Straddling the fence of computer programs' patentability: How to foster software invention and innovation

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Abstract

This thesis identifies means available to industry actors and policy makers to foster invention and innovation in the software industry. To this end, the fence of computer programs' patentability is straddled: not taking any particular position on this debate, the standpoint that this fence provides is used to assess instruments stimulating software invention and innovation on two criteria. First, their pragmatic feasibility is examined by analysing the international law superstructure for intellectual property, mainly the *Agreement on Trade Related Aspects of Intellectual Property Rights*, which sets minimum standards that Members of the World Trade Organisation have to give effect to. Second, their consequential desirability is assessed by reference to four elements of the utilitarian rationale on which is predicated the exclusion of abstract subject matter from patent-eligibility in Canadian and U.S. patent law, namely, pre-emption, the building-block structure of the inventive process, the risks of patent thickets and disembodiment. Instruments discussed this way include standards for computer programs' patent-eligibility, patent working requirements, revocation of patent rights, reverse-engineering, path dependency, covenants not to compete, models of innovation favoured by the network enterprise, contractual patent practices, antitrust authorities and competition between the two main schemes of software development: exclusionary appropriation and free and open source software.

Résumé

Ce mémoire identifie des moyens accessibles aux décideurs politiques et aux acteurs de l'industrie informatique pour promouvoir l'inventivité et l'innovation de logiciels. Pour ce faire, la clôture de la brevetabilité des programmes informatiques est chevauchée : ne prenant pas parti à ce débat, le point de vue qu'elle procure est utilisé pour apprécier sur deux volets des outils favorisant l'inventivité et l'innovation de logiciels. D'abord, leur faisabilité est évaluée de façon pragmatique en analysant la superstructure du droit international de la propriété intellectuelle, principalement l'*Accord sur les aspects des droits de propriété intellectuelle qui touchent au commerce*, qui prévoit des dispositions auxquelles les Membres de l'Organisation mondiale du commerce doivent donner effet. Ensuite, des intérêts bénéfiques potentiels de ces mesures sont discutés en lien avec quatre éléments qui justifient la non-brevetabilité des sujets abstraits à l'intérieur de la logique utilitaire des systèmes canadien et américain des brevets, soit la préemption issue de l'exclusivité octroyée par les brevets, la structure par combinaison et accumulation de l'inventivité, les obstructions causées par un trop grand nombre de brevets et la désincarnation. Parmi ces instruments, sont notamment discutés les normes de brevetabilité des programmes informatiques, la prescription d'exploitation des brevets, la révocation de brevets, l'ingénierie inversée, la dépendance au sentier, les clauses de non-concurrence, les effets de l'entreprise réseau sur l'innovation, les pratiques contractuelles en lien avec les brevets, les autorités de concurrence et la rivalité entre les deux principales approches en développement de logiciels : l'appropriation privative et le logiciel libre et ouvert.

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Introduction

Is it possible for any North American wandering on the cobblestones of Murano to resist the charms of the scenery? Indeed, reaching the island by boat and being surrounded by the Grand Canal in Venice, a setting incomparable with any place in the Western hemisphere, partly explain the enchantment. In this Venetian cocoon, glassmakers have been isolated from the main islands centuries ago because of the fire hazards that their craft involved. The beauty of the glass products and the pride of their craftsmen (and now craftswomen) who captivatingly explain the basics of their art enthral visitors. Centuries later, Murano remains renowned for its craft.

During the Middle Ages, Venetian glassmaking was so superior to glassware produced elsewhere in Europe that the city-state established an unprecedented reward system for these artisans: patents.[1] The protectionist goal was to convince these craftsmen to stay in Venice and for their techniques to remain within Venetian boundaries. Obviously, these patents' features and purpose were quite different from today's, but it is this system that led to similar royal grants being awarded in Elizabethan England.[2] Following much controversy, in 1624, these privileges were restricted to patents for new 'Manufactures' under the *Statute of Monopolies*,[3] a practice that subsequently evolved very little in England until the industrial revolution.

