Amendment).

⁴ 35 U.S.C. §§ 101 et seq.

⁵ 21 U.S.C. § 301.

⁶ 42 U.S.C. § 7601.

⁷ *Id.* § 7401.

⁸ 47 U.S.C. § 151.

⁹ 15 U.S.C. § 77(a).

¹⁰ *Id.* § 78(b).

technology largely transcend the statutory, regulatory, or common law context at issue. Often, existing legal principles will not fit well with new technologies because those principles were drafted without those technologies in mind and because those technologies present concerns that cut across various areas of law.

The mere existence of a legal principle that would seem to allow regulation, we argue, should not suffice for a court either to mechanically apply a principle developed without the technology in mind, especially when there are strong arguments that novel aspects of the technology provide countervailing reasons not to follow that principle, or to resolve ambiguity based on policy considerations. Courts, of course, must resolve issues before them, and agencies may feel a need to reduce uncertainty. But if they must issue a ruling or guidance on a new technology, then the same concern that underlies the major questions doctrine, namely the possibility that the legislature may not have intended for the statute to apply to the relevant legal issue, can similarly affect the interpretive result. A court should default in favor of allowing a new technology to develop, rather than issuing a regulation that either might doom the new technology or that might make development of the technology considerably more difficult, absent a clear indication that the legislature would have intended for the law to cover this technology.

We do not claim that the major questions doctrine itself necessarily encompasses the principles for addressing major technological questions that we address here, but we believe that there are significant similarities that should lead adherents of the major questions doctrine to adopt an interpretive stance of hesitating to regulate major technological questions. One similarity is that in both contexts, the law, read literally, either applies or arguably applies. In the major questions doctrine cases, the Supreme Court has acknowledged that the statutes it has interpreted are ambiguous with respect to the issues at hand.¹¹ Ordinarily, under the *Chevron* doctrine or under explicit congressional delegations of administrative lawmaking power,¹² administrative agencies may be empowered to make reasonable interpretations of ambiguous statutes. What distinguishes the major questions doctrine from other principles of administrative law—and makes it controversial—is that the doctrine embraces a form of exceptionalism. Because this issue is especially important, an agency cannot do what it ordinarily does. The justification of exceptionalism is, of course, that the issue is exceptional—in the case of the major questions doctrine, the issue is exceptionally important. Similarly, we argue here that for major technological questions, an agency (or a court) should adopt a degree of exceptionalism appropriate to the circumstances

¹¹ *FDA v. Brown & Williamson Tobacco Corp.*, 529 U.S. 120 (2000).

¹² *Chevron, U.S.A., Inc. v. Nat. Res. Def. Council, Inc.*, 467 U.S. 837 (1984).

and not simply take the mere existence of a textual or doctrinal hook as controlling new regulation.

The metaphor of a “hook” is an apt one that may help illustrate both the major questions doctrine and our argument about major technological questions. A “hook” is a convenient device “for catching hold of or hanging things on.”¹³ Unlike, say, a clothes hanger, a hook is an all-purpose device that can be used to hold a wide variety of items, such as oil lamps, cooking utensils, coats, and hats. Though it might be designed with one purpose in mind, it can be used for another. The phrase a “textual hook” is thus sometimes used to describe a provision that is used as the basis for a proposition motivated by principles entirely outside the text. Advocates of a certain position may search for a “textual hook” on which they can “hang” arguments.¹⁴ A textual hook can be used to ground structural constitutional arguments for jurists who insist upon such things, even if the words or phrases themselves do not clearly encompass the meaning imposed on them.¹⁵ Though often pejorative,¹⁶ the phrase “textual hook” need not be. Just as many hooks can bear the weight of coats for which they were never intended, so too can many legal doctrines bear the weight of innovative interpretations and applications.

Sometimes, however, a hook can be “flimsy.”¹⁷ One who places a coat on a hook that was not made for coats may find that it breaks. The major questions doctrine can be seen as a means of avoiding such flimsy hooks that cannot bear the weight of the arguments placed on them. When a textual provision appears to provide authority for relatively minor agency action, but the agency wishes to use it to resolve a question of great “economic or political significance,”¹⁸ the Court may under the major questions doctrine find that the hook was never intended for such an issue. Such findings, of course, can be controversial, as reasonable people

¹³ *Hook*, THE OXFORD POCKET DICTIONARY OF CURRENT ENGLISH, <https://www.encyclopedia.com/places/britain-ireland-france-and-low-countries/british-and-irish-political-geography/hook> (last visited Oct. 9, 2023).

¹⁴ See, e.g., Mark A. Graber, *Korematsu’s Ancestors*, 74 ARK. L. REV. 425, 438 (2021) (“No consensus developed in the antebellum United States on the best textual hook to hang constitutional commitments to equality.”).

¹⁵ See Thomas B. Colby, *Originalism and Structural Argument*, 113 NW. U. L. REV. 1297, 1319, 1320-22 (2019) (discussing textual hooks in constitutional argument).

¹⁶ See, e.g., Jim Chen, *The Constitutional Law Songbook*, 11 CONST. COMMENT. 263, 265 (1994) (“All I need is a textual hook. / Who wants more than one sober look? / So remember that text is clear, / And let your legal doubts disappear.”).

¹⁷ E.g., Thomas B. Colby, *In Defense of the Equal Sovereignty Principle*, 65 DUKE L.J. 1087, 1145 (2016) (referring to a “flimsy textual hook”).

¹⁸ *Util. Air Regul. Grp. v. EPA*, 573 U.S. 302 (2014) (quoting *FDA v. Brown & Williamson Tobacco Corp.*, 529 U.S. 120 (2000)).

may disagree about whether the hook can bear the weight of the argument.¹⁹ Our goal in highlighting “major technological questions” is to push against placing heavy weight on flimsy hooks. When a new technology is extraordinary and raises issues well beyond the scope of what a legislature (or court announcing a common-law principle) could initially have contemplated, we argue that courts should not apply that legislation (or common-law principle) in a way that might make it considerably more difficult for the technology to develop.

This approach, we recognize, will generally be a one-way ratchet that acts against regulation, rather than encouraging regulation.²⁰ An administrative agency generally has the power to deregulate, at least if it follows the appropriate procedures and offers reasonable justifications for doing so,²¹ and a major technological questions doctrine would thus usually not prevent an agency from changing rules so that they no longer prevent commercialization of some new technology. Similarly, courts engaged in common law reasoning generally possess the power to distinguish past cases and thus can properly conclude that precedents that would appear to apply to new technologies should not because of some feature of new technologies. Indeed, our approach to major technological questions encourages such reasoning. This approach is thus like the major questions doctrine in another way. Although one could imagine many deregulatory major questions,²² and although at least one Supreme Court decision allowed regulation required a market intervention that otherwise might not have been permitted,²³ the major questions doctrine might have an anti-regulatory bias.

¹⁹ In criticizing the major questions doctrine, Mila Sohoni leads with a measure of agreement: “Begin with what is uncontroversial: nobody *likes* to see ‘agencies asserting highly consequential power *beyond* what Congress could reasonably be understood to have granted.’” Mila Sohoni, *The Major Questions Quartet*, 136 HARV. L. REV. 262, 262 (2022) (quoting *West Virginia v. EPA*, 142 S. Ct. 2587, 2609 (2022)) (emphasis added by Sohoni).

²⁰ The potential exception is when a statutory regime allows market entry only if some form of license is obtained. If a license is being obtained for some new technology that could not have been anticipated and raises fundamentally different concerns from those ordinarily implicated in the license, then a hesitance to resolve major technological questions would point in the opposite direction.

²¹ The agency’s analysis, however, must pass hard-look review. *See* 5 U.S.C. § 706(2)(A).

²² For example, an administrative agency like the Federal Emergency Management Agency conceivably might override state statutes against price gouging on the ground that such statutes interfere with market responses to price gouging.

²³ *King v. Burwell*, 576 U.S. 473 (2015) (upholding the Affordable Care Act’s provision of subsidies in states that had not set up their own insurance exchanges using reasoning similar to that in the major questions doctrine).

Although some other canons impose substitutive biases,²⁴ we recognize that this partly explains why the major questions doctrine is so controversial.

Our approach to major technological questions need not be so controversial, because major technological questions need not align on the traditional liberal-conservative axis. Nonetheless, to the extent that our approach does have substantive implications that systematically point mostly in an anti-regulatory direction, we believe that is justified. Technology is expensive to develop, and our legal system seeks to ensure that inventors will be able to appropriate benefits from invention and commercial development.²⁵ If regulations make it infeasible to market new technologies, then there will be considerably less incentive to develop them in the first place. Providing a legal environment that generally embraces new technologies will tend to foster innovation. That, of course, does not mean that technology should never be regulated, and some new technologies will unmistakably be subject to regulation under existing laws. But when some existing regulatory principle is based on assumptions that plainly do not apply to the new technology, or when the principle is ambiguous, a reluctance to apply that principle to new technology will tend to improve incentives to invent those technologies.

Our approach to major technological questions not only promotes incentives to develop new technologies, but also allows for experimentation with those technologies. This is relevant in two senses. First, as we have written elsewhere,²⁶ sometimes there may be inadequate social incentives for entrepreneurs to undertake market innovations, because second-mover advantages swamp first-mover advantages. This distinction may matter less with most new technologies, because patents augment first-mover advantages, but some new technologies may not be patented or may enjoy only weak patent protection. The greater the initial market obstacles are to new innovations, the less will be the

²⁴ The avoidance canon, for example, narrowly interprets ambiguous statutes and thus has the practical effect of broadening the effective scope of constitutional rights. *See, e.g.*, Adrian Vermeule, *Saving Constructions*, 85 GEO. L.J. 1945, 1946 (1997) (noting that avoidance “has the effect of overprotecting constitutional norms through statutory interpretation”). The extraterritoriality canon, meanwhile, will tend to limit the scope of statutes. *See, e.g.*, Natascha Born, *The Presumption Against Extraterritoriality: Reconciling Canons of Statutory Interpretation with Textualism*, 41 U. PA. J. INT’L L. 541 (2020) (finding some but not all versions of the canon consistent with textualism).

²⁵ *United States v. Dubilier Condenser Corp.*, 289 U.S. 178, 206 (1933) (observing a committee’s intent noting “there is little incentive for anyone to take up a patent and spend time, effort, and money. . . on its commercial development without at least some measure of protection against others free to take the patent as developed by him and compete in its use”).

²⁶ *See* Michael Abramowicz & John F. Duffy, *Intellectual Property for Market Experimentation*, 83 NYU L. REV. 337 (2008).

incentives to attempt those innovations. Second, legislatures may benefit from experience with new innovations before they make decisions about how to create appropriate regulatory regimes. If regulatory regimes are applied mechanically to technologies whose implications extend well beyond the area of regulation, legislatures may not be able to obtain this information.

The approach that we endorse does not mean that all new technologies earn a free pass from regulation. Just as the major questions doctrine applies only to issues of exceptional significance, so too do we envision our approach applying only in limited circumstances. We can accent this by viewing “major” as modifying both “technology” and “questions.” The importance of the technology at issue need not be defined solely in economic terms, but the technology should be sufficiently different from pre-existing technologies that the regulatory regime is not likely to apply squarely to the technology. In any event, the approach does not apply to routine regulatory matters, but only to regulation that serves as a significant obstacle to development of the technology. Such application will generally present “major questions” about whether the legislature would have wanted to extend the relevant regulatory requirement to this technology.

