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Response

Innovating Between and Within Technological Paradigms: A Response to Samuelson

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Patents on interfaces are problematic—sometimes. In *Are Patents on Interfaces Impeding Interoperability?*, Professor Pamela Samuelson lays a valuable foundation for distinguishing when they are and when they are not.[1] She begins by reviewing the economic benefits of interoperability as well as the historical emergence of interface patents, which threaten to impede such interoperability.[2] After surveying an impressive array of potential policy responses,[3] she concludes that patentees generally face adequate incentives to allow access to proprietary interfaces.[4] Therefore, she ultimately argues in favor of measured, targeted policy interventions to remediate the (rare) instances when interface patents actually impede interoperability.[5] In this Response, I extend Professor Samuelson's analyses to further explore the antecedent question of identifying *when* intervention is warranted. As we will see, moreover, determining when such patents warrant attention informs the question of what *kinds* of intervention are most appropriate.

In elaborating my Response, I rely heavily on the concept of technological paradigms. I adapt this term from philosopher of science Thomas Kuhn, who characterized "scientific paradigms" as coherent traditions of scientific practice rooted in un-

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1. Pamela Samuelson, *Are Patents on Interfaces Impeding Interoperability?*, 93 MINN. L. REV. 1943 (2009).
2. *Id.* at 1946–65.
3. *Id.* at 1969–2004.
4. *Id.* at 2004–05.
5. *Id.* at 2009.

ifying theory.[6] By analogy to the technological sphere, I suggest that interfaces define technological paradigms: integrated systems of interoperability.[7] Examples of technological paradigms include VHS, Betamax, and DVD, all of which define systems of interoperable components that are not interoperable with each other. Kuhn used the concept of paradigms to differentiate between two different types of scientific progress. Incremental progress proceeds as so-called normal science that refines and elaborates an established paradigm.[8] However, truly "revolutionary" progress occurs via paradigm shifts—disjunctive leaps from one paradigm to another.[9] As we will see, interface patents (and their modification) can promote both kinds of progress in the technological sphere.[10]

This Response highlights the importance of context in determining the social benefits and costs of interface patents. Compared to Professor Samuelson, I take a more salutary view of such patents—and *non*-interoperability in general—in driving certain kinds of technological progress. I argue that exclusive rights can provide incentives to invent valuable interfaces and encourage healthy competition between emerging technological paradigms. However, once an industry has coalesced around a single paradigm, the costs of strictly asserting interface patents likely outweigh their benefits. By considering industrial and informational developments over time, policymak-

6. THOMAS S. KUHN, THE STRUCTURE OF SCIENTIFIC REVOLUTIONS 10 (2d ed. 1970) (discussing scientific paradigms and "paradigm shifts"). For example, Aristotelian and Newtonian mechanics both represent coherent scientific paradigms, even though they are incommensurable with each other. *See id.* at 10.

7. While I use the term "technological paradigm" in a rather broad sense, other authors have used it more narrowly. *See, e.g.*, Clayton M. Christensen & Richard S. Rosenbloom, *Explaining the Attacker's Advantage: Technological Paradigms, Organizational Dynamics, and the Value Network*, 24 RES. POL'Y 233, 235 (1995) (characterizing technological paradigms as core technologies that define an overarching architecture); Giovanni Dosi, *Technological Paradigms and Technological Trajectories: A Suggested Interpretation of the Determinants and Directions of Technical Change*, 11 RES. POL'Y 147, 148 (1982) (likening technological paradigms to worldviews that define research programs and modes of conceptualizing technical problems). In drawing this analogy between science and technology, I acknowledge its inherent limitations. *See id.* at 158 ("[T]he analogy between science and technology is, in some respects, 'impressionistic' and the parallel should not be pushed too far without reaching decreasing returns.").

8. KUHN, *supra* note 6, at 23–42.

9. *Id.* at 66–91.