According to Christine MacLeod, the modern patent system should be envisioned as a technological creation initially inspired by the *Statute of*

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1 Pamela O Long, "Invention, Authorship, "Intellectual Property," and the Origin of Patents: Notes Toward a Conceptual History" (1991) 32:4 Technology and Culture 846 at 875-78.

2 *Ibid* at 880.

3 Chris Dent, "'Generally inconvenient': the 1624 Statute of Monopolies as political compromise" (2009) 33:2 Melbourne UL Rev 415 at 416.

Monopolies but highly shaped during the British industrial revolution.[4] The Venetian, protectionist experience and its system's exportation to England support this idea of a *technological creation*. This picture helps understand two primordial elements about patents: first, patent rights do not emanate from any conception of natural rights, but rather derive from the state, a "statutory creature",[5] created by policy makers for a specific purpose (at least in common law jurisdictions);[6] second, the purpose of this legal fiction evolved according to historical needs and contexts, an ongoing evolution. During the British industrial revolution, the patent system served to protect the growing capital investments of entrepreneurs in new manufacturing technologies;[7] nowadays, most theorists[8] and practitioners agree that it purports to promote the disclosure of inventions and technical knowledge to the public in order to help inventors build on prior art to further stimulate technological development in the long term.[9.] This utilitarian conception is itself based on the assumption, unchallenged herein, that society benefits from invention and innovation.[10]

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4 Christine MacLeod, "Patents for invention: setting the stage for the British industrial revolution?" (2009) 18 Empiria 37 at 37, 46-51. At p. 39, MacLeod presents historical sources that attenuate the generally conceived importance of the industrial revolution, and so she refers to this era by using lower case initial letters. The point is convincing enough to reproduce it.

5 *Apotex Inc v Wellcome Foundation Ltd*, [2002] 4 SCR 153 at para 37, Binnie J [*Wellcome Foundation*].

6 In France, for instance, patents (*brevets d'invention*) were initially conceptualised as a natural property right. See Liliane Hilaire-Pérez, "Invention and the State in 18th-Century France" (1991) 32:4 Technology and Culture 911 at 915.

7 MacLeod, *supra* note 4 at 49.

8 For an unorthodox view, see generally Nuno Pires de Carvalho, *The Trips Regime of Patent Rights*, 3rd ed (The Netherlands: Kluwer Law International, 2010) at paras IN3-IN29, where it is argued that patents, like all forms of intellectual property rights, have as a primary purpose the protection of business-differentiating intangible assets.

9 *Consolboard Inc v MacMillan Bloedel (Sask.) Ltd*, [1981] 1 SCR 504 at 517, Dickson J [*Consolboard*].

10 The terms *invention* and *innovation* are not synonymous. Unless used as an Usherian concept in Section 2.3 or in the context of the *Patent Act*, RSC 1985, c P-4 [*Patent Act*], *inventing* refers to its common, everyday meaning of "creat[ing] or design[ing] (something that has not existed before); [to] be the originator of". *The Oxford English Dictionary*, *sub verso* "invent", online: Oxford Dictionaries <http://oxforddictionaries.com/definition/english/invent>. *Innovation*, on the other hand, unless quoted or referring to an author's or case law's argumentation, exclusively draws out of Schumpeterian theory, meaning the "carrying out of new combinations", which Frederic Michael Scherer aptly summarises as "reducing an invention to practice and exploiting it commercially". FM Scherer, "Invention and Innovation in the Watt-Boulton Steam-Engine Venture" (1965) 6:2 Technology and Culture 165 at 165.

In a nutshell, the patent system represents a legal tool whose objective consists in spurring technological activities. Just like any competent repairman keeps more than a hammer in his toolbox, private and public parties wishing to promote invention and innovation should rely on more than the patent system. Our interest herein is exactly that: to examine other available devices in the technology-stimulating toolbox that may contribute to fostering invention and innovation in a particular sector of interest: software. It must be noted, however, that software invention and innovation are singularly affected by patents granted for computer programs.

