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GHOST IN THE "NEW MACHINE": HOW *ALICE* EXPOSED SOFTWARE PATENTING'S CATEGORY MISTAKE

Andrew Chin*

The Alice *Court's characterization of computer programming has effectively repudiated, inter alia, the doctrine that programming a general-purpose computer creates a patent-eligible "new machine." This Article revisits* In re Bernhart*, the first holding based on the "new machine" principle, concluding that the Court of Customs and Patent Appeals committed a category mistake in conducting its nonobviousness analysis. This suggests that § 101 has a unique role to play in ensuring the analytical coherence of the other tests for patentability, and that step two of the* Mayo/Alice *test could helpfully enforce the doctrinal distinction between a patent-eligible "method or means" and an unpatentable "result or effect."*

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I. THE "NEW MACHINE" RATIONALE

In re Alappat,[1] once a mainstay of the Patent Office's Guidelines for Examining Computer-Related Inventions,[2] and its doctrinal principle that programming a general-purpose computer creates a patent-eligible "new machine"[3] are already fading into history. Not much was left of this principle after the Federal Circuit reviewed *Alice*'s patents en banc,[4] and even less remains now that the Supreme Court has concluded "mere recitation of a generic computer cannot transform a patent-ineligible abstract idea into a patent-eligible invention."[5] Consequently, the agency's post-*Alice* Interim Guidance on Patent Subject Matter Eligibility[6] makes

[1] 33 F.3d 1526 (Fed. Cir. 1994) (en banc).

[2] *See Examination Guidelines for Computer-Related Inventions*, 61 Fed. Reg. 7478 (Feb. 28, 1996) (citing *Alappat* nine times).

[3] *Alappat*, 33 F.3d at 1545 *abrogated by In re* Bilski, 545 F.3d 943 (Fed. Cir. 2008) (citation omitted) ("We have held that such programming creates a new machine, because a general purpose computer in effect becomes a special purpose computer once it is programmed to perform particular functions pursuant to instructions from program software.").

The *Alappat* court also reasoned that the claimed programmed general-purpose computer was "not a disembodied mathematical concept which may be characterized as an 'abstract idea,' but rather a specific machine to produce a useful, concrete, and tangible result." *Id.* at 1544. It was not until *State Street Bank*, however, that the Federal Circuit elevated *Alappat*'s "useful, concrete, and tangible result" language into a test for patent-eligibility. State St. Bank & Trust Co. v. Signature Fin. Grp., Inc., 149 F.3d 1368, 1373 (Fed. Cir. 1998) ("Today, we hold that the transformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a [patent-eligible invention] because it produces 'a useful, concrete and tangible result. . . .") Since the Federal Circuit abrogated this test in *In re* Bilski, 545 F.3d at 959–60, it has no bearing on *Alappat*'s "new machine" principle as discussed in this Article.

[4] *See* CLS Bank Int'l v. Alice Corp., 717 F.3d 1269, 1292 (Fed. Cir. 2013) (en banc) (Lourie, J.) (plurality opinion) ("Not only has the world of technology changed, but the legal world has changed. The Supreme Court has spoken since *Alappat* on the question of patent eligibility, and we must take note of that change.").

[5] *See* Alice Corp. v. CLS Bank Int'l, 134 S. Ct. 2347, 2358 (2014).

[6] *See* United States Patent and Trademark Office, *Interim Guidance on Patent Subject Matter Eligibility*, 79 Fed. Reg. 74618 (Dec. 16, 2014) [hereinafter *Interim Guidance*].

no mention of *Alappat*, the leading case in support of the principle.[7] In its place are lists of examples purporting to illustrate the otherwise undefined[8] category of unpatentable abstract ideas[9] and the kinds of additional claim elements that may provide the requisite "significantly more" to impart patent-eligibility.[10]

Yet *Alappat* has lessons to impart before it is sent into oblivion. First, *Alappat* remains an important precedent concerning the interpretation of functional language in software patent claims under § 112(f). As argued elsewhere,[11] the Federal Circuit's claim construction in that case is both rhetorically and logically unconnected to the "new machine" principle, and properly illustrates the kinds of computer technologies that may be found sufficiently concrete in a specification to support a claimed means-plus-function element.[12]

Second, it is time for patent-eligibility doctrine to recognize the now-discredited "new machine" principle for what it has always been: an abdication of § 101's[13] essential role in guarding against mistakes that could otherwise arise in the patentability analysis of software-implemented inventions. Dissenting in *In re Bilski*,[14] the Federal Circuit's former Chief Judge Randall Rader suggested such a role for patentable subject matter doctrine in finding *Bilski*'s hedging claim facially abstract without resorting to the en banc majority's machine-or-transformation test:

> When considering the eligibility of "processes," this court should focus on the potential for an abstract claim. Such an abstract claim would

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[7] *See id.* at 74624.

[8] *See Alice*, 134 S. Ct. at 2357 ("In any event, we need not labor to delimit the precise contours of the 'abstract ideas' category in this case."); Bilski v. Kappos, 561 U.S. 593, 621 (2010) (Stevens, J., concurring) ("The Court, in sum, never provides a satisfying account of what constitutes an unpatentable abstract idea.").

[9] *See Interim Guidance*, *supra* note 6, at 74622.

[10] *See id.* at 74624.

[11] Andrew Chin, Alappat *Redux: Support for Functional Language in Software Patent Claims*, 66 SMU L. REV. 491, 500 (2013).

[12] *Id*. at 500–01.

[13] 35 U.S.C. § 101 (2012).

[14] *In re* Bilski, 545 F.3d 943 (Fed. Cir. 2008) (en banc) (Rader, J., dissenting) (emphasis added).

> appear in *a form that is not even susceptible to examination against prior art under the traditional tests for patentability*. Thus this court would wish to ensure that the claim supplied some concrete, tangible technology for examination. Indeed the hedging claim at stake in this appeal is a classic example of abstractness. . . . Hedging is a fundamental economic practice long prevalent in our system of commerce and taught in any introductory finance class. In any event, this facially abstract claim does not warrant the creation of new eligibility exclusions.[15]

Judge Rader's approach merits close study, because the Supreme Court's *Bilski* majority essentially adopted it in its own opinion rejecting the machine-or-transformation test.[16]

Even before *Alice*,[17] the "new machine" principle had been criticized often enough to earn the derisory nickname "The Old

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[15] *Id.* at 1013.