10. *See* Dosi, *supra* note 7, at 158 (emphasizing the roles of continuity and discontinuity in technological change).

ers can calibrate policy interventions to maximize innovation both between and within technological paradigms.[11] Because context-specific information is critical to such measures, I argue that ex post mechanisms such as remedies analysis, patent misuse, and regulatory action by antitrust authorities constitute the most effective policy interventions for addressing problematic interface patents.

This Response proceeds in three Parts. Part I examines the underappreciated benefits of interface patents and non-interoperability in promoting innovation between technological paradigms. The value of interface patents is highly contextual, however, and Part II argues that weakening certain interface patents—such as those covering industry standards—may be warranted to promote innovation within an established paradigm. Part III builds on these observations to argue against broad, ex ante regulatory measures in favor of targeted, ex post policy interventions that can exploit industrial and informational developments over time.

I. INNOVATING BETWEEN TECHNOLOGICAL PARADIGMS: TECHNOLOGICAL MULTIPLICITY, COMPETITION, AND DISPLACEMENT

The title of Professor Samuelson's article is a fitting place to initiate a policy discussion. After all, before legislatures, regulatory agencies, courts, and industry actors consider modifying interface patents, they should be sure that a problem exists. Unfortunately, the extent to which interface patents impede interoperability is an exceedingly difficult question to answer. At a theoretical level, Professor Samuelson is certainly correct that firms have strong incentives to allow wide access to patented interfaces.[12] Based on a dearth of litigated cases, as well as anecdotal accounts, Professor Samuelson reasonably concludes that interface patents do not produce significant blockage.[13] As she acknowledges, however, there may be more inhibition than meets the eye; it is very difficult to enumerate development opportunities foregone because of interface pa-

11. *Cf.* Philip J. Weiser, *The Internet, Innovation, and Intellectual Property Policy*, 103 COLUM. L. REV. 534, 546 (2003) (advocating proprietary development to facilitate competition between rival platforms but open standards where a single platform has won out).

12. Samuelson, *supra* note 1, at 1951 (explaining the positive feedback loop and network effects arising from interoperability).

13. *Id.* at 2009.

tents.[14] Professor Samuelson's work thus invites further empirical inquiries to quantify the extent to which patents actually impede interoperability.[15]

Unfettered interoperability, however, is not always desirable. At a theoretical level, there are situations where interface patents—and the *non*-interoperability they facilitate—are quite critical to driving technological progress. These circumstances, moreover, depend heavily on industry dynamics. As Professor Samuelson recognizes, interfaces are valuable and often costly to develop.[16] Therefore, based on the underlying logic of the patent system, exclusive rights can provide valuable incentives to invent and develop new interfaces. More importantly, interface patents provide a mechanism by which firms can appropriate the value of broader technological paradigms.[17] Thus, for example, Microsoft's patents on application program interfaces (APIs) help it appropriate the value of Windows, since other firms cannot interoperate with that system without utilizing those proprietary resources.[18] Drawing from Joseph Schumpeter's classic theory,[19] patents on interfaces may promote the emergence of new technological paradigms through a process of "creative destruction."[20] According to this view, revolutionary

14. *Id.*

15. In similar fashion, empirical work has valuably delineated the contours of the "tragedy of the anticommons" in biomedical research. *See* Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998); Fiona Murray & Scott Stern, *Do Formal Intellectual Property Rights Hinder the Free Flow of Scientific Knowledge? An Empirical Test of the Anti-commons Hypothesis*, 63 J. ECON. BEHAV. & ORG. 648, 651 (2007) (finding modest anticommons effects in biomedical research); JOHN P. WALSH ET AL., PATENTS, MATERIAL TRANSFERS AND ACCESS TO RESEARCH INPUTS IN BIOMEDICAL RESEARCH 2, 6 (2005), http://www2.druid.dk/conferences/viewpaper.php?id=776&cf=8 (finding little evidence of patent-related blockage).

16. Samuelson, *supra* note 1, at 1962.

17. *See* Weiser, *supra* note 11, at 579.