We are especially concerned about situations in which a new technology has implications far beyond the domain of the statute, common law doctrine, or regulatory agency. If an existing law provided, “nothing manmade shall move at greater than 55 miles an hour,” it might well be plausible to apply this statute not only to the cars that existed at the time of the law’s enactment, but also to later developed rocket ships. That would be especially so if the basis for the law was a concern that people should not travel fast. But if an existing law enacted provided “all seat belts should include buttons to allow easy disengagement,” it might not make sense to apply that to rockets, because space travel involves issues well beyond ordinary vehicular travel. This is not only so in the sense that space travel might demand special safety requirements,²⁷ but also because space travel involves economic and political dimensions entirely separate from ordinary vehicular travel.

This concern, we will argue, also helps explain many major questions doctrine cases. Those cases are not concerned solely with the economic or political magnitude of any particular regulation, though that is clearly an important factor, but also with whether a regulation appears to venture far beyond the expertise of the regulatory agency. When an agency with expertise in

²⁷ Spaceships do in fact have restraints, though considerably more comprehensive than those found in cars, both to protect astronauts at launch and re-entry and to prevent free floating in a zero-gravity environment. 5-POINT CREW/PASSENGER HARNESS RESTRAINT SYSTEM, <https://www.schroth.com/en/aerospace/space/details/show/id-5-point-crew-passenger-harness-restraint-system/> (last visited Oct. 12, 2023).

medicinal drugs tries to regulate tobacco²⁸ or assisted suicide,²⁹ or a health agency regulates evictions,³⁰ or a workplace safety agency addresses a matter of public health,³¹ the agency is arguably extending beyond its immediate expertise. Similarly, if an agency regulates a technology based on one consideration, but the economic or political implications of that technology extend well beyond that consideration, that strengthens the case for regulatory restraint. This is especially so if earlier technologies affected by the regulation did not feature such implications.

We have described our “approach” to major technological questions rather than a “major technological questions canon” or a “major technological questions clear statement rule.” We are somewhat agnostic as to the best way to achieve our concerns. An explicit canon would, of course, give prominence to the concerns that we raise and reduce the dangers of inappropriate and premature regulation. But our approach, unlike the major questions doctrine, has relevance even in cases in which judges are applying common law principles, regardless of whether there is a governing administrative agency. In this sense, a canon would be too narrow. And yet we also recognize that the threshold for creating a canon of interpretation may be relatively great, and we believe that our analysis can be helpful even in the absence of recognition of a canon. That is, judges may account for the considerations that we raise when they do interpret statutes and common law principles, and agencies may take them into account as well, even in the absence of creation of a formal canon.

The Article proceeds as follows. In Part II, we consider technologies that are now commonplace, but at one time were new. For each example, we identify contexts in which courts recognized that mechanical application of existing principles might be inappropriate, not necessarily because they would produce the wrong result, but because the technologies raised issues that transcended the concerns that animated the original principles. Part **Error! Reference source not found.** then reviews the major questions doctrine and compares it with the concerns that we identify regarding major technological questions. Finally, Part IV applies the concern about major technological questions to modern technologies. Crypto regulations will tend to raise major technological questions when the crypto technology’s primary function involves features that are irrelevant to the legal regime. In addition, our approach counsels not finding developers of large language models liable either for using existing data on the

²⁸ *FDA v. Brown & Williamson Tobacco Corp.*, 529 U.S. 120 (2000).

²⁹ *Gonzales v. Oregon*, 546 U.S. 243 (2006).

³⁰ *Alabama Ass'n of Realtors v. Dep't of Health & Hum. Servs.*, 141 S. Ct. 2485 (2021).

³¹ *Nat'l Fed'n of Indep. Bus. v. OSHA* 595 U.S. 109 (2022).

Internet for training or for misstatements of fact. But we do not believe that the novelty of large language models undermines the copyrightability of their outputs.

II. TRANSLATING THE MAJOR QUESTIONS DOCTRINE TO TECHNOLOGY

Determining the implications of the major questions doctrine for new technologies itself requires a process of translation. The Supreme Court's cases on major questions do not involve new technologies, and moreover, all the cases to date involve potential regulatory issues that were foreseeable, though perhaps not easy to foresee, at the time of the initial statutory enactments. Though futurists and science fiction writers may sometimes foresee new technologies,³² in general, Congress does not draft statutes with future technologies in mind, particularly when those technologies are the result of pioneering inventions rather than incremental improvements.³³ Superficially, this might seem to present both an argument against and an argument for allowing regulation. The argument against regulation is that Congress could not have authorized regulating something it did not even know would exist, and the argument for regulation is that Congress could not have intended to limit regulation to exclude the new technology when it could not have known that it would exist. This may make the translation process seem to depend on baselines.

Neither of these positions makes sense. Any congressional delegation of authority covers some but not all potential regulations, and delegations frequently address both issues that the legislature recognized and issues that the legislature did not anticipate. This highlights that the determination of whether an agency can regulate a new technology cannot depend solely on whether a technology is new or foreseeable. That might seem to suggest that emerging technologies should be treated no differently from existing technologies. New technologies, however, present three related concerns. The first concern is that new technologies will often create entirely new markets, and if regulation would prevent or greatly limit emergence of such markets, the question arises whether the legislature would have wanted such a drastic result. The second concern is that existing statutory frameworks may fit the new technology poorly. New technologies may present cross-cutting concerns across regulatory areas. Regulators in any single domain

³² Melissa T. Miller, *Automatic Sliding Doors Didn't Exist Before Star Trek*, NERDIST (Dec. 14, 2022, 2:45PM), <https://nerdist.com/article/star-trek-popularized-automatic-sliding-doors/>.

³³ For example, the Civil Aeronautics Act was not passed and signed into law until 1938, 35 years after the Wright Brothers' maiden flight. *A Brief History of the FAA*, FEDERAL AVIATION ADMINISTRATION https://www.faa.gov/about/history/brief_history#:~:text=To%20ensure%20a%20federal%20focus,Civil%20Aeronautics%20Act%20in%201938 (last visited Oct. 12, 2023).

may be poorly positioned to weigh concerns outside their domain. This is an especially powerful concern when the social and economic implications of a new technology are largely independent of the regulatory question at issue. The third concern, necessarily the overriding one, is that it may not be obvious whether words in a statute encompass a technology not then in existence.

We thus read the major questions doctrine cases with these concerns in mind. Our goal is not simply to determine how the major questions doctrine itself applies to new technologies. Rather, it is to identify core principles animating the doctrine and then determine the relevance of those core principles for determining both the scope of legislative delegations and the appropriate construction of common law principles. We highlight three points, which correspond directly to the concerns noted above. First, the Court has worried about the sheer magnitude of regulation, as measured against economic and political yardsticks, particularly when that regulation might eliminate or dramatically transform markets. We do not believe that this translates straightforwardly into some minimum threshold where regulation becomes too major. Rather, it suggests that inquiries into major technological questions should consider, in addition to the importance of the new technology, the magnitude of the effect on that technology. Second, in many of the major questions doctrine cases, the Supreme Court has worried about agencies making decisions that meaningfully exceed their mandates. That highlights the importance of attention to whether the new technology raises significant issues beyond those within the scope of the regulatory framework. Third, the major questions doctrine requires careful attention to the text of any applicable statutes. Whether a new technology is subject to some form of regulation thus cannot be answered in the abstract without confrontation with the statutory text.

A. The Major Questions Doctrine Cases

Each of these points can be seen in the Supreme Court's most recent decision citing the major questions doctrine, *Biden v. Nebraska*.³⁴ Congress had authorized the Secretary of Education to "waive or modify any statutory or regulatory provision" of certain loan finance programs in the event of a "national emergency,"³⁵ and two years into the COVID-19 pandemic, the Secretary invoked this provision to eliminate the debt of most borrowers.³⁶ The Court found this action to be in excess of statutory authority, first engaging in general statutory

³⁴ No. 22-506 (U.S. June 30, 2023).

³⁵ 20 U.S.C. § 1098bb(a)(1).

³⁶ *Waivers and Modifications of Statutory and Regulatory Provisions*, 87 Fed. Reg. 61512 (Oct. 12, 2022). The precise amount of the waiver varied depending on the adjusted gross income of the borrower and whether the borrower had qualified for Pell Grants.

interpretation,³⁷ and then reinforcing that conclusion with discussion of the major questions doctrine.³⁸

The Court highlighted the total dollar amount of the cancellation, noting that “[i]t amounts to nearly one-third of the Government’s \$1.7 trillion in annual discretionary spending.”³⁹ Indeed, the majority accepted that the agency could cancel some loan balances, but thought it implausible that Congress would have approved of such a large cancellation under the circumstances then present.⁴⁰ Notably, the majority focuses not only on the size of the regulation in comparison to the American economy,⁴¹ but also on the size of the loan cancellation relative to the size of the regulatory program.⁴² This reinforces the first point above, the importance of considering whether regulatory action will drastically affect markets (such as the market for an emerging technology) or will have a merely incidental effect, as well as considering whether the regulatory action is relatively minor or is major relative to the scope of government or economic activity as a whole.

The majority’s conclusion that loan cancellation was a major question did not depend on a determination that the agency was acting beyond its general expertise. Still, the case highlights that a question is more likely to be major when an agency exceeds its expertise. In dissent, Justice Kagan pointed out that “[s]tudent loans are in the Secretary’s wheelhouse.”⁴³ The majority responds that “in light of the sweeping and unprecedented impact of the Secretary’s loan forgiveness program, it would seem more accurate to describe the program as being in the ‘wheelhouse’ of the House and Senate Committees on Appropriations.”⁴⁴ Justice Barrett, in a concurring opinion, notes in reviewing the major questions doctrine cases, “Another telltale sign that an agency may have transgressed its statutory authority is when it regulates outside its wheelhouse.”⁴⁵ Neither Chief Justice Roberts for the majority or Justice Barrett found an assessment of borrowers’ economic situation to be beyond the expertise of the

³⁷ *Nebraska v. Biden*, slip op. at 13-18.

³⁸ *Id.* at 19-25.

³⁹ *Id.* at 21.

⁴⁰ The majority imagines asking the Congress the following question: “‘Can the Secretary use his powers to abolish \$430 billion in student loans, completely canceling loan balances for 20 million borrowers, as a pandemic winds down to its end?’” *Id.* at 22.

⁴¹ *Id.* (“There is no serious dispute that the Secretary claims the authority to exercise control over ‘a significant portion of the American economy.’”) (citation omitted).

⁴² *Id.* (“Practically every student borrower benefits, regardless of circumstances.”).

⁴³ *Id.* at 26 (Kagan, J., dissenting).

⁴⁴ *Id.* at 23 (majority opinion).

⁴⁵ *Id.* at 12-13 (Barrett, J., concurring).

Secretary of Education, but the discussion of “wheelhouses” confirms the second point above, that the major questions doctrine is especially concerned with exercises of regulatory authority that affect issues or markets beyond an agency’s expertise.

The third point is that the major questions doctrine does not relieve judges of their duty or ability to engage in statutory interpretation. The majority emphasizes the limited nature of the verb “modify,” which also was at issue in another major questions doctrine case,⁴⁶ quoting Justice Scalia’s observation in that case that it would be understatement to note that “the French revolution ‘modified’ the status of the French nobility.”⁴⁷ In her concurrence, Justice Barrett insists that there is nothing more to the major questions doctrine than application of “the ordinary tools of statutory interpretation,”⁴⁸ reminding the courts of “the importance of *context* when a court interprets a delegation to an administrative agency.”⁴⁹ She resists the classification of the major questions doctrine as a substantive canon of interpretation, which “advance values external to a statute” and thus may be seen as extra-textual.⁵⁰ The majority does not agree or disagree with Justice Barrett on this point, leaving the classification of the major questions doctrine somewhat uncertain. The Chief Justice, however, does emphasize in his conclusion, “We have employed the traditional tools of judicial decisionmaking.”⁵¹ In assessing new technologies, statutory interpretation will no doubt be central to the inquiry as well.