[16] Judge Rader prefigured the Supreme Court's rejection of the en banc majority's project of elevating machine-or-transformation from a clue to a definitive test, and took existing Supreme Court precedents as sufficient guideposts for finding *Bilski*'s claimed method to be "facially abstract." *Id.* at 1013. The sole factual basis underlying the Supreme Court majority's rejection of *Bilski*'s claims was Judge Rader's characterization of hedging. Bilski v. Kappos, 561 U.S. 593, 611 (2010) (quoting *In re* Bilski, 545 F.3d 943, 1013 (Fed. Cir. 2008) (Rader, J., dissenting)); *see also id.* at 606 (citing *In re* Bilski, 545 F.3d at 1015) (agreeing with Judge Rader's findings of "difficulties" with the *en banc* majority's machine-or-transformation test). The Court proceeded immediately from this characterization to the conclusion that *Bilski*'s claims were unpatentably abstract, just as Judge Rader had done. *Id.*

Underscoring the fundamental importance of this analytical mistake-avoiding function is the fact that Judge Rader's post-*Bilski* opinions generally take a narrow view of the abstract-idea exclusion, limiting its application to where abstractness "exhibit[s] itself so manifestly so as to override the broad statutory categories of eligible subject matter and the statutory context that directs primary attention on the patentability criteria of the rest of the Patent Act." Research Corp. Technologies, Inc. v. Microsoft Corp., 627 F.3d 859 (Fed. Cir. 2010); Ultramercial v. Hulu, 722 F.3d 1335, 1354 (Fed. Cir. 2013), *vacated*, 134 S. Ct. 2870 (2014) (citing *Research Corp.*). In fact, Judge Rader's dissent in *Alice* may turn out to be the last Federal Circuit opinion to cite *Alappat* for its "new machine" rationale. *See* CLS Bank Int'l v. Alice Corp., 717 F.3d 1269, 1302 (Fed. Cir. 2013) (Rader, J., dissenting) (citing *Alappat*, 33 F.3d at 1544–45). Abstractness in patent claims appears, to Judge Rader's mind at least, to exhibit itself most manifestly in the form of analytical errors inherent in applying "the patentability criteria of the rest of the Patent Act."

[17] Alice Corp. v. CLS Bank Int'l, 134 S. Ct. 2347, 2358 (2014).

Piano Roll Blues."[18] The implied comparison, as the government argued in *Gottschalk v. Benson*, was to "the insertion of a new piano roll into an old player piano," which may enable the piano to play a new song, but should not be considered "a patentable 'discovery.'"[19] Former Chief Judge Glenn Archer's *Alappat* dissent appealed to the analogy at length, concluding that "[t]he only invention by the creator of a roll that is new because of its music is the new music,"[20] which is nonstatutory subject matter. Still, the player-piano characterization of the "new machine" principle played no role in the *Alice* decision, nor did it offer any insight into the nature of the patent-eligibility inquiry after *Alice*.

This Article offers a new and more constructive criticism of the "new machine" principle: i.e., that it provided an opening for the kinds of category mistakes in patentability analysis that § 101 should serve to prevent, and that its repudiation in *Alice* should be an occasion for doctrinal realignment with this mistake-preventing purpose. Part II provides a brief explanation of category mistakes and the analytical difficulties they present for the law generally and patent law specifically. Part III traces the "new machine" principle back to its origin in *In re Bernhart*,[21] in which the Court of Customs and Patent Appeals made the category mistake of concluding that six pages of algebraic simplifications were too difficult for "one of ordinary mathematical skill" to perform.[22]

As Part IV discusses, *Alice* is irreconcilable with the "new machine" principle and the patent-eligibility determination in *Bernhart*. This suggests that the two-step patent-eligibility test outlined in *Alice*[23] and *Mayo*[24] could be coherently focused on the salutary purpose of preventing future category mistakes in patentability analysis. Consistent with Supreme Court software

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[18] *Old Piano Roll Blues*, PETER GROVES, A DICTIONARY OF INTELLECTUAL PROPERTY LAW 220 (2011).

[19] Government's Opening Brief, Gottschalk v. Benson, 409 U.S. 63 (1972).

[20] *Alappat*, 33 F.3d at 1567 (Archer, J., dissenting).

[21] 417 F.2d 1395 (C.C.P.A. 1969).

[22] *See id.* at 1402.

[23] Alice Corp. v. CLS Bank Int'l, 134 S. Ct. 2347, 2355 (2014).

[24] *See* Mayo Collaborative Servs. v. Prometheus Labs, 132 S. Ct. 1289, 1297–98 (2012).

patent doctrine, the abstract-idea exclusion could enforce the longstanding distinction between a patent-eligible "method or means" and an unpatentable "result or effect." Part V concludes with a brief discussion of future work.

II. AN INTRODUCTION TO CATEGORY MISTAKES

This section introduces category mistakes and the doctrinal difficulties that result from them. This Article will argue *Alice*'s repudiation of the "new machine" principle should be viewed as an opportunity for the patent system to recognize § 101's role in preventing category mistakes in patentability analysis. Over the centuries, various philosophers have attempted to answer the question "What is there?" by classifying the world's entities[25] into broad ontological categories[26] that can be the subject of meaningful discourse.[27] Two criteria for a successful classification are that (1) the set of categories is complete, i.e., each entity in the world belongs to one and only one category; and (2) attributes are category-specific; i.e., an attribute that can belong to entities in one category cannot be an attribute of entities in any other category.[28]

A category mistake occurs when an entity is placed in the wrong category or is given an attribute that only entities in another category can have.[29] "This memory is violet,"[30] "Caesar is a prime number,"[31] and "Colorless green ideas sleep furiously"[32] are examples

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[25] An entity is "something that exists by itself" or "something that is separate from other things." *Entity Definition*, MERRIAM-WEBSTER.COM, http://www.merriam-webster.com/dictionary/entity (last visited Apr. 15, 2015).

[26] Ontological knowledge is "one's conception of the basic categories of existence, of what sort of things there are." FRANK C. KEIL, SEMANTIC AND CONCEPTUAL DEVELOPMENT: AN ONTOLOGICAL PERSPECTIVE 457 (1979).