18. *See* Thomas A. Piraino, Jr., *Identifying Monopolists' Illegal Conduct Under the Sherman Act*, 75 N.Y.U. L. REV. 809, 888–89 (2000) (discussing Microsoft's frequent updates to and additions of APIs); Samuelson, *supra* note 1, at 1948 (explaining APIs). As Professor Samuelson notes, there is a self-disciplining relationship between exclusivity and value appropriation. Strict assertion of interface patents tends to decrease the value of a technological paradigm, thus encouraging patentees to voluntarily permit some degree of interoperability. *Id.* at 1951.

19. JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM, AND DEMOCRACY 81–86 (2d ed. 1947).

20. *See* Dosi, *supra* note 7, at 157–58; Weiser, *supra* note 11, at 576–79. However, some have questioned the continuing relevance of this classical

new entrants challenge and ultimately displace incumbent technological platforms. In this manner, interface patents—and the value appropriation they facilitate—can spur technological paradigm shifts.[21]

Along these lines, exclusive rights may facilitate valuable competition among emerging, non-interoperable platforms. Take, for example, the recently concluded format war between Sony-backed Blu-ray and Toshiba-backed HD DVD. Notably, the technology underlying both of these formats—which is critical to achieving interoperability among their respective components—is patented.[22] Although the history of the format war is still being written, consensus exists that the more technologically robust format, Blu-ray, ultimately won out.[23] Of course, one must balance these technological gains with the significant waste engendered by format wars; thousands of consumers who bought HD DVD players probably regret their purchases.[24] However, establishing a dominant paradigm always entails some waste, as a victorious technology renders rival technologies obsolete.[25]

Even aside from facilitating the emergence of a single "victorious" paradigm, interface patents can produce a stable equi-

narrative for software patents. *See, e.g.*, Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CAL. L. REV. 1, 8 (2001) (warning that innovation could suffer if software patents are not adequately restricted in scope).

21. *Cf.* Christensen & Rosenbloom, *supra* note 7, at 233–34 (suggesting that the introduction of radically different technologies can create new technological paradigms). Such competition may be particularly valuable if it prevents an industry from coalescing around an inferior interface standard. *Cf.* Paul A. David, *Clio and the Economics of QWERTY*, 75 AM. ECON. REV. 332, 336 (1985) (noting the widespread adoption of the QWERTY keyboard even though other formats, such as the Dvorak Simplified Keyboard, facilitate more rapid typing); Maureen A. O'Rourke, *Toward a Doctrine of Fair Use in Patent Law*, 100 COLUM. L. REV. 1177, 1215 n.152 (2000) (noting the risk that the "winning" standard will be "both inferior and durable").

22. *See* Jeff Sauer, *Nothin' But Blu Skies*, COMPUTER GRAPHICS WORLD, Apr. 1, 2008 (describing the patent positions of the Blu-ray and HD DVD supporters).

23. This, too, is a contested notion. In many ways, Sony "bought" adoption of Blu-ray by offering significant concessions to major content providers and retailers. Additionally, Sony helped its cause by integrating Blu-ray technology into its popular PlayStation gaming console. Nevertheless, Blu-ray has higher data capacity than HD DVD, thus promising better image quality and more robust user interactivity. *Id.*

24. *See* Samuelson, *supra* note 1, at 1951 n.31 (noting that the format war delayed the development of the high definition DVD market).

25. *See* Christensen & Rosenbloom, *supra* note 7, at 234 (describing the emergence of new technologies as "competence-destroying" for older firms).

librium of multiple coexisting platforms. As Professor Samuelson recognizes, competition among proprietary systems, as well as among open systems, can enhance social welfare.[26] And as Professor Christopher Yoo has described in the copyright context, exclusive rights promote product differentiation that enhances both incentives to create and access to creations.[27] While certain caveats apply to the patent context,[28] there is reason to believe that various "fiefdoms" of interoperability, while not interoperable with each other, may offer a wide menu of functionalities that appeal to different consumers.[29] Thus, progress involves not only replacing an incumbent paradigm with a new one (for example, CDs triumphing over cassettes), but by the simultaneous existence of multiple technological paradigms (for example, Microsoft Windows, Mac OS, and Linux).[30] Interface patents and non-interoperability may thus facilitate greater consumer choice.[31]