Biden v. Nebraska is hardly alone in highlighting these three points. *West Virginia v. Environmental Protection Agency* unmistakably highlights economic significance.⁵² The EPA, charged with determining the “best system of emission reduction” for carbon dioxide emissions,⁵³ found that such a system would shift production from coal-fired plants to natural gas fired plants and to renewables.⁵⁴ The Court emphasized the magnitude of this regulation, noting that upholding the EPA’s interpretation would allow “it to substantially restructure the American

⁴⁶ *MCI Telecommunications Corp. v. AT&T*, 512 U.S. 218, 225 (1994).

⁴⁷ *Nebraska v. Biden*, slip op. at 15 (quoting *MCI*, 512 U.S. at 228).

⁴⁸ *Id.* at 1 (Barrett, J., concurring).

⁴⁹ *Id.* at 2.

⁵⁰ *Id.*

⁵¹ *Id.* at 25 (majority opinion).

⁵² No. 20-1530 (U.S. June 30, 2022).

⁵³ 42 U.S.C. § 7411(a)(1).

⁵⁴ *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, 80 Fed. Reg 64661, 64727, 64729 (Oct. 23, 2015).

energy market.”⁵⁵ This also highlights that the EPA was engaged in a subject matter, directly controlling “what the market share of coal, natural gas, wind, and solar must be,”⁵⁶ that might be considered to be closer to the expertise of the Federal Energy Regulatory Commission than of the EPA itself. And the Court engaged in statutory interpretation, arguing that the word “system” refers to a technical system and cannot bear the weight of authorizing the agency to create a new legal or economic system.⁵⁷ The dissent counters with its own textual argument featuring dictionary definitions of the word “system.”⁵⁸

All the same points could be made in the case in which the Court found that the Centers for Disease Control and Prevention (CDC) lacked the authority to impose a nationwide eviction moratorium during the COVID-19 pandemic.⁵⁹ The regulations were of much broader scope than actions typically taken by the CDC,⁶⁰ the Court worried that authorizing the moratorium would allow the agency power over markets distantly related to disease prevention,⁶¹ and the Court carefully read together the first and second sentences of the applicable statutory provision.⁶² In a separate COVID-related case, the Court struck down a vaccine mandate imposed by the Occupational Safety and Health Administration.⁶³ The Court noted the magnitude of the regulation, which it said would affect 84 million Americans,⁶⁴ emphasized that the agency was acting outside its usual area of expertise by enacting what it found to be “broad public health measures” rather

⁵⁵ *West Virginia v. EPA*, slip op. at 20.

⁵⁶ *Id.* at 27 n.4 (distinguish this from merely “issuing a rule that may end up causing an incidental loss of coal’s market share”).

⁵⁷ *Id.* at 28 (“[O]f course almost anything could constitute such a ‘system’; shorn of all context, the word is an empty vessel.”).

⁵⁸ *Id.* at 7-8.

⁵⁹ *Alabama Ass’n of Realtors v. Department of Health and Human Svcs.*, No. 21A23 (U.S. Aug. 26, 2021) (on application to vacate stay).

⁶⁰ *Id.* slip op. at 3; *id.* at 7 (“Since that provision’s enactment in 1944, no regulation premised on it has even begun to approach the size or scope of the eviction moratorium.”).

⁶¹ *Id.* at 7 (“Could the CDC, for example, mandate free grocery delivery to the homes of the sick or vulnerable? Require manufacturers to provide free computers to enable people to work from home? Order telecommunications companies to provide free high-speed Internet service to facilitate remote work?”).

⁶² *Id.* at 5 (interpreting 42 U.S.C. § 361(a)).

⁶³ *National Fed. of Ind. Bus. V. Department of Labor*, Nos. 21A244 & 21A247 (U.S. Jan. 13, 2022) (on applications for stays).

⁶⁴ *Id.* at 5.

than “workplace safety standards,”⁶⁵ and focused closely on the words of the statute.⁶⁶

Many similar themes can be identified in earlier cases. In *FDA v. Brown & Williamson*,⁶⁷ the Court voided the Food and Drug Administration’s attempt to regulate tobacco, in effect finding that the agency was moving outside its wheelhouse by interfering with the Congress’s express policies governing tobacco regulation,⁶⁸ affecting a large existing market. In *Gonzales v. Oregon*,⁶⁹ the Court effectively saw the Attorney General as similarly overstepping by prohibiting doctors from prescribing drugs to be used in physician-assisted suicide. And in *King v. Burwell*,⁷⁰ the Court agreed with the agency’s interpretation of a provision of the Affordable Care Act, but based on its own interpretation rather than deference. The Court believed that the statutory scheme would collapse with a different interpretation,⁷¹ and its approach ensured that a political change in the composition of the agency could not undo the Act’s core purposes. Thus, the Court again showed wariness of an agency vastly changing a statutory scheme and a significant economic market merely because a statute was ambiguous.

B. Critiques of the Major Questions Doctrine

The major questions doctrine has been subject to considerable criticism. With the exception of *King v. Burwell*, all but one of the cases above resulted in outcomes that conservatives would tend to prefer more than liberals, so it is unsurprising that the academy and bar are polarized on the major questions doctrine.⁷² Questions such as whether the doctrine should be abandoned and whether it should be interpreted as a canon of construction are beyond our scope here. Our goal is as much to advise courts as it is to advise agencies about how to address major technological questions, whether those courts are exercising judicial review or simply interpreting statute or common law doctrine in the absence of agency action.

⁶⁵ *Id.* at 6.

⁶⁶ *Id.* at 2-3.

⁶⁷ 529 U.S. 120 (2000).

⁶⁸ *Id.* at 139 (citing 15 U.S.C. § 1331).

⁶⁹ 546 U.S. 243 (2006).

⁷⁰ 576 U.S. 473 (2015).

⁷¹ *See id.* at 476 (noting that with the alternative interpretation, “only one of the Act’s three major reforms would apply in States with a Federal Exchange”).

⁷² For a rare defense of the doctrine from academia, along with some suggestions for clarification, see Louis J. Capozzi III, *The Past and Future of the Major Questions Doctrine*, 84 OHIO ST. L.J. 191 (2023).

An opponent of the majority questions doctrine could still support our interpretive stance regarding major technological questions. Some of the criticisms of applications of the major questions doctrine are entirely internal. We do not here take positions on the statutory interpretation disagreements above. Meanwhile, Natasha Brunstein and Richard Revesz, for example, note that the cost of the Clean Power Plan voided eventually in *West Virginia v. EPA*⁷³ “was only an extremely small proportion of the regulated industry’s revenue.”⁷⁴ We agree that where a regulation has only a relatively small impact on a technology market, the case for treating it as a major technological question is weak.

There are, however, criticisms of the major questions doctrine that may have some force against our approach to major technological questions as well. Mila Sohoni views the major questions doctrine cases as reflecting separation-of-power themes, “allowing nondelegation doctrine to be effectively resurrected” without directly confronting nondelegation concerns.⁷⁵ At least one proponent of the major questions on the Court, Justice Gorsuch, acknowledges the connection. He states, “The nondelegation doctrine ensures democratic accountability by preventing Congress from intentionally delegating its legislative powers to unelected officials.... The major questions doctrine serves a similar function by guarding against unintentional ... delegations of the legislative power.”⁷⁶ Indeed, someone who is skeptical of the concern underlying the nondelegation doctrine, i.e. that the executive branch should not exercise legislative power, may similarly be skeptical of the reduction in executive power effected by the major questions doctrine. Both doctrines seek to force democracy by requiring certain decisions to be made by the legislature.

Similarly, the approach to the major technological questions doctrine that we advocate has a democracy-forcing nature. A normative position underlying our approach is that it would be preferable for Congress to resolve major technological questions than for the executive or courts to do so, and someone who generally believes that an activist executive or judiciary is necessary to compensate for the deficiencies of the legislative branch may oppose both the major questions doctrine and our approach to major technological questions. On the other hand, even such a person might be less skeptical of the major technological questions doctrine, simply because Congress historically has eventually addressed major new technologies with legislation.

⁷³ *West Virginia v. EPA*, 142 S. Ct. 2587 (2022).

⁷⁴ Natasha Brunstein & Richard L. Revesz, *Mangling the Major Questions Doctrine*, 74 ADMIN L. REV. 217 (2022).

⁷⁵ Mila Sohoni, *The Major Questions Quartet*, 136 HARV. L. REV. 262, 267 (2022).

⁷⁶ *National Fed. Of Ind. Bus v. Department of Labor*, [FULL CITE AND PIN CITE].

Telecommunications law is a good example, with the Radio Act shortly following the development of radio,⁷⁷ the Communications Act following television,⁷⁸ and the Telecommunications Act following the development of the Internet.⁷⁹ Whether Congress writes good statutes for technology can be reasonably debated, but congressional action will displace administrative and judicial interpretations in any event. The import of our approach to major technological questions doctrine is that we should ensure that market experimentation proceeds until the legislature acts.

III. CHALLENGES WITH (OLD) NEW TECHNOLOGIES

A. Photography

Early photography presents not just one but two excellent examples where courts were confronted with technological questions concerning the reach of previously enacted statutory law. Appropriately, in the first case, the court read the old statute as silent on whether copyright applied to photographs and thereby left photography unregulated by copyright law. Yet with equal propriety, the court in a second case held that photographing an indisputably copyrighted work (a copyrighted engraving) did “copy” the work within the meaning of the infringement provisions of the statute.

The relevant legal background for the first case—*Wood v. Abbott*⁸⁰—was that in 1802, copyright law in the United States extended rights for “prints,” granting rights to any person who “invent[ed] and design[ed]” or “work[ed]” “any historical or other print or prints.”⁸¹ Essentially the same statutory coverage was reaffirmed in the 1831 Copyright Act, which granted rights to person who “engraved, etched, or worked from his own design, *any print* or engraving.”⁸² To a modern reader, the extension of copyright to “any print” might seem dispositive of the question whether copyright covered photography, for it has become so common to refer to physical copies of photographs as “prints” that the dictionary definitions of the word “print” include as a distinct meaning “a photographic or motion-picture copy.”⁸³ Yet that modern intuition is anachronistic. Photographic

⁷⁷ 47 U.S.C. § 96

⁷⁸ *Id.* § 151.

⁷⁹ *Id.* § 251.

⁸⁰ 30 F. Cas. 424 (1866).

⁸¹ 2 Stat. 171, 171 § 2 (1802).

⁸² 4 Stat. 436, 436 § 1 (1831) (emphasis added).

⁸³ “A reproduction of an original painting or other work of art obtained usu by a photomechanical process . . . a photographic copy” WEBSTER’S THIRD NEW INTERNATIONAL DICTIONARY OF THE ENGLISH LANGUAGE UNABRIDGED 1803 (Philip Babcock Gove, 1993).

“prints” were wholly unknown when the 1802 and 1831 statutes were enacted, as even a brief glance at the history of the technology demonstrates.