[27] The first such effort is credited to Aristotle. *See* ARISTOTLE, CATEGORIES (J.L. Ackrill trans., 1963) (listing substance, quantity, quality, relation, place, date, posture, state, action, and passion).

[28] *Category*, *in* THE CAMBRIDGE DICTIONARY OF PHILOSOPHY 122–23 (Robert Audi ed., 1999).

[29] *Id.* at 123.

[30] *Id.*

[31] *Id.*

[32] Noam Chomsky, *Three Models for the Description of Language*, 2 IRE TRANSACTIONS ON INFO. THEORY 113 (1956).

of category mistakes as they often manifest themselves in unintelligible or absurd discourse.

Some category mistakes, however, are exposed only through deeper analysis. A famous example is Gilbert Ryle's argument against Rene Descartes's mind-body dualism, which he characterized as "the dogma of the Ghost in the Machine:"

> [The dogma] maintains that there exist both bodies and minds; that there occur physical processes and mental processes; that there are mechanical causes of corporeal movements and mental causes of corporeal movements.[33]

Ryle's critique depends on a more extensive argument that physical processes and mental processes belong to distinct categories, so that "it makes no sense to conjoin or disjoin the two."[34] That is to say, Descartes commits a category mistake.

Similarly, as Steven Smith argued in *Law's Quandary*, the ontological categories constructed by law can obscure even pervasive gaps between a society's consciously held beliefs about ontological categories and "the ontological assumptions that are implicit or presupposed in practice and ways of talking."[35] Lawyers and laypeople alike speak of "the law" as if it were a real entity,[36] but it is far from clear that the legal community can account for "the law" in a careful inventory of its ontological commitments.[37] We may all be speaking "nonsense."[38] For example, Smith problematizes the writing of dissenting opinions, noting that they "typically assert that the majority has *misstated the la*w . . . . What could this kind of talk mean if the judicial decision *is* law?"[39]

A recent article[40] conducted an inventory of the ontological commitments surrounding the category of "useful Arts" in the discourse of patent law, in which "claims are novel kinds of

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[33] GILBERT RYLE, THE CONCEPT OF MIND 11 (Julia Tanney ed., 2009).
[34] *Id.* at 11–12.
[35] STEVEN D. SMITH, LAW'S QUANDARY 16 (2007).
[36] *Id.* at 13.
[37] *Id.* at 19–22.
[38] *Id.* at 30.
[39] *Id.* at 58 (emphasis in original).
[40] *See generally* Andrew Chin, *The Ontological Function of the Patent Document*, 74 U. PITT. L. REV. 263 (2012).

embodiments; and embodiments are entities whose properties include essential causal powers, and whose possible existence is therefore warranted by scientific essentialism and scientific realism."[41] A wide range of patent doctrines, including patentable subject matter, utility, anticipation, infringement, constructive reduction to practice, written description, enablement, and claim construction all support this ontological picture.[42]

Following naturally from patent law's long-recognized status as "the most metaphysical branch of modern law,"[43] its adherence to this system of ontological commitments through so many doctrinal ramifications necessitates a distinctive role for the patentable subject matter requirement in policing against category mistakes.[44] Like Descartes's "Ghost in the Machine,"[45] the "new machine" principle is a dogma that falsely conjoins mathematical inferences with the category of "useful Arts": a category mistake that, in *Bernhart*, had spectacularly far-reaching consequences. It should have had no place in § 101[46] doctrine. We now turn to that story.

III. THE CATEGORY MISTAKE IN *BERNHART*

Despite the importance of the *Bernhart* case to the histories of both software patents and computer technology, it has received little attention in contemporary debates over the patenting of software. But the "new machine" principle it articulated and the category mistake it allowed continued to hold legal significance for nearly four decades.

In 1961, Boeing employees Walter Bernhart and Bill Fetter

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[41] *Id.* at 323.

[42] *Id.*

[43] Hogg v. Emerson, 47 U.S. 437, 485–86 (1848); *see also* Rohm & Haas Co. v. Dawson Chemical Co., 599 F.2d 685, 706 (5th Cir. 1979) (citing Judge Rich's comment that "patent law is 'the metaphysics' of the law").

[44] *See* Chin, *supra* note 40, at 268 ("The advantage of such an approach is that any resulting doctrinal proposals can find warrant not only on policy grounds but also importantly as metaphysically necessary consequences of settled legal principles.").

[45] *See* RYLE, *supra* note 33.

[46] 35 U.S.C. § 101 (2012).

filed a patent application[47] for a computer system capable of drawing two-dimensional representations of three-dimensional objects. Bernhart and Fetter, who are credited with coining the term "computer graphics,"[48] would have to wait eight years for the U.S. Court of Customs and Patent Appeals to award them their patent.[49] Hundreds of firms, including Disney, expressed interest in licensing the technology,[50] and Computerworld heralded the issued patent as "the first true software patent."[51]

Bernhart and Fetter's claimed system included a "general-purpose digital computer" programmed to calculate a series of coordinates $\{(v_i, w_i)\}$ representing the projections of object points $\{(x_i, y_i, z_i)\}$ from a viewpoint (x_e, y_e, z_e) onto the plane located at k times the distance from the viewpoint to the origin and normal to the line between them. The calculation was to be based on the formulas:

$$v_i = \frac{k(x_e^2 + y_e^2 + z_e^2)(-y_e x_i + x_e y_i)}{\sqrt{(x_e^2 + y_e^2)}\left[(x_e^2 + y_e^2 + z_e^2) - (x_e x_i + y_e y_i + z_e z_i)\right]}$$

$$w_i = \frac{k\sqrt{(x_e^2 + y_e^2 + z_e^2)}}{\sqrt{(x_e^2 + y_e^2)}}\left(\frac{-x_e z_e x_i - y_e z_e y_i + z_i(x_e^2 + y_e^2)}{(x_e^2 + y_e^2 + z_e^2) - (x_e x_i + y_e y_i + z_e z_i)}\right)$$

The system also included a planar "plotting machine" for plotting the points $\{(v_i, w_i)\}$ on paper. The "plotting machine" could use any known output technology for this purpose, including ink pens, cathode ray photography, or electrostatic paper.[52]

The Patent Office had rejected the system claims under § 101 because their point of novelty consisted of the mathematical equations used to program the computer.[53] On appeal, the U.S. Court of Customs and Patent Appeals acknowledged that equations were excluded from patentable subject matter, but found that the