II. INNOVATING WITHIN TECHNOLOGICAL PARADIGMS: PROMOTING "NORMAL" PROGRESS BY BROADENING ACCESS TO AN INDUSTRY STANDARD

While interface patents in "contested" industries may be salutary, they can be quite detrimental in other contexts. They may be particularly problematic when a patented interface becomes an industry standard.[32] While Professor Samuelson recognizes that patented standards are problematic, I wish to accentuate their pernicious effects. When an industry has coalesced around a particular standard, the interfaces underlying that standard approach the status of "infrastructure,"

26. Samuelson, *supra* note 1, at 1953.

27. Christopher S. Yoo, *Copyright and Product Differentiation*, 79 N.Y.U. L. REV. 212, 276 (2004).

28. *Id.* at 225 n.41 (noting that patent law's more expansive coverage of functionality calls into question the applicability of the differentiated products model to the technological sphere).

29. *See id.* at 255 n.136 (distinguishing product differentiation as competition "within" the market from Schumpeterian competition "for" the market, which is dominated by successive monopolists).

30. *See* Samuelson, *supra* note 1, at 1953 ("To compete effectively against Apple, RealNetworks has incentives to develop technology and music services that would be more attractive to consumers."); *cf.* PAUL FEYERABEND, AGAINST METHOD 24–32 (3d ed. 1993) (highlighting the value of simultaneous, competing scientific theories).

31. *See* Weiser, *supra* note 11, at 586–87.

32. *See* Samuelson, *supra* note 1, at 1949–50 (distinguishing between interfaces and standards).

which economic theory suggests should be widely accessible.[33] Qualcomm's patents on video compression technology provide a particularly striking example. In late 2001, two standard-setting organizations created the Joint Video Team (JVT), which aimed to develop a standard for video compression technology.[34] Qualcomm participated in the JVT but did not disclose two critical patents that covered elements of the so-called H.264 standard, ultimately released in May 2003. Widespread adoption of this standard offered Qualcomm significant market power, and Qualcomm soon began exercising it. In 2005, Qualcomm sued Broadcom for infringing its patents by practicing the H.264 standard. The district court held that Qualcomm's patents were categorically unenforceable because of Qualcomm's failure to disclose them to the JVT.[35] On appeal, the Federal Circuit narrowed the scope of this order, holding the patents unenforceable as to H.264-compliant products.[36]

Although one could quibble over the appropriate scope of Qualcomm's injunction, this is clearly a situation where interface patents had potential to do much harm. Qualcomm's patented interfaces were incorporated into an industry-wide standard, thus giving Qualcomm the right to exclude broad swaths of productive activity. In some sense, the Qualcomm case is an easy one for intervention because of the company's bad-faith participation in the standard-setting process.[37] Even

33. *See* Brett M. Frischmann, *An Economic Theory of Infrastructure and Commons Management*, 89 MINN. L. REV. 917, 922–23 (2005) (arguing that "if a resource can be classified as infrastructure . . . there are strong economic arguments that the resource should be managed in an openly accessible manner"); Brett M. Frischmann & Mark A. Lemley, *Spillovers*, 107 COLUM. L. REV. 257, 290–98 (2007) (observing that optimal patent protection is limited and generates significant positive externalities); Peter Lee, *The Evolution of Intellectual Infrastructure*, 83 WASH. L. REV. 39, 85 (2008) ("[E]quating commonplace entities with nonprotectable ideas ensures that widely used infrastructure remains in the public domain.").

34. Qualcomm Inc. v. Broadcom Corp., 548 F.3d 1004, 1008 (Fed. Cir. 2008).

35. *Id.* at 1009.