An Often Disregarded International Superstructure

Seen under the lens of MacLeod's historical work-in-progress picture, the current patent rationale asks for flexibility to take into account technology-specific particularities. However, since 1994, the inclusion of the *Agreement on Trade Related Aspects of Intellectual Property Rights*[11] ("TRIPS") into the framework of the World Trade Organisation (the "WTO") notably affected how Members of the WTO can implement such technological specificity into their national legislation and practices. In the midst of all these concerns, pundits debate different propositions regarding the treatment of computer programs' patentability, ranging from the *status quo* to complete rejection, but also alternative possibilities like shortening the duration of patent rights for computer programs or limiting the types of computer programs that should be patent-eligible. External, pragmatic elements like TRIPS often receive little attention in this important discussion that influences software development and its economic, sociological, technological and political aspects.[12]

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[11] *Agreement Establishing the World Trade Organization, Annex 1C: Agreement on Trade-Related Aspects of Intellectual Property Rights*, 15 April 1994, 1869 UNTS 299, WTO.

[12] See, e.g., Michele Boldrin & David K Levine, *Against Intellectual Monopoly* (Cambridge: Cambridge University Press, 2008) and Adam B Jaffe & Josh Lerner, *Innovation and its Discontents: How our Broken Patent System Is Endangering Innovation and Progress, and*

At this stage, one can but surmise the reasons that account for this lack of attention to TRIPS. Economically, most firms involved in software development have actively or tacitly, by their patenting practices, taken a position favouring computer programs' patentability (Apple, Google, IBM and Microsoft number among the main firms, but manufacturing firms that rely on computer programs for their processes or their products[13]—notably, cell phone and computer manufacturers—must also be counted). Legally, the question of computer programs' patent-eligibility is still unsettled in many jurisdictions. Canada is among them. In such cases, attention is mostly focused on national legal concerns rather than on the international environment.[14] Technologically, many opponents of computer programs' patentability are grassroots organisations or individuals involved with the parallel free and open source software ("F/OSS") movement. As these hobbyists tend to work on their own developer-oriented and patent-free software instead of competing directly with market-oriented and often patented software products,[15] the debate shifts from the legitimacy of patent rights for computer programs to their application against F/OSS infringers.[16] Finally, for reasons that deserve further enquiry elsewhere, the WTO, TRIPS even more, is not a well-known and well-understood organisation. Not only is this ignorance pervasive in the general public, it also penetrates discourses of people interested in patents' technological and economic outcomes.[17]

TRIPS affects how the conception of patentable subject matter and the scope of such patents rights, once allowed, are to be applied in national jurisdictions.

What to Do About It (Princeton, NJ: Princeton University Press, 2004), which both propose patent system reforms without taking any look at TRIPS.

13 James Bessen & Robert M Hunt, "An Empirical Look at Software Patents" (2007) 16:1 Journal of Economics & Management Strategy 157 at 171.

14 See Section 1.2 below for an analysis of computer programs' patent-eligibility in Canadian law.

15 Douglas E Phillips, *The Software License Unveiled: How Legislation by License Controls Software Access* (New York: Oxford University Press, 2009) at 154.

16 The way Ronald J Mann, "Do Patents Facilitate Financing in the Software Industry?" (2005) 83 Tex L Rev 961 at 1010-11 discusses F/OSS is a good example.

17 In his extensive analysis of TRIPS, Nuno Pires de Carvalho identifies many of these pervasive misunderstandings. See, e.g., *supra* note 8 at paras IN142, P14, 1.15, 29.9 and 64.25.