Like many technologies, photography does not have a single definitive date for its invention. The earliest possible date is in 1826 or 1827, when Nicéphore Niépce produced what is considered to be the oldest surviving photograph, “View from the Window at Le Gras.”⁸⁴ Yet like many early photographs, that image was captured on a polished and specially treated metallic plate.⁸⁵ It could not be reproduced or “printed” in the ways that subsequent photographs could be. Moreover, such an early success in photographic experiments was not well known; the picture itself was a fuzzy image of some rooftops near the photographer’s home; the image took literally days of exposure time; and the process was not commercialized for many years.

Photography did not become well-known until at least 1839, when the photographic successes of Louis Daguerre were announced in France. Indeed, Daguerre’s success was “reported in all the major newspapers of the world,” and “the dominant historical narrative” became that Daguerre invented the process of photography in 1839.⁸⁶ Yet even in 1839 and for years thereafter, the concept of photographic “prints” as copies of an original photograph would have been unknown. Daguerre’s process was an extension of the work of Niépce (with whom Daguerre had formed a partnership prior to the Niépce’s death in 1833), and like Niépce’s process, the “Daguerretype” process formed images on solid metal plates that could not be copied (or certainly not easily copied) with the technology of the time. Thus, legislators writing a statute in 1831—or even a decade later—could hardly have been anticipated that the extension of copyright to “any print” would cover photographic prints.

The copyrightability of photographs would not generate litigation for more than two decades after Daguerre’s 1839 announcement. The technological limitations of the Daguerrotype process explain the delay. Because copies of a Daguerretype image could not be made, copyright protection was not commercially important. Also, and again because of the technological limitations of the process, the market for Daguerrotype photographs was primarily portrait photography for private enjoyment. Federal copyright protection for such photographs would have been economically infeasible at that time for the independent reason that the statute imposed significant formalities as a condition for protection: Filing a copy of the work with a U.S. district court along with a fee

⁸⁴ Gregory A. Wickliff, *Light Writing: Technology Transfer and Photography to 1845*, 15 *TECH. COMM. Q.* 293, 299 (2006); see also NAOMI ROSENBLUM, *A WORLD HISTORY OF PHOTOGRAPHY* (1993 ed.).

⁸⁵ Wickliff, *supra* note 84, at 300 (noting that the image was on a “a polished pewter plate”).

⁸⁶ Wickliff, *supra* note 84, at --.

of 50 cents (approximately \$17 in current dollars).⁸⁷ Private parties contracting for private portraits of their families were, to put it mildly, highly unlikely to satisfy those formal requirements for copyright protection.

By the early 1860s, however, the Daguerretype process was being replaced by various processes that produced translucent “negatives” of images (with the negative often contained on a glass plate), and the negatives could then easily produce multiple positive copies. It was the advent of those technologies that made the copyrightability of photographs an issue worth litigating. The *Wood v. Abbott* litigation arose when there was not yet affirmative legislation granting or denying the copyrightability of photographs. The plaintiffs in the case contracted with an artist to make drawings in crayon, which were then photographed and reproduced in large numbers for sale. At the time, mere drawings could not be protected by copyright, but “any print or engraving” could be. The plaintiffs proceeded on the theory that photographs of drawings qualified as “prints,” and they deposited copies of photographs in a United States district in an attempt to satisfy the formal requirements of then-existing copyright law. The defendants in the case purchased copies of plaintiffs’ photographs and then proceeded to copy and sell them. The plaintiffs brought an infringement suit, but the court held that a photograph did not qualify as a “print” within the meaning of the statute.

The *Wood* court began its analysis by describing the new technology of photography and noting that it was “a new and beautiful art,” but one “discovered long after the statute in question was enacted.”⁸⁸ At the time of the statute’s enactment, the word “print” was limited to marks “made by impression” or “that which, being impressed, leaves its form.”⁸⁹ The court found that “print” was synonymous with the term “engraving,” with which it is connected in the act, which means, in this relation, ‘an engraved plate; an impression from an engraved plate.’”⁹⁰ To the court, these definitions connoted the application of pressure to form the image, and in photography, the image is not “formed by pressure.” Instead, the image is formed by “the chemical force of light, operating on a surface made sensitive to its power.”⁹¹

The court rejected two clever arguments in favor of viewing photographs as prints. First, the court acknowledged that some pressure is involved in making

⁸⁷ Act of Feb. 3, 1831, ch. 16, § 4, 4 Stat. 436.

⁸⁸ 30 F. Cas. at 425.

⁸⁹ *Id.* The court did not cite the dictionary being quoted, but the definition is similar to the 1828 Webster’s dictionary, which defined “print” to be a mark “made by impression” or any form “made by the pressure of one body or thing on another.” 1828 Webster’s Dictionary (<https://webstersdictionary1828.com/Dictionary/print>).

⁹⁰ *Id.* Again the court did not identify the dictionary quoted.

⁹¹ *Id.*

photographs. To make a positive copy of a photographic negative (which was the process the plaintiffs had used), photographic paper was placed into a frame containing the glass negative and pressure was applied to bring the paper into direct and uniform contact with the glass negative. But that pressure, the court correctly recognized, was merely to “hold the paper firmly in contact with the glass,” and the image was formed not by that pressure but by the exposure to light.⁹² Second, the court also acknowledged that, by the time of the litigation, those in the field had come to call the process “photographic printing.” “But,” the court emphasized, “names are not things,” and what was then called “photographic printing” was “not printing in any sense known to the arts at the time this copyright act was passed.”⁹³

Finally, the court noted that in 1865—the year before the court’s decision but after the attempt to take out copyrights in the photographs at issue and after the infringement suit was filed—Congress did extend copyright protection to photographs.⁹⁴ But that action, the court believed, merely reinforced its decision because Congress must have been “proceeding upon [the same] view [as the court],” namely that photographs were not previously eligible for copyright protection.

In our view, the court in *Wood* got it right. The technology of photography was fundamentally different from the technologies to which Congress had previously granted copyright protection. The pre-existing arts of printing or engraving combined “creative or imitative power *and mechanical skill*.”⁹⁵ Photography did not involve any “work[ing] on any surface from which copies are to be produced by impression or printed.”⁹⁶ To a modern reader, this might seem like a trivial and highly formalistic distinction, but copyright law had a more narrow scope in the middle of the 19th century. Critically, the crayon drawings that were the subject of the photographs were also *not* eligible for copyright protection. Moreover, as the *Wood* court noted, the methods and creativity used in photography were distinctly different than the work of prior printers and

⁹² *Id.* The scientific truth that the photons in light exert pressure had been discussed as a matter of theory since the 17th century, but it was not proven until the early 20th century. The court was obviously unaware of that then-theoretical possibility, but then of course, Congress would not have been either. Furthermore, the plaintiffs themselves appear not to have argued that the exposure to light was itself a use of a form of pressure. Instead, as discussed by the court, the argument was solely about the pressure applied by the frame that held the photographic paper to the glass negative.

⁹³ *Id.*

⁹⁴ See Act of March 3, 1865, 13 Stat. 540 (1865). The act was a short, half-page statute extending copyright protection to “photographs and the negatives thereof.” *Id.* at 540.

⁹⁵ 30 F. Cas. at 425.

⁹⁶ *Id.*

engravers, who needed some mechanical skill to cut or etch patterns into physical blocks or plates.

Indeed, the nature of creativity involved in photography was so different that the congressional extension of copyright to photography led to a constitutional challenge that the Supreme Court found “not free from difficulty.”⁹⁷ The argument was that, while the Constitution authorizes Congress to grant rights to “Authors” for their “Writings,”⁹⁸ “a photograph being a reproduction, on paper, of the exact features of some natural object or of some person, is not a writing of which the producer is the author.”⁹⁹ While the Court ultimately rejected that argument, the Court had to spend considerable analysis on defining the necessary creativity that photographers had to exhibit to be entitled to copyrights.¹⁰⁰

An excellent contrast to *Wood* is *Rossiter v. Hall*, another 1866 decision that addresses the quite different issue whether a photograph of an indisputably copyrighted work could constitute an infringing “copy” of the protected work.¹⁰¹ *Rossiter* was decided just a few months after *Wood*, but the legal issue turned not on section 1 of the 1831 Copyright Act, which defined the eligibility of works for copyright, but instead on section 7, which defined liability for infringement. The plaintiffs in the case owned the copyright in an engraving entitled “The Home of Washington,” and there was no dispute that such an engraving qualified for copyright protection under section 1 of the 1831 Act. Infringement of such a copyright was controlled by section 7, which imposed liability on any party who would “copy” the work or “cause [it] to be ... copied.” The *Rossiter* court held that each photographic reproduction was a “copy,” reasoning that “[t]he word ‘copy’ is a general term, added to the more specific terms before used, for the very purpose of covering methods of reproduction not included in the words ‘engrave, etch or work,’ and, if it covers anything, should cover the photographic method, which, more nearly than any other, produces a perfect copy.”¹⁰²

Again, we think that the *Rossiter* court got it right, and the case provides a good example where a major technological question does not arise. In *Wood*, the court was confronted with a technological question because it had to determine whether photography was sufficiently like pre-existing printing and engraving in a context where Congress was being very specific about the eligibility of works for copyright protection. Deciding whether the analogy was close enough dragged the *Wood* court into the details of the technology and, with the analogy uncertain, the

⁹⁷ *Burrow-Giles Lithographic Company v. Sarony*, 111 U.S. 53, 56 (1884)

⁹⁸ U.S. CONST. art. I, § 8, cl. 8.

⁹⁹ *Burrow-Giles*, 111 U.S. at 56.

¹⁰⁰ *Id.* at 59-61.

¹⁰¹ 20 F. Cas. 1253, 1254 (1866).

¹⁰² 20 F. Cas. at 1254.

court took the right step in concluding that the statute should be read as silent about photography. By contrast, the *Rossiter* court merely had to decide whether a photograph was a “copy” of the work, where that word appeared in a section of statute with a structure apparently designed to be general and all-encompassing. Thus, the general concept of “copy” did extend to subsequently arising technologies, but the more limited word of “print” would not be extended by an analogy that presented significant technological questions. Significantly, this decision in no way threatened the continued emergence of photography, but restricted one particular use of it.

B. Airplanes

Flight with powered aircraft was a revolutionary technology of the twentieth century. Unlike photography, the invention of powered, heavier-than-air flying machines is frequently and accurately pinpointed to a specific date—December 17, 1903, when the Wright Brothers first successfully tested their Wright Flyer over the sandy shore hills at Kitty Hawk, North Carolina. The brothers’ longest flight that day was only a few hundred yards, and the craft gained only a few dozen feet of altitude. They conducted their Kitty Hawk experiments on unowned beach land, and when they returned to their native Ohio, they conducted more tests over their own property. Thus, the Wrights did not have to confront a key legal issue that would soon bedevil the new technology: Should airplane overflights be viewed as trespasses on the underlying ground-level parcels of property?

The legal issue grew out of an ancient common law concept embodied in the Latin maxim “*cujus est solum ejus est usque ad coelum et ad infernos*,” which means “the owner of the soil also owns up to the sky and down to the underworld.” The Latin phrase originated in the writings of the 13th-century Roman Law scholar Accursius of Bologna, but it was made famous by its inclusion in major treatises on the English common law, including Lord Coke’s *Institutes of the Law of England*¹⁰³ and Blackstone’s *Commentaries*.¹⁰⁴ The maxim might seem to support the right of a property owner to exclude aircraft from any overflights of the owner’s property, but the maxim itself has multiple ambiguities, each of which raises significant technological questions in the context of airplanes.

¹⁰³ 1 EDWARD COKE, *INSTITUTES OF THE LAWS OF ENGLAND* § 1, 4 (1633) (noting that “the earth hath in law a great extent upwards, not only of water as hath been shown, but of any and all other things even up to heaven, for cuius est solum eius est usque ad coelum”).