[47] U.S. Patent No. 3,519,997 (filed Nov. 13, 1961).
[48] 39 COMM. ARTS MAG. 216 (1997).
[49] *See In re* Bernhart, 417 F.2d 1395 (C.C.P.A. 1969).
[50] *Firm Wins Battle for Mechanical Cartoonist Patent*, GREAT BEND DAILY TRIB., May 1, 1970, at 1.
[51] COMPUTERWORLD, July 29, 1970, at 2.
[52] *See* U.S. Patent No. 3,519,997 at cols. 4-6 (filed Nov. 13, 1961).
[53] *Bernhart*, 417 F.2d at 1398.

system claims in issue would not preempt all uses of the recited equations:

> [A] member of the public would have to do much more than use the equations to infringe any of these claims. He would have to use them in the physical equipment recited in the claim . . . . We should not penalize the inventor who makes his invention by discovering new and unobvious mathematical relationships which he then utilizes in a machine, as against the inventor who makes the same machine by trial and error and does not disclose the laws by which it operates.[54]

The comparison between the two inventors here appeals to the longstanding principle that a patent applicant has no duty to disclose a correct theory of operation.[55] In making the comparison, the court's implication was that Bernhart and Fetter had not only invented a new machine, but had performed a further public service of disclosing its theory of operation, over and above the amount of disclosure needed to patent it. In this account, the mathematical equations played no part in the invention's patent-eligibility, which turned solely on the invention's characterization as a new machine.

The court then made the characterization explicit by way of invoking the "new machine" principle for the first time as a rationale for patent-eligibility:

> [I]f a machine is programmed in a certain new and unobvious way, it is physically different from the machine without that program; its memory elements are differently arranged. The fact that these physical changes are invisible to the eye should not tempt us to conclude that the machine has not been changed. If a new machine has not been invented, certainly a "new and useful improvement" of the unprogrammed machine has been . . . . We are concluding here that such machines are statutory under 35 U.S.C. § 101, and that claims defining them must be judged for patentability in light of the prior art.[56]

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[54] *Id.* at 1399–1400 (emphasis omitted).

[55] *See* Newman v. Quigg, 877 F.2d 1575, 1581–82 (Fed. Cir. 1989).

[56] *Bernhart*, 417 F.2d at 1400. The court subsequently characterized the "physical changes" resulting from programming a computer in categorical terms, stating "once a program has been introduced, the general-purpose digital computer becomes a special-purpose digital computer." *In re* Prater, 415 F.2d 1393, 1403 n. 29 (C.C.P.A. 1969) (dicta); *see also In re* Alappat, 33 F.3d 1526, 1545 (Fed. Cir. 1994) (en banc) (citing *Prater*) ("We have held that such programming creates a new machine, because a general purpose computer in

The court proceeded to review the Patent Office's § 103 rejection of the Bernhart and Fetter's claims in light of the prior art. Unbeknownst to the Boeing scientists, a very similar patent application, filed in 1960 by Bernard Taylor, Jr., was already pending in the Patent Office.[57] Taylor had claimed a system with special-purpose circuitry for calculating and outputting the coordinates of a planar projection of a three-dimensional object. Taylor's circuits calculated the coordinates (f_1, f_2) representing the projections of an object point $C = (c_1, c_2, c_3)$ from a viewpoint $A = (a_1, a_2, a_3)$ onto the plane passing through the point $B = (b_1, b_2, b_3)$ and normal to the line between this point and the viewpoint. Taylor's application disclosed the following expressions for f_1 and f_2:

$$
\begin{aligned}
f_1 &= d_1 \Psi / \lambda \\
d_1 &= \sqrt{e_1^2 + e_2^2 + e_3^2} \\
(e_1, e_2, e_3) &= \big((a_1 - b_1), (a_2 - b_2), (a_3 - b_3)\big) \\
\Psi &= \frac{e_3 \omega}{d_2} - d_2 \gamma_3 \\
\omega &= e_1 \gamma_2 + e_2 \gamma_1 \\
(\gamma_1, \gamma_2, \gamma_3) &= \big((a_1 - c_1), (a_2 - c_2), (a_3 - c_3)\big) \\
d_2 &= \sqrt{e_1^2 + e_2^2} \\
\lambda &= \omega + e_3 \gamma_3 \\
f_2 &= \frac{(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_3 - b_3)^2}{\sqrt{(a_1 - b_1)^2 + (a_2 - b_2)^2}} \bullet \\
&\qquad \frac{(a_1 - b_1)(a_1 - c_2) - (a_2 - b_2)(a_1 - c_1)}{(a_1 - b_1)(a_1 - c_1) + (a_2 - b_2)(a_2 - c_2) + (a_3 - b_3)(a_3 - c_3)}
\end{aligned}
$$

When rewritten solely in terms of A and C (with B set to the origin), these expressions simplify to the following representations

effect becomes a special purpose computer once it is programmed to perform particular functions pursuant to instructions from program software.").

[57] U.S. Patent No. 3,153,224 (filed Feb. 23, 1960).

of Bernhart and Fetter's equations:

$$f_2 = \frac{(a_1^2 + a_2^2 + a_3^2)(a_2 c_1 - a_1 c_2)}{\sqrt{(a_1^2 + a_2^2)}\left[(a_1^2 + a_2^2 + a_3^2) - (a_1 c_1 + a_2 c_2 + a_3 c_3)\right]}$$

$$f_1 = \frac{\sqrt{a_1^2 + a_2^2 + a_3^2}}{\sqrt{a_1^2 + a_2^2}}\left(\frac{-a_1 a_3 c_1 - a_2 a_3 c_2 + c_3(a_1^2 + a_2^2)}{(a_1^2 + a_2^2 + a_3^2) - (a_1 c_1 + a_2 c_2 + a_3 c_3)}\right)$$

In fact, an enterprising patent examiner performed these algebraic simplifications over six pages of manuscript, showing that for $(a_1, a_2, a_3) = (kx_e, ky_e, kz_e)$ and $(c_1, c_2, c_3) = (x_i, y_i, z_i)$, Taylor's formulas calculate the same projection coordinates $(f_2, f_1) = (v_i, w_i)$.[58] Accordingly, the Patent Office rejected Bernhart and Fetter's claims as obvious over Taylor's application[59] in light of known programmed computer systems with plotters.[60]