These effects stem from articles 1 to 8 and 27 to 34 of TRIPS, which establish minimal requirements that most WTO Members have to formally give effect to in their national patent system.[18] Unlike most international agreements, including the *Paris Convention for the Protection of Industrial Property*,[19] TRIPS' provisions exhort compliance from Members of the WTO: should a dispute arise between Members regarding a violation of this agreement by a Member, a dispute settlement process may be initiated on request by a Member, and, if no mutually agreed upon solution is reached, a Panel or a subsequent Appellate Body will issue a report deciding the dispute on request of one of the disputing Members. Should a Member found violating TRIPS not conform its legislation or practice to the report's recommendations, retaliatory and/or compensatory measures against that Member are available through the WTO system until it conforms to TRIPS.[20]

Computer Programs' Patent-Eligibility and the Patent Rationale

Now that the relationship between TRIPS and computer programs' patent-eligibility has been sketched, the next step is to connect the latter with software invention and innovation ("SII"). The simplest way to do so is to consider recent news events. In the sector of software technology, many technological and economic analysts have observed different *wars* going on (i) between competing major corporations (among others, Apple, Facebook, Google, IBM, Microsoft,

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[18] TRIPS, *supra* note 11 at art 1. See also Subsection 1.1.2 below. Least-developed countries are not yet obligated to give such effect to all provisions of TRIPS. See TRIPS' Article 66.1, paragraph 7 of the *Declaration on the TRIPS Agreement and Public Health*, WTO Doc WT/MIN(01)/DEC/2 (20 November 2001), online: WTO <http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_trips_e.htm>, paragraph 1 of the *Decision of the Council for TRIPS of 27 June 2002*, WTO Doc IP/C/25, online: WTO <http://www.wto.org/english/news_e/pres02_e/pr301_e.htm>, and paragraph 1 of the *Decision of the Council for TRIPS of 29 November 2005*, WTO Doc IP/C/40, online: WTO <http://www.wto.org/english/news_e/pres05_e/pr424_e.htm>.

[19] *Paris Convention for the Protection of Industrial Property*, 20 March 1883, 828 UNTS 305, as last revised at the Stockholm Revision Conference 14 July 1967, WIPO [*Paris Convention*].

[20] TRIPS, *supra* note 11 at art 64.1. For the detailed process of the Dispute Settlement Mechanism, see the *Agreement Establishing the World Trade Organization, Annex 2: Understanding on Rules and Procedures Governing the Settlement of Disputes*, 15 April 1994, 1869 UNTS 401, WTO.

Samsung and Yahoo), using patents as offensive weapons or defensive armour against their opponents; and (ii) between software-developing start-ups, patent aggregators[21] and larger incumbent firms, each using different intellectual property ("IP") regimes, but mainly patents, to their own advantage.[22] Google's acquisition in 2011 of Motorola Mobility, allegedly to use the latter's patents as defensive asset against the former's competitors[23] and the much higher than expected bidding on Nortel's patent portfolio[24] both illustrate this warlike role patents play in the software-related economy. Likewise, in 2012, facing patent infringement claims by Yahoo, Facebook quickly acquired patents from IBM and filed a countersuit against Yahoo. The dispute was settled soon afterwards.[25] These cases instantiate a rent-seeking approach to patents that contrasts sharply with the system's intended purpose of acting as an incentive to invent and innovate; the massive amounts of time and financial resources spent in strategic acquisitions of patent rights represent resources not invested in the invention and innovation of new technologies, striking at the heart of the patent rationale.

Patents' effects on computer programs step beyond the economic and financial aspects of software technology. Another oft-encountered critique of computer programs' patentability relates to a presumable slowing down of

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21 Patent aggregators are "firms whose main business is to obtain title or licenses to [patents] and then license or otherwise monetize the rights obtained." Sean M O'Connor, "IP Transactions as Facilitators of the Globalized Innovation Economy" in Rochelle C Dreyfuss, Harry First and Diane L Zimmerman, eds, *Working Within the Boundaries of Intellectual Property: Innovation Policy for the Knowledge Society* (New York: Oxford University Press, 2010) 203 at 215. Patent aggregators include what is pejoratively called "patent trolls".