¹⁰⁴ 2 WILLIAM BLACKSTONE, *COMMENTARIES ON THE LAWS OF ENGLAND* 18 (1766).

The various ambiguities concerning the maxim are evident in Blackstone's *Commentaries*, and accordingly, this article will focus on that source to illuminate the issues. The passage in which Blackstone invokes the maxim reads:

Land hath also, in it's legal signification, an indefinite extent, upwards as well as downwards. Cujus est solum, ejus est usque ad coelum, is the maxim of the law, upwards; therefore no man may erect any building, or the like, to overhang another's land: and, downwards, whatever is in a direct line between the surface of any land, and the center of the earth, belongs to the owner of the surface; as is every day's experience in the mining countries. So that the word "land" includes not only the face of the earth, but every thing under it, or over it. And therefore if a man grants all his lands, he grants thereby all his mines of metal and other fossils, his woods, his waters, and his houses, as well as his fields and meadows.¹⁰⁵

The first ambiguity in this passage is that Blackstone does not identify the precise type of ownership interest that the surface property owner has in the three-dimensional volume defined by extending the property lines "upwards" and "downwards." In the preceding chapter of the same book, however, Blackstone made clear that "there are some few things, which ... must still unavoidably remain in common," and he lists as examples both the "air" and "water" associated with a property.¹⁰⁶ For such things, Blackstone maintained that "nothing but an usufructuary property is capable of being had," meaning that those things "belong to the first occupant, during the time he holds possession of them, and no longer."¹⁰⁷ As Professor Eric Claeys has suggested, one reasonable way to combine these two passages is to view the "ad coelum" passage as demonstrating that surface owners have property rights, but only usufructuary property rights in the air in a manner similar to their rights to the water.¹⁰⁸

The second ambiguity in the passage goes to the height of the property rights. The traditional maxim extends property right "to" the sky ("ad coelum"), not through the sky ("per coelum"). Literally, the sky is the limit—the boundary of the property rights. But how high is the sky? Blackstone does not say, though he prefaces his discussion of the Latin maxim by stating that property rights in land have "an indefinite extent"—not an *infinite* extent. In classical times, the "coelum" (or caelum) quite possibly began only a few hundred feet above the

¹⁰⁵ *Id.*

¹⁰⁶ *Id.* at 14.

¹⁰⁷ *Id.*

¹⁰⁸ Eric R. Claeys, *On the Use and Abuse of Overflight Column Doctrine*, 2 BRIGHAM-KANNER PROP. RIGHTS CONF. J. 61, 66-68 (2013).

surface.¹⁰⁹ Indeed, even into the nineteenth century, the conceptual height of the “sky” might not have been very high. With the advent of tall buildings built with steel structures, such buildings quickly came to be known as “skyscrapers,” with many sources referring to these buildings as extending “into the sky,”¹¹⁰ even though early skyscrapers extended only a few hundred feet above the surface. Thus, even taking the “ad coelum” maxim to mean all that it says, the maxim confirms rights only up *to* the sky; it is silent about the rights that may exist *within* the sky.

A third ambiguity in Blackstone involves the relationship between the existence of property rights and the extent of exclusionary rights. The first issue is discussed in Book II, which recites the ad coelum maxim; the second, in Book III, which discusses trespass. Blackstone recognizes that “[i]n some cases trespass is justifiable” and gives as one exemplary exception to trespass the privilege of “hunting of ravenous beasts of prey, as badgers and foxes, in another man’s land; because the destroying such creatures is profitable to the public.”¹¹¹ Such hunting privileges are quite broad in some U.S. jurisdictions including, among others, Virginia, which permits armed fox and racoon hunters to continue to “follow their dogs” chasing prey across private property.¹¹² Though hunting and transportation are quite different activities, Blackstone’s “profitable to the public” justification would seem capable of applying to both.

Each of these ambiguities in pre-aviation property law presents difficult technological questions. Should property owners have merely usufructuary property rights in the air over their property? If property rights go to the sky, how high is the sky? And if property rights do not always grant exclusionary rights

¹⁰⁹ See *Swetland v. Curtiss Airports Corp.*, 41 F.2d 929, 937 (6th Cir. 1930) (noting that, classically, “the caelum was a space which began only a short distance above the surface of the earth ... only a little above the highest tree tops and buildings. The area below this caelum belongs to the owner of the surface.”) (quoting Hiram L. Jome, *Property in the Air as Affected by the Airplane and the Radio*, 4 J. LAND & PUB. UTIL. ECON. 257, 261 (1928)).

¹¹⁰ R.W.S., “*The Sky-Line*” *The New Yorker* 28 (May 2, 1925) (describing the Shelton Hotel—a 1,200 foot building—as “soar[ing] into the sky”); James D. Kenyon, “*The Lesson of New York City*,” *The Rotarian* (Nov. 1912) at 7, 8 (noting that a “few years ago ... the twenty-story skyscraper shot it way up into the sky” and “was the wonder of the world” but that by 1912 skyscrapers were reaching forty-one stories or 612 feet “into the sky”); see also ROBERT MORRIS PIERCE, *DICTIONARY OF AVIATION* 201 (1911) (defining a “skyscraper” to include a building that “extends or is projected far into the sky”); 9 SIR JAMES A.H. MURRAY, *A NEW ENGLISH DICTIONARY* 161 (Oxford 1919) (defining “sky-scraping” as “[h]igh enough to appear to touch the sky”).

¹¹¹ 3 COMMENTARIES at 212-13.

¹¹² VA. Code 18.2-136 (2023) (allowing the chase to continue even on “prohibited lands,” which are lands marked with “no trespassing” signs).

against all intrusions, are temporary intrusions by airplanes similar to the permissible intrusions that Blackstone permitted as “profitable to the public”?

The thesis of this paper is first and primarily that courts should not present major legal questions for newly developing technologies as *controlled* by prior law, doctrines and legal maxims, absent unambiguous legal authority extending prior principles to new technology. Our thesis also includes a secondary principle that, to the extent that courts are formulating law in a case-by-case manner (as in a common law case), judges should be willing to accommodate the new technology as least provisionally rather than to adopt a provision that would prevent its emergence. New technologies present as yet unanswered questions of law of policy, and thus looking to the past cannot provide a definitive answer. But even the present may not provide a great answer because experience with the new technology might be in short supply. A future time informed by experience may thus have an advantage to answering major questions about technologies that are presently new, but an answer that fails to accommodate a new technology precludes a more experienced future.

IV. APPLICATIONS

As technological progress accelerates, courts increasingly confront major new technological questions and, of course, hear arguments trying to apply past legal authorities to utterly new technological environments. Below are just a few of the major technological questions presented in our era. As discussed, answers to such questions should generally be viewed as not controlled by ambiguous commands in the past.

A. *Crypto*

The legal question surrounding crypto that has been debated the most extensively, some might say *ad nauseum*, is whether crypto counts as a “security” under section 2 of the Securities Act.¹¹³ The definition includes a long list of what counts as a “security,” including “stock,” “bond,” and more exotic instruments like “straddle.” One of the items listed, “investment contract,” has become something of a catch all.¹¹⁴ In *SEC v. W.J. Howey Co.*,¹¹⁵ the Supreme Court clarified, “The test is whether the scheme involves an investment of money in a

¹¹³ 15 U.S.C. § 77b(a)(1).

¹¹⁴ The statute also refers to “any interest of instrument commonly known as a ‘security,’” and the Supreme Court has defined that to have the same meaning of “investment contract.” *Landreth Timber Co. v. Landreth*, 471 U.S. 681, 691 n.5 (1985).

¹¹⁵ 328 U.S. 293 (1946).

common enterprise with profits to come solely from the efforts of others.”¹¹⁶ The decision date being 1946, the Court said nothing about digital assets. And thus the Court unleashed a torrent of scholarship and litigation concerning whether particular digital assets count as investment contracts and thus securities.

The importance of the case law greatly outstrips its analytical interest. The honest answer, after all, is obvious: sort of. A purchaser of a cryptocurrency, for example, will generally part with money or something else of value (such as other digital assets) to obtain the cryptocurrency, and for most such purchasers, whether the purchase appreciates or depreciates in value will have nothing to do with the purchasers’ own efforts. But whether a cryptocurrency or other digital asset is a “common enterprise” is a little bit more baffling. The courts have devised a test for “horizontal commonality,” indicating that the returns of different holders of the asset are proportional to holdings.¹¹⁷ Yet many digital assets pay no dividends; investors are simply hoping that they will rise in value, presumably because the digital asset itself has some practical use, such as serving as a store of value.¹¹⁸ The original cryptocurrency, Bitcoin, does not do much of anything else, and thus to call it an “enterprise” is plausible yet expansive,¹¹⁹ in much the same way as was the use of the word “system” to refer to the Clean Power Plan.¹²⁰

And so, if *Chevron*¹²¹ deference is the rubber stamp that scholars so long thought it to be, then the SEC could resolve this question, if it chose to do so through the notice-and-comment process of informal rulemaking. In the absence of rulemaking, the SEC can develop its views in enforcement proceedings against

¹¹⁶ *Id.* at 301.

¹¹⁷ *See, e.g.,* Revak v. SEC Realty Corp., 18 F.3d 81, 87 (2d Cir. 1994 (asking whether each investor’s fortunes is tied “to the fortunes of the other investors by the pooling of assets”).

¹¹⁸ John P. Kelleher, *Why Do Bitcoins Have Value?*, INVESTOPEDIA (Oct. 8, 2023) <https://www.investopedia.com/ask/answers/100314/why-do-bitcoins-have-value.asp#:~:text=Like%20all%20forms%20of%20currency,regardless%20of%20its%20monetary%20value> (“Like all forms of currency, Bitcoin is given value by its users, supply and demand. As long as it maintains the attributes associated with money and there is demand for it, it will remain a means of exchange, a store of value, and another way for investors to speculate, regardless of its monetary value.”).

¹¹⁹ The word “enterprise” can be defined as a “project or undertaking, typically one that is difficult or requires effort.” *Enterprise*, OXFORD ENGLISH DICTIONARY https://www.oed.com/dictionary/enterprise_n?tab=meaning_and_use#5487135 (last visited Oct. 12, 2023). A cryptocurrency plausibly might be thought to meet this definition. But there is an argument that the more specific definition of “enterprise” as a “business or company” was intended. *Id.*

¹²⁰ *See supra* note 80 at 2596 (“The word “system” shorn of all context, however, is an empty vessel”).

¹²¹ *Chevron, U.S.A., Inc. v. Nat. Res. Def. Council, Inc.*, 467 U.S. 837 (1984).

particular purveyors of digital assets, and so it has.¹²² To the extent that the SEC issues guidance documents,¹²³ those may be entitled to less powerful *Skidmore* deference,¹²⁴ requiring the SEC to persuade the courts but allowing the courts to take into account the SEC's presumed expertise. If, however, the courts concluded that the application of the securities laws to digital assets was a major question, or simply determined that the securities laws clearly do not encompass digital assets at issue, then there would be no need for deference.