The court was not persuaded by the Patent Office's algebra, finding that it amounted to a hindsight reconstruction of Bernhart and Fetter's equations:

> There is nothing in the record to suggest that there was any possibility of the simplified programming claimed by the applicants in claim 19. The Patent Office belatedly . . . attempts to show that Taylor's equations can be manipulated to an identity with the [applicants'] equations . . . . In so doing the solicitor has had the benefit of seeing applicants' equations, and with this hindsight a mathematical identity is revealed. There is nothing to suggest that, within the context of automated drawing, *one of ordinary mathematical skill* armed with the Taylor reference would be able to discover the simpler equations which are the basis of the claimed programming.[61]

Hindsight is a legitimate concern for courts and patent examiners when inquiring into whether a claimed invention was nonobvious at the time it was made.[62] In formulating an obviousness rejection, there can be a "temptation to read into the prior art the teachings of

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[58] Brief for the Commissioner of Patents at 13–18, *In re* Bernhart, 417 F.2d 1395 (C.C.P.A. 1969).
[59] *See id.* at 6.
[60] *See, e.g.*, U.S. Patent No. 3,066,868 (filed Nov. 15, 1956).
[61] *Bernhart*, 417 F.2d at 1402.
[62] KSR Int'l. Co. v. Teleflex Inc., 550 U.S. 398, 421 (2007).

the invention in issue,"[63] thereby understating the difficulty of the problem that would have faced a person having ordinary skill in the art at the time of invention. The *Bernhart* court's characterization of the patent examiner's calculations, however, is strained at best.

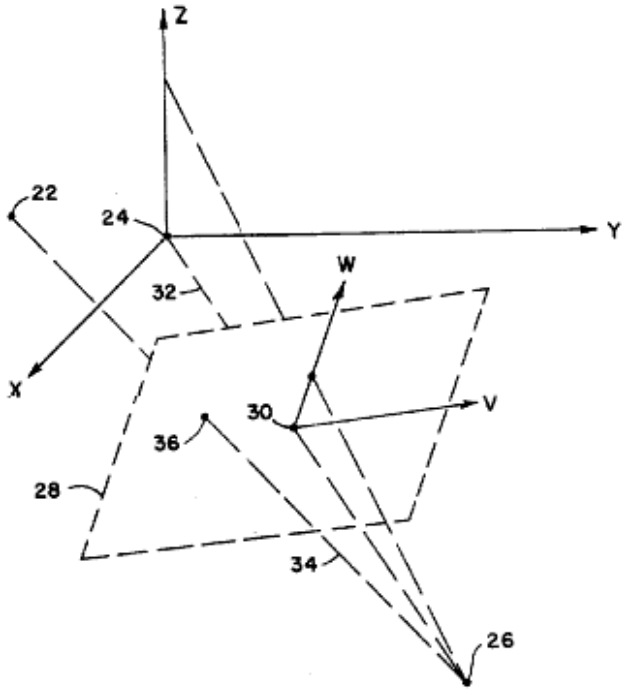

Figure 1 - Graphical representation of Bernhart and Fetter's projection equations.

The reason Bernhart and Fetter's equations are simpler than Taylor's is that the former apply only to the special case where the normal from the viewpoint (26 in Figure *1*) to the projection plane (28) passes through the origin (30). Once the coordinates b_1, b_2, b_3 drop out of Taylor's equations, the expressions are greatly simplified, and it is a straightforward exercise in first-year algebra to solve for f_1 and f_2 in terms of A and C. From these simplified equations, expressing $\{(v_i, w_i)\}$ in terms of $\{(x_i, y_i, z_i)\}, (x_e, y_e, z_e)$ and k requires only a change of notation. Bernhart and Fetter's equations

[63] *See* Graham v. John Deere, 383 U.S. 1, 36 (1966).

immediately follow from Taylor's prior art disclosure as a special case, at least to one of ordinary skill in ninth-grade mathematics.[64] In short, the court's determination as to what a person of "ordinary mathematical skill" would be able to do with a particular set of algebraic equations is problematic, because it grossly underestimates the mathematical abilities of the patent's intended audience.

Even more fundamentally, the court's notion of an inventor "discovering new and unobvious mathematical relationships" and its interposition of "mathematical skill" for the predicate of "ordinary skill in the art" constitute category mistakes. This is because the attributes of nonobviousness and ordinary skill in the art are inapplicable to the mathematical derivation of equations (and the category of the mathematical arts more generally). As the Supreme Court acknowledged in *Flook* and reiterated in *Bilski*, even previously unknown mathematical properties must be "assumed to be within the prior art" at the outset of a patentability determination.[65] Moreover, a § 103[66] inquiry into the level of ordinary skill in the art[67] is misplaced where the art in question, and the field of knowledge being advanced by the patent disclosure, is not one of the "useful Arts," but mathematics.[68] The patentability analysis of a claimed software-implemented invention

[64] The nonobviousness analysis is not changed by characterizing Bernhart and Fetter's as a species selected from a prior art genus. *See generally* MPEP 2144.08 (9th ed., Mar. 2014). On the other hand, Taylor's equations are not readily deducible from Bernhart and Fetter's disclosure, which offers no indication as to how to calculate the coordinates of a projection onto a plane located elsewhere in space.

[65] Parker v. Flook, 437 U.S. 584, 594 (1978); Bilski v. Kappos, 561 U.S. 593, 610 (2010) (quoting *Flook*).

[66] 35 U.S.C. § 103 (2012).

[67] *Graham*, 383 U.S. at 17.

[68] *See id.* at 6 (quoting U.S. CONST., art. I, § 8, cl. 8) ("Innovation, advancement, and things which add to the sum of useful knowledge are inherent requisites in a patent system which by constitutional command must 'promote the Progress of . . . useful Arts.'").

Since the claimed system in *Bernhart* becomes obvious once the "new" equations are assumed to be within the prior art, it also fails the historical requirement that "a patent-eligible invention must reflect invention in the application of otherwise ineligible science, nature, or ideas." Joshua D. Sarnoff, *Patent-Eligible Inventions After* Bilski*: History and Theory*, 63 HASTINGS L.J. 53, 72 (2011).

should never leave a court in the position of determining how hard the math was.