36. *Id.* at 1026.

37. These inquiries are, of course, highly fact-dependent. Rambus, which designs computer memory systems, has been accused of fraudulently participating in a standard-setting process that ultimately adopted its patented random access memory technology as an industry standard. Rambus Inc. v. Infineon Techs. AG, 318 F.3d 1081, 1106 (Fed. Cir. 2003). However, the Federal Circuit rejected claims of fraud and questioned whether Rambus actually had a duty to disclose patents and patent applications. *Id.* In related litigation, the D.C. Circuit rejected the Federal Trade Commission's allegations that Ram-

outside of such malfeasance, however, the prospect of monopolizing an industry standard renders certain patented interfaces particularly troubling.[38]

This undue market leverage is present in other situations identified by Professor Samuelson as warranting some form of regulatory intervention.[39] For example, citing "abuse of dominant position," the European Commission compelled Microsoft to disclose specifications to allow interoperability with Windows-based technologies.[40] In general, patents on standards represent a subset of patents on interfaces that commentators have found highly problematic.[41] In all of these cases, when interface patents cover a technological paradigm that has become an industry standard, the social costs of the right to exclude likely outweigh its benefits. Exacerbating this costliness is the ability of the patentee to appropriate value exogenous to itself;[42] the value of a patented interface standard may reside less in its technical merit and more in the simple fact that

bus's conduct was unlawfully monopolistic. Rambus Inc. v. FTC, 522 F.3d 456, 466–67 (D.C. Cir. 2008), *cert. denied*, 129 S. Ct. 1318 (2009).

38. For example, Forgent Networks aggressively asserted its patent on the technology underlying JPEG, a widely used standard for photographic compression. Forgent obtained over $100 million in royalties before a consortium of information technology companies challenged the validity of the patent, leading to settlement. Michael Kanellos, *Forgent Settles JPEG Patent Cases*, CNET NEWS, Nov. 1, 2006, http://www.news.com/Forgent-settles-JPEG-patent-cases/2100-1014_3-6131574.html?tag=item. Forgent's actions prompted the International Organization for Standardization to consider withdrawing JPEG as a formal standard. *See* Priscilla Caplan, *Patents and Open Standards*, INFO. STANDARDS Q., Oct. 2003, at 2, 3 (discussing the JPEG dispute).

39. In arguing for enhanced access to proprietary technological paradigms, it is important to distinguish between vertical access (by complementary products) and horizontal access (by "platform-level" competitors). *See* Weiser, *supra* note 11, at 560–61. Vertical access, such as allowing software applications to interoperate with Microsoft Windows, is generally desirable and may even redound to the benefit of the interface patentee (in this case, Microsoft). In extreme cases of abuse of a dominant position, however, even horizontal access by platform competitors may be warranted. *See id.* at 593 (arguing that horizontal access should be allowed when a single standard is clearly dominating in order to facilitate competition within the platform).

40. Samuelson, *supra* note 1, at 1989–96.

41. *See, e.g.*, Mark A. Lemley, *Intellectual Property Rights and Standard-Setting Organizations*, 90 CAL. L. REV. 1889 (2002); Janice M. Mueller, *Patent Misuse Through the Capture of Industry Standards*, 17 BERKELEY TECH. L.J. 623 (2002); O'Rourke, *supra* note 21, at 1213; *cf.* Pamela Samuelson, *Questioning Copyrights in Standards*, 48 B.C. L. REV. 193 (2007) (asserting that standards should not be protected by copyright).