And so, it is not surprising that, in the wake of the increased invocation of the major questions doctrine in recent years, targets of the SEC have invoked it as well. Consider, for example, a recent case against Terraform Labs.¹²⁵ Terraform marketed the TerraUSD stablecoin and its sister coin LUNA. For present purposes, we need not elaborate the algorithm that sought to ensure that the TerraUSD would remain pegged to the U.S. dollar. It suffices to say that it did not work, and the coins eventually collapsed in value.¹²⁶ In a motion to dismiss the fraud and failure-to-register claims filed by the SEC, the defendants cited the major questions doctrine.¹²⁷ They note what is undisputable, that “there is no evidence that the 1930s statutory structure contemplated it”¹²⁸ and that the appropriate regulation of crypto has generated substantial debates, including in the SEC.¹²⁹ They also point out that Congress has considered many proposals to regulate crypto but has so far not acted.¹³⁰

¹²² See, e.g., *SEC Charges Coinbase for Operating as an Unregistered Securities Exchange, Broker, and Clearing Agency*, SEC, June 6, 2023, <https://www.sec.gov/news/press-release/2023-102>. For a list of enforcement actions, see *Crypto Assets and Cyber Enforcement Actions*, <https://www.sec.gov/spotlight/cybersecurity-enforcement-actions> (last visited Nov. 23, 2023).

¹²³ See, e.g., SEC, FRAMEWORK FOR “INVESTMENT CONTRACT” ANALYSIS OF DIGITAL ASSETS, <https://www.sec.gov/corpfin/framework-investment-contract-analysis-digital-assets>.

¹²⁴ *Skidmore v. Swift & Co.*, 323 U.S. 134 (1944).

¹²⁵ *SEC v. Terraform Labs Pte. Ltd.*, No. 23-cv-1346 (S.D.N.Y. 2023).

¹²⁶ See generally Krisztian Sandor & Ekin Genç, *The Fall of Terra: A Timeline of the Meteoric Rise and Crash of UST and LUNA*, COINDESK, Dec. 22, 2022.

¹²⁷ *Terraform*, Memorandum of Law in Support of Defendants' Motion to Dismiss the Amended Complaint 7-9 (filed Apr. 21, 2023).

¹²⁸ *Id.* at 8.

¹²⁹ *Id.* at 8-9.

¹³⁰ Congressional inaction does not demonstrate an affirmative legislative preference not to regulate. See, e.g., Daniel T. Deacon & Leah M. Litman, *The New Major Questions Doctrine*, 109 VA. L. REV. 1009, 1062 (2023) (discussing inaction in the context of major questions). But the volume of legislative activity suggests at least a possibility that Congress will act and that given continued technological development and uncertainty, judicial or agency regulation may be premature.

Rejecting the applicability of the major questions doctrine, Judge Rakoff notes that in major questions doctrine cases, the Supreme Court has highlighted “the extraordinary nature of the agency’s claims and the exceptional importance of the industries to be regulated.”¹³¹ The “crypto-currency industry—though certainly important—falls far short of being a ‘portion of the American economy’ bearing ‘vast economic and political significance,’” Judge Rakoff ruled.¹³² The court concluded that “it would ignore reality to place the crypto-currency industry and the American energy and tobacco industries—the subjects of *West Virginia* and *Brown & Williamson*, respectively—on the same plane of importance.”¹³³ Judge Rakoff added that the SEC does not “exercise vast economic power over the securities markets,” but simply seeks to assure sufficient disclosure.¹³⁴ Finally, noting the laundry list of examples included in the example of “security,” Judge Rakoff concluded that it is important for the definition to extend not only to known securities but also to new ones developed after the statute was passed.¹³⁵

Judge Rakoff’s interpretation is a conventional reading of the major questions doctrine, but ultimately a superficial one. It is understandable that a court would hesitate to label a particular case on securities a major question. After all, *Terraform* did not represent some major new initiative by the SEC, but rather reflected a more prudent case-by-case approach focusing on the specific attributes of individual digital assets, and in that sense the case differs from the existing major questions doctrine cases. Moreover, the fact that crypto developed after the Securities Act might seem to strengthen his argument. Congress knew that it could not anticipate every type of security, and so it listed a number of types, including some that have broad but uncertain application. And although the market capitalization of cryptocurrencies remains high, they have not yet directly impacted American life to the extent that energy and tobacco have.

Our approach to major technological questions, however, suggests that there is a strong argument for excluding cryptocurrencies and many other digital assets from the definition of “securities.” Let us return to the three critical points that we raised about major technological questions above. Above, we argued that courts should consider not only the importance of the new technology, but also the magnitude of the effect of the regulation on the new technology. While Judge Rakoff is thus correct to assess the size of the market and to point out that regulation would not eliminate the market, there are strong counterarguments. The

¹³¹ *Terraform*, Opinion and Order (July 31, 2023).

¹³² *Id.* at 21-22 (citing *Utility Air Regul. Grp.*, 573 U.S. [CITE], 324 [YEAR]).

¹³³ *Id.* at 22.

¹³⁴ *Id.*

¹³⁵ *Id.* at 23.

total global market capitalization of cryptocurrencies exceeded that of the tobacco industry.¹³⁶ Judge Rakoff suggests that the market is merely being subject to a modest disclosure regulation, but he makes no attempt to quantify the potential cost of such regulation. A significant selling point for cryptocurrencies is that they are decentralized. The argument is that they may allow financial functions to be performed without traditional intermediaries such as banks. Imposition of securities law on cryptocurrencies means that large players with high ownership shares will be needed to distribute the cryptocurrency. Thus, the implications of regulation may in fact be quite large for this industry.

The second observation from the major questions doctrine cases is that the Supreme Court has focused on cases in which the agency was outside its wheelhouse. On one hand, recognizing financial fraud is well within the wheelhouse of the SEC. But the challenges of regulating decentralized assets may be quite different from the challenges of regulating centralized institutions. At least as a practical matter, these assets are designed so that they can be traded without the need for a centralized exchange, and as a result there is no national regulator that is uniquely situated to regulate any given security. Meanwhile, these assets are controlled by code rather than by conventional contract provisions. SEC lawyers can, of course, learn about the unique aspects of cryptocurrencies. But many of the most important issues concerning cryptocurrencies have no analogue in conventional securities. The ongoing debate about whether the SEC or the CFTC is better situated to regulate cryptocurrencies highlights that neither is a very good fit. The statutory regime for neither agency was made with cryptocurrencies in mind, and so each is likely to fit uneasily with cryptocurrencies.

The existence of the CFTC further highlights the third teaching we derived from the major questions doctrine. Judge Rakoff notes that the laundry-like definition of “security” suggests a broad definition, but it clearly omits some important economic arrangements, such as the commodities that the CFTC regulates. There is another even more important omission: currencies. Advocates for cryptocurrencies contend that they might serve as substitutes for national currencies, so this analogy has at least some power. Other analogies may be relevant, too. The IRS regulates cryptocurrency transactions as property,¹³⁷ and

¹³⁶ Compare *Global Cryptocurrency Market Cap Charts*, <https://www.coingecko.com/en/global-charts> (indicating a cryptocurrency market capitalization greater than \$1 trillion at the time), with *Top 10 Tobacco Companies in the World by Market Capitalization*, <https://www.globaldata.com/companies/top-companies-by-sector/consumer/global-tobacco-companies-by-market-cap> (reporting a total market capitalization of \$453 billion combined market cap for the top 10 companies, with the least value of these worth only \$2 billion).

¹³⁷ I.R.S. Notice 2014-21, 2014-16 I.R.B. 938.

even outside the example of NFTs,¹³⁸ cryptocurrency assets bear some resemblance to assets like art or collectibles, whose value depends largely on what others might be willing to pay for them. And many cryptocurrencies have features of smart contracts,¹³⁹ and contracts are not included in the list either. Given that Congress omitted many important economic arrangements and enumerated a list of specific instruments, one might conclude that Congress in fact intended the phrase “investment contract” to refer to a specific type of arrangement rather than a catch all. Admittedly, “investment contract” may be more difficult to interpret than “stock,”¹⁴⁰ but that does not mean that it is so expansive as to encompass radically new arrangements bearing little resemblance to conventional investments in business enterprises.

Perhaps a reasonable person could disagree with our statutory interpretation, but at the least, an awareness of issues surrounding major technological questions should prompt a more searching analysis than the courts have offered so far. The mechanical way to interpret the Securities Act is to simply take the Supreme Court’s explanation in *Howey* and treat the words in that test as one might treat the words in a statute. Judge Rakoff is not known as a mechanical or conventional judge, but even he did not look deeper than this. *Howey* is not a statute, and lower courts can at the least engage in common law type reasoning in assessing whether a test fits some new phenomenon. A court doing so would focus not just on issues such as horizontal commonality, but also on whether crypto is the sort of thing that Congress wanted the SEC to regulate, despite its differences from other types of investments.

Courts might reach different conclusions for different cryptocurrencies (or even different results for the same cryptocurrency depending on how it was marketed),¹⁴¹ focusing on the meaning of the Securities Act and the phrase “investment contract” rather than solely on the words of the *Howey* test. This would be an improvement, as would be recognition that major technological questions require more searching statutory construction. But a focus on major technological questions also suggests a result more akin to that in the major questions doctrine. When a major new technology arises, statutory interpretation will often seem abstract and difficult to resolve, as the difficulty of using analogical reasoning to assess whether cryptocurrencies are “investment

¹³⁸ See generally Usman W. Chohan, *Non-Fungible Tokens: Blockchains, Scarcity, and Value* (2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3822743.

¹³⁹ See generally Mark Verstraete, *The Stakes of Smart Contracts*, 50 LOY. U. CHI. L.J. 743 (2019).

¹⁴⁰ See *United Housing Foundation, Inc. v. Forman*, 421 U.S. 837 (1975) (interpreting “stock”).

¹⁴¹ Indeed, one court has already held that the *same* cryptocurrency can be both an investment contract and not an investment contract depending upon whether it was marketed to retail investors or institutional investors. *SEC v. Ripple Labs*, July 13 2023 S.D.N.Y.

contracts” illustrates. The reasoning in cases thus may resemble metaphysics more than policy analysis. Major new technologies need to be analyzed on policy grounds. The courts do not share Congress’s institutional capacity to engage in open-ended policy analysis. A presumption of non-regulation would highlight the courts’ conclusion that Congress has not yet done its job.

It may appear that our analysis reflects an endorsement of the proposition that cryptocurrencies and other digital assets should not be regulated. But in noting that the cryptocurrency industry is large, that it might be quite negatively affected by regulation, and that cryptocurrencies have many features that conventional securities do not have, we do not intend to be wide-eyed advocates for crypto. To the contrary, we recognize many compelling arguments in favor of regulating crypto, including conventional arguments about protecting ordinary investors. That is a function of the securities laws, but because cryptocurrencies differ in so many ways from ordinary investments, there is a strong argument that Congress has not yet made the determination that pursuing such protection is sensible. Advocates of crypto claim that it can be self-regulating. Many industries might like to be self-regulating, but the design of cryptocurrencies explicitly seeks to avoid requiring the judgment of government officials to function. That does not mean that legislators must embrace that vision, but Congress has not yet decided to reject that vision. It cannot have so decided because it could not in the 1930s confront this major technological question. And because our marketplace has a default of allowing market entry for innovative new products, the considerations associated with major technological questions argue for Terraform, as well as companies similarly targeted.