IV. DISCUSSION

A. Bernhart *in Light of* Alice *(and Vice Versa)*

There can be little doubt that *Bernhart* would have been decided differently after *Alice*. The claims in *Bernhart* are facially directed to patent-ineligible mathematical equations. The remaining system elements are recited in means-plus-function format[69] and supported in the specification by broad disclosures of "a general-purpose digital computer," "a plotting machine," "the input devices of the computer," and "the output of the computer."[70] A representative figure from the disclosure is reprinted in Figure ***2***.[71] Read together, these claim elements constitute only a "wholly generic computer implementation"[72] that "cannot transform a patent-ineligible abstract idea into a patent-eligible invention."[73] Under *Alice*, a general-purpose computer programmed to evaluate mathematical formulas would not have been characterized as a "new machine" but rather as an unpatentable abstract idea. This conclusion to the § 101 analysis would have obviated *Bernhart*'s category mistake in its § 103 inquiries.

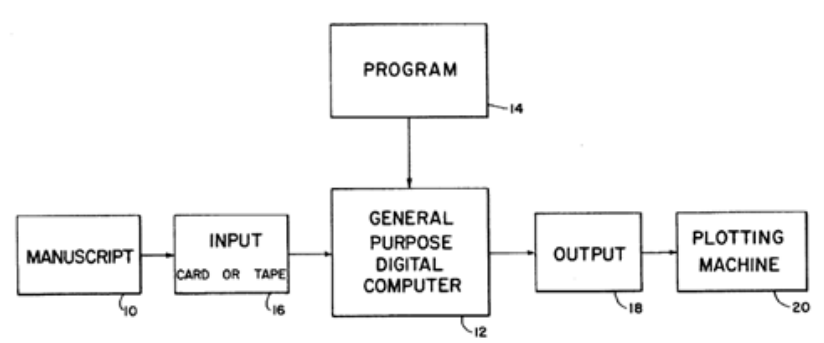

Figure 2. Block diagram of Bernhart and Fetter's claimed system.

[69] *See* U.S. Patent No. 3,519,997, *supra* note 47, at cols. 1–3.
[70] *Id.* at col. 4.
[71] *See id.* at fig. 1.
[72] Alice Corp. v. CLS Bank Int'l, 134 S. Ct. 2347, 2358 (2014).
[73] *Id.*

Bernhart thus reveals a previously hidden role for the patent-eligible subject matter inquiry after *Alice*: preventing future category mistakes in connection with "examination against prior art under the traditional tests for patentability."[74] When conducting the *Alice*/*Mayo* analysis in light of this role, however, not all cases will be as clear as *Bernhart*, even within the limited field of software-implemented inventions.[75] Fortunately, a doctrine dating from the Industrial Revolution and reaffirmed by the Supreme Court in *Diamond v. Diehr*[76] can supply the ontological distinctions necessary to illuminate the potential for category mistake.

B. *The "Method or Means" Requirement*

Since at least the 1850s, patent-eligibility has required that claims be limited to a particular method or means for bringing about a desired effect, rather than the effect itself.[77] *Diehr*

[74] *In re* Bilski, 545 F.3d 943, 1013 (Fed. Cir. 2008) (en banc) (Rader, J., dissenting).

[75] For an empirical survey of the diverse levels of abstraction involved in the technical disclosures of "software patents," see Martin Campbell-Kelly & Patrick Valduriez, *A Technical Critique of Fifty Software Patents*, 9 MARQ. INTELL. PROP. L. REV. 249 (2005).

[76] 450 U.S. 175 (1981).

[77] LeRoy v. Tatham, 55 U.S. 156, 175 (1852) ("A patent is not good for an effect, or the result of a certain process, as that would prohibit all other persons from making the same thing by any means whatsoever. This, by creating monopolies, would discourage arts and manufactures, against the avowed policy of the patent laws."). In *Corning v. Burden*, 56 U.S. 252, 268 (1853), the Supreme Court extended this principle to machines as well as processes, stating, "It is for the discovery or invention of some practical method or means of producing a beneficial result or effect, that a patent is granted, and not for the result or effect itself."

Joshua Sarnoff has pointed to an even earlier expression of the "method or means" requirement in Justice Story's 1840 decision in *Wyeth v. Stone*. In that case, Justice Story found that a patent could not validly be "for any mode whatsoever of cutting ice by means of an apparatus, worked by power, not human, in the abstract, whatever it may be . . . ." Wyeth v. Stone, 30 F. Cas. 723, 727 (C.C.D. Mass. 1840). Such a patent, Story reasoned, "is void, as it is for an abstract principle, and broader than the invention, which is only cutting ice by one particular mode, or by a particular apparatus or machinery." *Id.* According to Sarnoff, Story's reasoning amounted to a holding that a claimed invention was limited to "only the inventive mode or apparatus embodying the patented principle that was actually disclosed in the patent specification." Joshua D. Sarnoff, *The Historic and Modern Doctrines of Equivalents and Claiming the Future, Part I (1790–1870)*, 87 J. PAT. & TRADEMARK OFF. SOC'Y 371, 390 (2005) (citing *Wyeth*).

reaffirmed this bedrock principle for the software era.[78] This distinction between a practical "method or means" and a beneficial "result or effect" provides the requisite ontological categories for identifying impermissibly abstract product and process claims under my proposed approach.

The "method or means" requirement calls for a simple inquiry into causality. A "method or means" is capable of making some beneficial difference in the state of the world because of its use. A "result or effect" that obtains in the world regardless of whether or not such an intervening act takes place, in contrast, is "part of the storehouse of knowledge of all men . . . free to all men and reserved exclusively to none"[79] and therefore cannot be preempted from the public domain as the subject matter of a patent.[80] This preemption concern extends to claims that effectively cover all applications of such a "result or effect" in a particular field of use or technological environment, or additionally recite only insignificant extra-solution activity.[81]

For example, consider the Pythagorean Theorem, a paradigmatic example of an unpatentable abstract idea.[82] The Pythagorean Theorem does not *cause* the square of the hypotenuse of a right triangle to be the sum of the squares of the legs, although it *explains* why this is so. Nor was this proposition *caused* by Pythagoras or by any of the hundreds of other mathematicians who have furnished proofs over the centuries.[83] Rather, the Pythagorean Theorem and its proofs simply reveal a relationship that has always existed among the sides of a right triangle regardless of human intervention.