42. *See* O'Rourke, *supra* note 21, at 1215–16 (noting that patents in network markets may represent an exception to the rule that exclusive rights generally do not confer monopolies).

many parties have adopted it.[43] Such patents may inhibit innovation *within* a dominant paradigm, thus preventing the significant gains to be realized from elaborating and refining an existing platform.[44]

III. THE IMPORTANCE OF CONTEXT: INDUSTRIAL AND INFORMATIONAL DEVELOPMENTS AND EX POST POLICY INTERVENTIONS

As Professor Samuelson recognizes, the virtues and vices of patents on interfaces, therefore, hinge considerably on context.[45] Interface patents in immature or contested industries may spur rival technological paradigms that produce either a victorious platform or the healthy coexistence of multiple platforms. However, when an industry has coalesced around a single interface standard, exclusive rights on that standard may be highly detrimental. These observations highlight the importance of information in determining appropriate responses to interface patents.[46] Industrial characteristics only become apparent with the passage of time and the emergence of ex post data. Thus, information is critical to Professor Samuelson's observation that "if regulatory intervention of interface patents is appropriate at all, it should only be undertaken in a targeted manner to address specific harms."[47]

This emphasis on industrial developments and information, moreover, lends itself to favor certain policy interventions over others. Ex ante interventions, such as removing interfaces from patentable subject matter, are likely to be blunt and overinclusive.[48] Furthermore, they foreclose the ability of patent protection to drive early stage technological innovation and paradigm definition. Rather, ex post interventions that can take

43. *See* Samuelson, *supra* note 1, at 1997; *cf.* Lotus Dev. Corp. v. Borland Int'l, 49 F.3d 807, 819–20 (1st Cir. 1995) ("A new menu may be a creative work, but over time its importance may come to reside more in the investment that has been made by *users* in learning the menu and in building their own mini-programs—macros—in reliance upon the menu.").

44. *See* Samuelson, *supra* note 1, at 2016.

45. *Id.* at 1945; Dosi, *supra* note 7, at 157–58.

46. *See* O'Rourke, *supra* note 21, at 1218.

47. Samuelson, *supra* note 1, at 1945.

48. However, other types of ex ante measures may be useful prophylactics. For example, standard-setting organizations would be well served to clearly delineate requirements for disclosing and licensing intellectual property prior to the creation of a standard. In this manner, they can leverage this preexisting "hook" if and when a firm asserts exclusive rights over such a standard. *See* Lemley, *supra* note 41, at 1957–68.

account of industry dynamics and context-specific information offer clear advantages. This argument thus favors ex post approaches such as remedies analysis, patent misuse, and regulatory action by antitrust authorities for addressing problems associated with interface patents.[49]

Ultimately, these observations shed new light on an apparent tension within patent law. Many commentators note that patents represent an intrinsic trade-off between maintaining incentives to invent and constraining access to new inventions.[50] While at first glance this trade-off appears limiting, policymakers should recognize that patent protection represents a policy lever that can toggle between two types of technological progress. Patents on interfaces can encourage firms to develop new interfaces (and entirely new platforms), thus ushering in technological paradigm shifts. However, when a patented interface becomes an industry-wide standard, relaxing exclusive rights may be warranted to promote "normal" progress within the paradigm. By recognizing the multifaceted functions that patents play[51]—and the environments in which they are most appropriate—policymakers can best harness the power of exclusive rights to promote multiple kinds of innovation.

49. Information is not only necessary to determine *when* intervention is warranted, but also to fashion targeted, specific remedies. For example, granting ongoing royalties or issuing compulsory licenses for patented interfaces requires complex valuations of technology that are quite information-intensive. Of course, such interventions demand a high degree of technical competence on the part of implementing institutions. However, past practice suggests that courts, antitrust authorities, and other regulatory bodies are capable of drawing meaningful distinctions and fashioning targeted remedies to address particular interface patents.

50. Telling in this regard, English patents originally arose as *exceptions* to legislation prohibiting deleterious monopolies. *But see* Yoo, *supra* note 27, at 264–65 (arguing that a product differentiation model in copyright eliminates the supposed trade-off between access and incentives).

51. As Professor Samuelson notes, policymakers should also be aware of nonpatent issues that impede interoperability, such as efforts to maintain the secrecy of interface information. Samuelson, *supra* note 1, at 2011–12. This, too, militates against categorically weakening interface patents, which may shunt firms into protecting interfaces as trade secrets.