A plausible counterargument to a default of nonregulation is that it will not necessarily be democracy-forcing, because the legislature may simply decide not to act. In the meantime, unscrupulous parties may take advantage of a regulatory void. On this theory, judicial regulation is needed while we wait for congressional resolution. But there are several problems with this. First, no regulation may be better than incoherent regulation, especially when that regulation ignores critical policy questions and mechanically parses statutes or doctrines that could not be expected to account for the nuances of a new problem. Second, judicial resolution may establish a status quo that could be difficult to dislodge. Nonregulation may also be a status quo, but if judicial doctrine emphasizes that the purpose of this lack of regulation is to spur the legislature to consider regulation and to allow for experimentation, the status quo may seem more tentative. Third, it is not our suggestion that those working on digital assets be free of all regulation; if the fraud allegations involving UST and LUNA are valid, then prosecutions could be maintained by the state or perhaps even by the

federal government on a wire fraud theory. Fraud statutes are, after all, written so that they can apply in entirely unexpected factual circumstances.¹⁴²

We acknowledge, however, that the mere fact that a technology is different does not mean that either it or the questions that it raises are major. A challenge in determining whether an industry presents major technological questions is that the definition of “major” may depend in part on one’s future assessment of the industry’s prospects. If one is confident, as some seem to be,¹⁴³ that crypto is nothing but a Ponzi scheme that is bound to fail because it has no underlying value, then one might conclude that crypto presents age-old questions, obscured by distractions and source code. Though it remains possible that all cryptocurrencies will fall in value to zero, the market data suggests that there are at least many people who are not naïve investors who believe that there is some chance that it will be very valuable.

B. Artificial Intelligence

While one can reasonably argue about whether crypto is of greater significance than the tobacco industry, there is little doubt that artificial intelligence presents major technological questions. Investment in this industry takes a much more conventional form than crypto investments, and it is growing rapidly, currently exceeding \$300 billion annually.¹⁴⁴ Meanwhile, AI raises a host of legal issues, all arising from the observation that AI can do things that previously required human agency, including but not limited to producing text and images. This raises the question whether the products of AI should have the same implications for the owners of the AI (or perhaps the users) as direct products of human effort. We consider two problems: libel and the copyrightability of AI.¹⁴⁵

¹⁴² See, e.g., 18 U.S.C. § 1341 (mail fraud statute).

¹⁴³ See, e.g., Nassim Nicholas Taleb, *Bitcoin Is the Detector of Imbeciles*, MEDIUM, Jan. 4, 2023, <https://medium.com/incerto/bitcoin-is-the-detector-of-imbeciles-e5cc5eecedbf>.

¹⁴⁴ See *Will Total Global Corporate Investment in AI in 2023 Reach or Exceed \$300 Billion, According to the Artificial Intelligence Index*, https://www.gjopen.com/questions/2728-will-total-global-corporate-investment-in-ai-in-2023-reach-or-exceed-300-billion-according-to-the-artificial-intelligence-index/crowd_forecast (estimating a 72% chance of global AI spending in 2023 exceeding \$300 billion).

¹⁴⁵ We do not here address the issue of whether training AIs on copyrighted material violates copyrights. See, e.g., Blake Brittain, *OpenAI, Microsoft Hit with New Author Copyright Lawsuit over AI Training*, REUTERS, Nov. 21, 2023, <https://www.reuters.com/legal/openai-microsoft-hit-with-new-author-copyright-lawsuit-over-ai-training-2023-11-21/>. Arguments that this is a major technological question include that permitting use of such materials might be essential to further development of such models and that the cost-benefit balance includes many issues beyond the

1. *Libel and Large Language Models*

Large language models such as ChatGPT sometimes “hallucinate” sources or facts.¹⁴⁶ Large language models are constructed with deep neural networks, and the dominant current training approach is autoregressive, meaning that the model learns to predict the next word based on the preceding context.¹⁴⁷ The model is thus situated not so differently from a human considering how another speaker might complete a thought. When the text is straightforwardly factual, such as “The capital of France is ...”, the model will likely fill the text in with the correct answer, but otherwise it might guess something that sounds correct, because that seems to it like a more plausible completion than an acknowledgement of not knowing the answer. Thus, if one asks the question “What was the crime that Michael Abramowicz and John Duffy were accused of?”¹⁴⁸ it might well respond with a crime of the sort that it seems those rascallions might commit. If so and that information is false, the reader might think less of them, particularly if the reader underappreciates the danger of hallucinations.

Eugene Volokh has written a thoughtful analysis of what he calls the “large libel model” problem.¹⁴⁹ He notes that in libel cases, the “key inquiry is whether the challenged expression, however labeled by defendant, would reasonably appear to state or imply assertions of objective fact.”¹⁵⁰ Although OpenAI has added a disclaimer to the bottom of the screen,¹⁵¹ the average lay reader may still take such facts to be true, and users of the service cannot waive third parties’ rights not to be libeled.¹⁵² Rumors can lead to liability, even when the speaker qualifies a statement by noting that it is a rumor.¹⁵³ Meanwhile,

rights of authors.

¹⁴⁶ Lawyers are thus well advised to carefully check any sources cited by ChatGPT. *See, e.g.*, *Mata v. Avianca, Inc.*, No. 1:22-cv-01461, Order to Show Cause at ECF No. 31 (S.D.N.Y. May 4, 2023); Benjamin Weiser, *Here’s What Happens When Your Lawyer Uses ChatGPT*, May 27, 2023, <https://www.nytimes.com/2023/05/27/nyregion/avianca-airline-lawsuit-chatgpt.html>.

¹⁴⁷ *See generally* Tony Jesuthasan, *Autoregressive (AR) Language Modeling*, MEDIUM, July 31, 2021, <https://tonyjesuthasan.medium.com/autoregressive-ar-language-modelling-c9fe5c20aa6e>.

¹⁴⁸ A recent query to ChatGPT of this question, however, reports that we have not committed any crimes.

¹⁴⁹ *See* Eugene Volokh, *Large Libel Models? Liability for AI Output*, 3 J. FREE SPEECH L. 489 (2023).

¹⁵⁰ *Id.* at 498 (quoting *Takieh v. O’Meara*, 497 P.3d 1000, 1006 (Ariz. Ct. App. 2021)).

¹⁵¹ *See* chat.openai.com (“ChatGPT can make mistakes. Consider checking important information.”) Previously, the disclaimer stated, “ChatGPT may produce inaccurate information about people, places, or facts.”)

¹⁵² Volokh, *supra* note 149, at 500.

¹⁵³ *Id.* at 501-03.

statements by chat services are properly thought to be “publications” under the Restatement definition.¹⁵⁴ Moreover, there are precedents indicating that libel can attach even if it arises from a technological error, where the error reflected negligence.¹⁵⁵ Whether negligence must be shown depends on whether negligence occurred and whether the person is a public figure or the issue is a matter of public concern.¹⁵⁶ Damages under traditional doctrine might be appropriate even in the absence of provable economic loss.¹⁵⁷ As Volokh acknowledges, the aggregate costs of liability, given the number of utterances produced by generative AI, could be ruinous.¹⁵⁸

Volokh, however, recognizes that “[c]ourts made the common-law rules in a pre-AI era; and they can change the rules if they think the rules have become inapt as to new technological developments.”¹⁵⁹ And he acknowledges that “[m]uch would be lost if ... functionality had to be sharply reduced in order to prevent libel.”¹⁶⁰ He floats the possibility that the products of AI might be seen as a “first stab”¹⁶¹ toward producing a final product, thus leaving the consumers of AI responsible for any further publication of the AI. But he expresses skepticism, noting that “many users will view AI programs’ output as the final step in some inquiries, not the first stab.”¹⁶² What does not enter his analysis is any special solicitude for large language models as a new, potentially revolutionary technology.

Each of the concerns that we have raised above suggests that libel liability for generative AI should count as a major technological question. First, not only is the size of the industry large, but libel liability has the potential to greatly delay introduction of the technology. This is, of course, somewhat speculative. ChatGPT was released to market despite the problem, after all. But if ruinous judgments follow, large language models could easily disappear from the web or at least from servers whose owners might concern themselves with liability in the United States. Second, the potential for libel is but one of many considerations

¹⁵⁴ *Id.* at 504-05 (citing RESTATEMENT (SECOND) OF TORTS § 577(1) (1977)).

¹⁵⁵ *Id.* at 508-09 (citing *Little Rock Newspapers, Inc. v. Fitzhugh*, 954 S.W.2d 914, 926 (Ark. 1997)). *Fitzhugh* involved a newspaper story reporting the indictment of one man named Fitzhugh but including a photograph of another.

¹⁵⁶ *See id.* at 513-14.

¹⁵⁷ *See id.* at 510-11.

¹⁵⁸ *See id.* at 539.

¹⁵⁹ *Id.* at 540.

¹⁶⁰ *Id.* at 543.

¹⁶¹ *Id.* at 542.

¹⁶² *Id.* at 543.

regarding the costs and benefits of large language models. On the benefit side, according to some analysts, large language models promise to greatly increase economic productivity.¹⁶³ On the cost side, the models might cause mass unemployment.¹⁶⁴ The danger is that the fate of large language models, at least over a significant period of time, might be decided on the basis of just one consideration, their potential to disseminate falsehoods. Third, the statutes are generally quite ambiguous. The word “publication,”¹⁶⁵ for example, could easily be interpreted to exclude AI. Major technological questions can prompt courts to focus more attention on the original statutory language and its ambiguities rather than on intervening interpretations made without the new technology in mind.

Although the major questions doctrine itself does not apply, given that no agency is involved, recognition of the underlying motivations behind the doctrine suggests that courts should treat the issue of libel for AI companies as a major technological question, rather than as business as usual. This will mean finding companies not liable for libel, at least during the period when the technology is nascent, on any number of grounds. That does not mean that the courts could never apply the common law in a way that would find liability, only that they wait until the industry is settled to do so. Granted, courts must make decisions based on the cases before them. But libel presents mixed questions of law and fact, and courts might find as a matter of law that generated AI should not be seen as involving asserted statements of fact in the absence of strong evidence that consumers will see statements as involving fact. When the technology develops more fully, if it seems clear that the legislature will not act, the courts might revise this sentiment.

A counterargument is that entrepreneurs introducing new technologies should take into account their costs and benefits. Steven Croley and Jon Hanson, for example, have written extensively about the virtues of strict liability for defective products, noting that it forces producers to internalize the costs that they are imposing on others.¹⁶⁶ Perhaps the creators of large language models should have waited until they could fix the hallucination problem before releasing the models. At the very least, one might argue, creators of large language models should be liable under a rule of negligence. We take no position here on whether,

¹⁶³ See Goldman Sachs, *Generative AI Could Raise Global GDP by 7%*, <https://www.goldmansachs.com/intelligence/pages/generative-ai-could-raise-global-gdp-by-7-percent.html>.

¹⁶⁴ See Tyna Eloundou et al., *GPTs Are GPTs: An Early Look at the Labor Market Impact Potential of Large Language Models*, ARXIV, Aug. 21, 2023, <https://arxiv.org/abs/2303.10130>.

¹⁶⁵ E.g., CAL. CIV. CODE § 45.

¹⁶⁶ See, e.g., Steven P. Croley & Jon D. Hanson, *Rescuing the Revolution: The Revived Case for Enterprise Liability*, 91 MICH. L. REV. 683 (1993).

in the long term, the creators of large language models should have immunity from libel or should be subject to libel under some other standard. And we recognize at least the theoretical possibility that real harm could occur as a result of false statements issued by generative AI.¹⁶⁷ Any default of inaction risks the potential for harm.

Still, we believe that there is insufficient warrant to conclude that legislatures would have intended to impose liability in this case, and we doubt that courts are well positioned to create law on a case-by-case basis when technology is rapidly evolving. There is even some risk that the courts will create an immunity that in the long term will turn out to be inappropriate, when the technology may evolve in such a way that it will be relatively straightforward to correct the hallucination problem.¹⁶⁸ In addition, the common law process does not place courts in a sound position to evaluate all of the benefits and costs of liability for libel. Nor does the common law process account for the benefits of innovation as a technology develops. It is true that innovations can impose negative externalities on third parties, but it is also true that innovations may create enormous positive network externalities. ChatGPT has contributed to a gold rush to develop large language models, and as with any gold rush, the initial finder seems likely to appropriate only a small percentage of the benefits. The patent system creates incentives to innovate, but a respect for major technological questions can augment such incentives, allowing both technologies to develop and society to develop appropriate information before any decision to regulate is made.