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[78] Diamond v. Diehr, 450 U.S. 175, 182 n.7 (1981) (quoting *Corning,* 56 U.S. at 268).

[79] Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948).

[80] *See id.* at 130–31 (rejecting claim to combination of bacteria species because "[t]hey serve the ends nature originally provided and act quite independently of any effort of the patentee").

[81] *See id.* at 132.

[82] Parker v. Flook, 437 U.S. 584, 590 (1978); *cf.* STEWART SHAPIRO, THINKING ABOUT MATHEMATICS: THE PHILOSOPHY OF MATHEMATICS (2000) (treating mathematical objects as paradigmatic examples of noncausal abstractions).

[83] *See* ELISHA S. LOOMIS, THE PYTHAGOREAN PROPOSITION (1968) (presenting 367 ways of proving the Pythagorean Theorem).

Some applications of the Pythagorean Theorem are patentable. For example, the "Cube Puzzle With Moving Faces" of U.S. Patent 4,872,682 is a product that can be made and used for beneficial entertainment and educational purposes.[84] It includes springs for creating frictional forces between the sliding pieces and the channels in which they slide as the faces of the cube are turned manually.[85] These and other built mechanisms for transmitting forces among the cube components can be accurately characterized as means for *causing* the beneficial behavior of the cube. This is true even though the Pythagorean Theorem can be used to verify that a slider in the middle layer of the cube is dimensioned so that it will not slide out of the mechanism when the top or bottom layer is rotated.[86] The claimed cube puzzle is a patent-eligible "method or means" for causing beneficial configurations when its faces are rotated by manual forces.

In contrast, consider a hypothetical patent claim directed to a kinematic chain comprising three sequentially linked members each having a given length, the longest of which is the square root of the sum of the squares of the two shorter lengths, whereby the members are constrained to form a right triangle when the linkage is closed. If the term "member" in such a claim refers to any structural element capable of being modeled geometrically as a line segment of a given length without limitation as to the forces that may operate on the member in use, then the claim effectively preempts all uses of the Pythagorean Theorem in the field of mechanical linkages. Since the Pythagorean Theorem is a property that obtains in the world regardless of human intervention, the claim should be found unpatentable under the "method or means" requirement.

C. *Harmonization with Supreme Court Jurisprudence*

The "method or means" requirement is a unifying principle that adheres to the Supreme Court's recent software patent jurisprudence in *Bilski* and *Alice*. The requirement, which closely

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[84] U.S. Patent No. 4,872,682 (filed Nov. 17, 1987) at col. 4.
[85] *Id.*
[86] *Id.* at cols. 8–9.

tracks "the guideposts in *Benson*, *Flook*, and *Diehr*,"[87] supports the use of the machine-or-transformation test as an important, but not definitive inquiry, in abstract-idea jurisprudence[88] and clarifies the role of the abstract-idea exclusion in guarding against inapposite inquiries into novelty and nonobviousness.[89]

In *Benson*, the Court distinguished phenomena of nature and abstract ideas from their "application . . . to a new and useful end."[90] A claim to a phenomenon of nature, such as the rejected claim in *O'Reilly v. Morse*,[91] manifests itself by coverage so broad that "it matters not by what process or machinery the result is accomplished."[92] Similarly, the Court found Benson's challenged claims "so abstract and sweeping as to cover both known and unknown uses of the BCD to pure binary conversion," and processes that could "be performed through any existing machinery or future-devised machinery or without any apparatus."[93] In contrast, the claimed chemical tanning and dyeing processes in *Corning* were "sufficiently definite to confine the patent monopoly within rather definite bounds."[94]

The Court's reasoning in *Benson* applies with equal force to any claim that fails the "method or means" requirement. Logically, it is only with respect to a claim directed to a "practical method or means of producing a beneficial result or effect" that coverage is contingent on "by what process or machinery the result is accomplished."[95]

In *Flook*, the Supreme Court credited the patent applicant with finding "a new and presumably better method for calculating alarm limit values"[96] by applying a new algebraic formula to variables

[87] Bilski v. Kappos, 561 U.S. 593, 621 (2010).
[88] *Id.*
[89] *In re* Bilski, 545 F.3d 943, 1013 (Fed. Cir. 2008) (en banc).
[90] Gottschalk v. Benson, 409 U.S. 63, 67 (1972) (quoting Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948)).
[91] 56 U.S. 62 (1853).
[92] *Id.* at 113.
[93] *Benson*, 409 U.S. at 68.
[94] *Id.* at 69.
[95] *Id.* at 68 (quoting *Morse*, 56 U.S. at 113).
[96] Parker v. Flook, 437 U.S. 584, 594–95 (1978).

involved in the catalytic conversion of hydrocarbons.[97] The Court characterized the applicant's new algorithm as an expression of a scientific principle that "reveals a relationship that has always existed,"[98] like Newton's equation expressing the law of universal gravitation,[99] and the algorithm therefore must be "assumed to be within the prior art."[100] The Court's conclusion—that a "merely heretofore unknown" expression of a "theretofore existing phenomenon or relationship"[101] is not the kind of "'discover[y]' that the statute was enacted to protect"[102]—applies with equal force to any property or principle (such as the Pythagorean Theorem) that obtains in the world regardless of whether or not any intervening causal act takes place.[103]

In *Diehr*, the Supreme Court found a process of curing synthetic rubber that used the well-known Arrhenius' equation to determine the appropriate cure time as patent-eligible.[104] Noting that "[t]ransformation and reduction of an article 'to a different state or thing' is the clue to the patentability of a process claim that does not include particular machines,"[105] the Court characterized Diehr's claimed invention as a patent-eligible process involving "the transformation of an article, in this case raw, uncured synthetic rubber, into a different state or thing."[106]

The Court distinguished the claimed invention from a mathematical equation, noting that the claim would only "foreclose from others the use of that equation in conjunction with all of the other steps in their claimed process."[107] Such "steps" included "installing rubber in a press, closing the mold, constantly determining the temperature of the mold, constantly recalculating the appropriate cure time through the use of the formula and a

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[97] *Id.*
[98] *Id.* at 593 n. 15 (citation omitted).
[99] *Id.*
[100] *Id.* at 594.
[101] *Id.* at 590, 593 n. 15.
[102] *Id.*
[103] *Id.*
[104] Diamond v. Diehr, 450 U.S. 175, 187 (1981).
[105] *Id.* at 184 (quoting *Benson*, 409 U.S. at 70).
[106] *Id.*
[107] *Id.*

digital computer, and automatically opening the press at the proper time."[108] These steps can be accurately characterized as comprising a practical method for *causing* the rubber to be cured. More generally, any process that causes the beneficial "transformation of an article . . . into a different state or thing" constitutes a "method or means of producing a beneficial result or effect."

In accordance with *Bilski's* precepts, the "method or means" requirement not only follows "the guideposts in *Benson*, *Flook*, and *Diehr*,"[109] but also provides a rationale for treating the Federal Circuit's erstwhile machine-or-transformation test as a "useful and important clue" to guide the abstract-idea inquiry.[110] The transformation prong, which calls for "a particular transformation of a specific article,"[111] simply represents the physical manifestation of a concrete beneficial difference in the state of the world that is produced by the claimed invention. Moreover, while the Federal Circuit never specified the criteria necessary for satisfying the machine prong of the test,[112] a claimed machine might reasonably be deemed patentably concrete by virtue of a

[108] *Id.*

[109] As other scholars have observed, a significant difficulty in interpreting *Bilski* is that the last two of the "guideposts in *Benson*, *Flook* and *Diehr*" are not in alignment. *See, e.g.*, Rebecca S. Eisenberg, Prometheus *Rebound: Diagnostics, Nature, and Mathematical Algorithms*, 122 YALE L.J. ONLINE 341, 343 (2013) (observing that *Diehr* and *Flook* "reach opposing conclusions on similar facts and are difficult to reconcile"); John M. Golden, Flook *Says One Thing*, Diehr *Says Another: A Need for Housecleaning in the Law of Patentable Subject Matter*, 82 GEO. WASH. L. REV. 1765, 1781 (2014) (noting the "clear tensions . . . between the differing language and holdings of *Diehr* and its predecessor *Flook*"); Mark A. Lemley et al., *Life After* Bilski, 63 STAN. L. REV. 1315, 1335–36 (2011) (noting that *Flook*'s point of novelty approach was "essentially overruled a few years later in *Diehr*"). The foregoing discussion, however, shows how each case *on its own terms* can be reconciled with the "method and means" requirement. *Cf.* Mayo Collab. Servs. v. Prometheus Labs., 132 S. Ct. 1289, 1299 (2012) (distinguishing *Flook* from *Diehr* based on how the *Flook* Court "characterized the claimed process").

[110] *See* Bilski v. Kappos, 561 U.S. 593, 658–59 (2010) (noting Court consensus on status of the machine-or-transformation test).

[111] *In re* Bilski, 545 F.3d 943, 957 (Fed. Cir. 2008) (en banc).

[112] *See id.* at 994 (Newman, J., dissenting) ("We aren't told when, or if, software instructions implemented on a general purpose computer are deemed 'tied' to a 'particular machine.'").

user's ability to produce a beneficial difference in the state of the world.

Finally, *Alice* draws an especially sharp distinction between a patent-eligible "method or means" of causing a beneficial change in the state of the world[113] and an ineligible "result or effect" that obtains in the world regardless of whether or not such intervening acts takes place.[114] In the context of software solutions, the "method or means" requirement forces patent claims to be limited in scope and directed to specific entities and processes whose effects in the real world are learned through empirical observation, not stipulated as mathematical properties of abstract models or of computer system components disclosed in "purely functional and generic"[115] terms.

It bears noting that the computer science community is already prepared to lend its expertise to such an inquiry. The requirement that a patentable invention be "causal" closely corresponds to a distinction that philosophers of computer science, most notably James Fetzer[116] and Aaron Sloman,[117] have drawn among different kinds of machine abstractions, and even different areas of computing research.

V. CONCLUSION

The Supreme Court long ago articulated a simple, generally applicable doctrine defining the scope of patent-eligible subject matter that can provide considerable clarity to the allowable extent

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[113] *See* Alice v. CLS Bank Int'l, 134 S. Ct. 2347, 2359 (2014) (finding that the method claims do not "purport to improve the functioning of the computer itself" or "any other technology or technical field").

[114] *See id.* (finding that the method claims "simply recite the concept of intermediated settlement as performed by a generic computer.").

[115] *Id.* at 2360.

[116] *See* James H. Fetzer, *Program Verification: The Very Idea*, 31 COMMUNICATIONS OF THE ACM 1048, 1057 (1988) (describing the "causal factors" underlying the performance of a simple compiler-ready Pascal program).

[117] *See* Aaron Sloman, *What Cognitive Scientists Need to Know About Virtual Machines*, in PROC. 31ST ANN. CONF. COGNITIVE SCI. SOC'Y 1210, 1214–15 (N.A. Taatgen & H. van Rijn, eds. 2009) (arguing that running virtual machines supervene on a complex of physical causal processes whose emergent behavior is not amenable to mathematical verification).

of abstraction in software patent claims: "It is for the discovery or invention of some practical method or means of producing a beneficial result or effect, that a patent is granted, and not for the result or effect itself."[118]

Unfortunately, since the 1960s the courts and the Patent Office have been distracted from this clear categorical distinction by the recurring specter of the "new machine" principle. Of course, just as not all software is mathematics,[119] not every software patent is predicated on the "new machine" principle or the miscasting of mathematics as one of the "useful Arts." As I have shown, however, both the "new machine" principle and the category mistake that gave rise to it attended the birth of the first software patent. As *Alice* lays the ghost to rest, it is time for the courts to recognize the original rationale for software patent-eligibility in *Bernhart* as a mistake that will never again be repeated.

[118] Corning v. Burden, 56 U.S. 252, 268 (1853).

[119] *See* Andrew Chin, *On Abstraction and Equivalence in Software Patent Doctrine: A Response to Bessen, Meurer and Klemens*, 16 J. INTELL. PROP. L. 197, 233–37 (2009) (citing Ben Klemens, *The Rise of the Information Processing Patent*, 14 B.U. J. SCI. & TECH. L.J. 1, 10 (2008)) (responding to Ben Klemens's claim that "all software is mathematics").