¹⁶⁷ For example, a colleague was falsely identified as a sexual harasser by ChatGPT. See Pranshu Verma & Will Oremus, *ChatGPT Invented a Sexual Harassment Scandal and Named a Real Law Prof as the Accused*, WASH. POST, Apr. 5, 2023, <https://www.washingtonpost.com/technology/2023/04/05/chatgpt-lies/>. We would be hurt and concerned if we were similarly labeled. Yet we think it is hard to know whether such a statement is yet comparable to a more direct accusation of sexual harassment. Anyone searching Google would quickly conclude that the allegation is unfounded, and we know of no one who was confused by these statements.

¹⁶⁸ Volokh notes that a large language model might include a post processing step correcting inaccuracies of which the company has been informed after the initial production of information. See Volokh, *supra* note 149, at 547 (“There seems to be little justification for absolving manufacturers of such an obligation, if I’m right that the AI companies can add post-processing content filters to block AI programs from outputting known demonstrated false statements, at fairly little cost”). But it is difficult to be sure this this can be done “at fairly little cost” right now. It might, for example, be prohibitively expensive to maintain a list of thousands of falsehoods to search for, constantly executing an inference step for each. But if it does turn out eventually to be fairly cheap, then it would be unfortunate if immunity existed as a result of high expense today.

2. *Protectability of Human-Initiated, AI-Assisted Content*

Even though AI qualifies as a major new technology, we do not believe that all issues related to AI count as major technological questions. Consider, for example, the question whether content created with the assistance of a generative AI may receive copyright protection. The U.S. Copyright Office has taken the position that many works prompted by humans containing material generated by artificial intelligence cannot be copyrighted. Specifically, the agency has stated that “when an AI technology receives solely a prompt from a human and produces complex written, visual, or musical works in response,” the resulting work is not copyrightable because “the ‘traditional elements of authorship’ are determined and executed by the technology—not the human user.”¹⁶⁹ We doubt that the agency’s position is correct.

“Copyright protection subsists,” under the statute, “in original works of authorship fixed in any tangible medium of expression, now known or later developed.”¹⁷⁰ The textual question is whether a work created by human prompting with the assistance of an AI can be “original,” a requirement that can be met by demonstrating a mere “modicum of creativity.”¹⁷¹ The Office’s position is that an author must show that certain “traditional elements” must arise from the author’s own mental conception. “[W]hen an AI technology receives solely a prompt from a human and produces complex ... works in response,” the Office will find this requirement not met.¹⁷² Accordingly, the Copyright Office refused to register an award-winning artwork, despite evidence that the alleged author revised the prompt 624 times to arrive at the image, unless the copyright claimant, who also edited the image, limited the copyright to what he added.¹⁷³

¹⁶⁹ Copyright Office, *Copyright Registration Guidance: Works Containing Material Generated by Artificial Intelligence*, 88 Fed. Reg. 16190, 16192 Mar. 16, 2023.

¹⁷⁰ 17 U.S.C. § 102.

¹⁷¹ *Feist Pubs., Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 346 (1991).

¹⁷² 88 Fed. Reg. at 16192.

¹⁷³ See Copyright Review Board, *Second Request for Reconsideration for Refusal to Register Théâtre D’opéra Spatial*, Sept. 5, 2023. <https://fingfx.thomsonreuters.com/gfx/legaldocs/byprpqkxpe/AI%20COPYRIGHT%20REGISTRATION%20decision.pdf>. In a separate case, Federal District Judge Beryl Howell confronted the quite separate question whether a work of computer-generated visual art was copyrightable without human authorship. See *Thaler v. Perlmutter*, D.D.C., No. 22-1564, https://ecf.dcd.uscourts.gov/cgi-bin/show_public_doc?2022cv1564-24. In that case, the applicant for copyright protection denied any human creativity in producing the work, and thus the court quite reasonably determined that “the single legal question presented here is whether a work generated autonomously by a computer falls under the protection of copyright law upon its creation.” Slip. Op. at 6. The court held that copyright has never protected “works generated by

We are skeptical of broad limitations on restricting the copyrightability of human-initiated works that use the assistance of generative AIs. Photographs created by amateur photographers exercising very little creative control—aiming the camera and pushing a virtual smartphone button—are clearly copyrightable under existing doctrine.¹⁷⁴ A process of writing 624 prompts counts, or even a single prompt, does not necessarily require any less originality than the process of point-and-click that seems sufficient in copyright. It is true that generative AI may be relatively unpredictable, but someone who shoots a video may copyright even a clip in which unexpected things occur.¹⁷⁵ Thus, a conventional approach to statutory interpretation, including traditional analogical reasoning, would seem strongly to allow for copyright in works generated with the assistance of AI provided that there is some minimal human prompting. If the Copyright Office’s approach were defensible, the defense might appear to reflect a concern about major technical questions. The Office seems to be interpreting “original” differently in this context because AI seems different in kind from other machines that assist in artistic creation.

The three factors that we considered in assessing major technological questions all suggest that this isn’t one. First, the economic and political effects do not seem of sufficient magnitude. It seems unlikely that the copyrightability of human-prompted AI-assisted content will have much impact on the future development of generative AI or the use of its products. After all, if generative AI can produce large volumes of work exceptionally cheaply, a large amount of such content may be produced even absent the possibility of protection from intellectual property rights. Second, modern copyright law focuses on whether individual works meet the creativity requirement,¹⁷⁶ and not (as it perhaps once did) on the precise ways that different technologies assist human creativity. Third, and perhaps most importantly, we see no textual ambiguity that would suggest the uncopyrightability of works created using AI. The copyright statute today unmistakably covers “pictorial” and “graphic” works,¹⁷⁷ and case law on the word

new forms of technology operating absent any guiding human hand.” *Id.* at 8.

¹⁷⁴ See, e.g., *Mannion v. Coors Brewing Co.*, 377 F. Supp.2d 444 (S.D.N.Y. 2006) (finding copyright in a photograph of an athlete and detailing the minimal contributions needed for a photograph to qualify as something other than a slavish copy of another work).

¹⁷⁵ The Zapruder film is the classic example. See “Zapruder Heirs to Get \$16M for Film Kennedy,” *Wash. Post*, Tuesday, August 3, 1999 (noting that arbitrators required the government to pay millions for taking Zapruder’s physical film of the Kennedy assassination even though the family retained the copyright in the film).

¹⁷⁶ For a recent case in which a lack of creativity was found because a photographic work was created by a monkey, see *Naruto v. Slater*, 888 F.3d 418 (9th Cir. 2018).

¹⁷⁷ 17 U.S.C. § 102(a)(5).

“original” has already clarified that only a “modicum” of human creativity is required.

Our conclusion might appear surprising based on our earlier assessment that the court in *Wood v. Abbott*¹⁷⁸ correctly refused to extend copyright protection to photographs.¹⁷⁹ With photography, it would have been inappropriate to apply the word “print” mechanically to the new technology because the statute in that era was very much limited to certain technologies (printing) but not others (like drawing). By contrast, the modern statute applies capaciously, with the technologically neutral concept of “originality” being the gatekeeper of copyrightability. The better analogy is *Rossiter v. Hall*,¹⁸⁰ where the technologically neutral word “copy” capaciously protected against any type of infringement.

One need not agree with all of our conclusions to accept our general views regarding the major questions doctrine. Perhaps one might conclude that a photograph was sufficiently like a “print” that there was no ambiguity in the original statute, and we concede that the economic stakes of the copyrightability of photography might not have appeared great at the time *Wood* was decided. Or one might read the word “original” to mandate an assessment of the relative contribution of humans and machines, or one might take an even more expansive view than we do of how significant a question must be before the courts reverse it for the legislature. These issues are, however, internal debates about major technological questions, and if those are the debates we are engaged in, we agree at least on the broad framework. The existence of internal debates highlights that recognition of major technological questions does not magically resolve all interpretive questions. Subtle distinctions will still need to be drawn. Within copyright, one might argue that an image created without any specificity in the prompt (such as the image reproduced at the end of this paragraph) might not be sufficiently “original.” And in patent law, there might be a strong argument that an AI cannot serve as an “inventor,”¹⁸¹ as the Federal Circuit recently concluded.¹⁸² And there might even be an argument that an invention conjured entirely by an autonomous AI might not be patentable.¹⁸³ Should we reach a

¹⁷⁸ 30 F. Cas. 424 (1866).

¹⁷⁹ See *supra* Part III.A.

¹⁸⁰ 20 F. Cas. 1253 (1866).

¹⁸¹ See 35 U.S.C. § 100(f) (defining an inventor as an “individual”).

¹⁸² *Thaler v. Vidal*, No. 2021-2347 (Fed. Cir. Aug. 5, 2022).

¹⁸³ The filer in *Thaler* did not attempt to name a human as an inventor for an AI-assisted invention. See *id.* (slip op. at 10) (“[W]e are not confronted today with the question of whether inventions made by human beings with the assistance of AI are eligible for patent protection.”).

technological singularity where computers self-improve and revolutionize biotechnology with little human involvement,¹⁸⁴ the fundamental policy rationale of providing incentives for inventive activities might change (although perhaps not, if the time and attention of inventive AIs remains an expensive scarce resource). Whether to create property rights based on inventions from a super intelligence might then be a major technological question that Congress should address. In the meantime, we see no obstacle to humans receiving copyrights or patents obtained with AI assistance.



An image generated by asking ChatGPT to generate “any image.”

Conclusion

The major questions doctrine rests on a sensible intuition against reading too much into general language. As applied to administrative law, the doctrine counsel against interpreting general statutory language as delegations to Executive agencies to control significant and controversial issues. A similar general instinct should apply where courts confront major new technological questions: Courts should not read too much into general language. Specifically, courts should not read general principles in earlier legal authorities, whether those authorities be statutes or common-law decisions, as controlling outcomes in situations that could not have been imagined when the earlier authority was promulgated and that present difficult issues concerning the similarities and differences between old and new technologies.

To be sure, the emergence of a new technology does not always present a major technological question. The emergence of electric vehicles or even self-driving cars does not present any technological question for a decisionmaker

¹⁸⁴ See RAY KURZWEIL, *THE SINGULARITY IS NEAR: WHEN HUMAN TRANSCEND BIOLOGY* (2006).

trying to apply a pre-existing rule forbidding any vehicle from driving over 65 miles per hour on the public roads. And a rule forbidding the making of any “copy” of a copyrighted work does not present a technological question when a new copying technology is created. Yet sometimes new technologies represent such a break from past categories that preexisting statutory terms and case law concepts no longer clearly apply. Our modest claim is that, in such circumstances, courts should read the prior authorities as not controlling. If the prior authority is a common-law authority, the presence of a major technological question may be liberating for the court, as it should recognize that its common-law powers of adjusting past authorities to fit the future are at their zenith. If the prior authority is a statute, the major technological question might well constrain courts and agencies by directing them to wait for the legislature to make fundamental decisions informed by new experience. And in both situations, all legal actors (courts, agencies and legislatures) should balk at legal regulation that threatens to squelch emerging technologies. Wise regulation of any technology demands experience, but experience cannot develop if the technology never does.