22 Amazon.com founder, Jeff Bezos, recently called for government intervention to prevent patent practices that might stifle innovation. See James Day, "Jeff Bezos: Kindle e-readers will soon become part of our everyday lives" *Metro* (16 October 2012), online: Metro <http://www.metro.co.uk/tech/915096-jeff-bezos-kindle-e-readers-will-soon-become-part-of-our-everyday-lives>.

23 Larry Page, *Supercharging Android: Google to Acquire Motorola Mobility*, online: Google Official Blog <http://googleblog.blogspot.com/2011/08/supercharging-android-google-to-acquire.html>.

24 Alastair Sharp & Sinead Carew, "Apple/RIM group top Google in $4.5 billion Nortel sale" *Reuters* (1 July 2011), online: Reuters <http://www.reuters.com/article/2011/07/01/us-nortel-idUSTRE7600PF20110701>.

25 "UPDATE 1-Facebook, Yahoo Tie up, Settle Lawsuits", *Reuters* (6 July 2012), online: Reuters <http://www.reuters.com/article/2012/07/06/facebook-yahoo-idUSL2E8I6ENW20120706>.

software innovation. Recent events are again helpful to explain this situation. In December 2011, Amazon.com was granted a patent in Canada for what is called the "one-click" process[26] following a decision from the Federal Court of Appeal in November 2011 that required the patent office to re-examine the patent application,[27] a decision that I review extensively in Chapter 1. The one-click process consists in Amazon.com (i) stocking personal data (name, contact information, payment information) when a customer orders an item on Amazon's website; (ii) assigning a cookie to the customer's computer; and (iii) when the customer tries to order another item from the website using that same computer, having the website recognise the cookie and associate it with the stocked personal information.[28] This allows customers to order items simply by clicking a button once instead of typing their personal information again and again.

To understand the technological effects of this patent, one needs to take a step back and consider the patent system's rationale. The one-click patent granted to Amazon.com is retroactively valid since 1998, the year in which Amazon.com initially filed for it, and this for a period of twenty years. Conditional on Amazon.com paying the patent's maintenance fees,[29] it will reach the public domain only in 2018. Yet such an invention was well-known among software developers early in the 2000's. As a matter of fact, Amazon sued in the United States one of its main competitors, Barnes & Noble, for patent infringement over its equivalent patent in the United States, a case that was later settled.[30] On the basis of scenarios such as this one, many argue that, instead of encouraging inventive and innovative developments, as they should, patents for computer programs rather stall SII.

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26 "Method and System for Placing a Purchase Order Via a Communication Network," Can Patent No 2246933 (9 November 1998).

27 *Canada (Attorney General) v Amazon.com*, 2011 FCA 328 [*Amazon.com*].

28 *Ibid* at paras 8-9. See *supra* note 26 for the patent's technical specification and claims.

29 *Patent Act*, *supra* note 10 at s 73.

30 Laura Rohde, "Amazon, Barnes & Noble, settle patent dispute" *CNN Tech* (8 March 2002), online: CNN <http://articles.cnn.com/2002-03-08/tech/amazon.bn.dispute.idg_1_patent-dispute-software-patents-patent-claim?_s=PM:TECH>.

These points are incomplete to determine if this conclusion is off or on the mark because of the difficulty, and perhaps impossibility, of obtaining accurate and cogent empirical data to assess the benefits of the patent system for software technology.[31] In addition to the need to first determine on what bases should the benefits of the patent system be rated, which inevitably leads to conflicting views, this complexity lies in the system's manifold effects in industry structure, market strategies, competition, incentive to invent and innovate, economic value and social value, among other elements. For instance, patent advantages for software technology to one of these elements may be counterbalanced by detrimental effects to another; or economic profits might not necessarily translate into social benefits or innovation improvements. Most importantly, any assessment would be highly speculative even if such reliable data was available: its positive or negative value would need to be weighed against what would have taken place instead (non-invention, non-innovation, trade secret, licensing, F/OSS, public domain, non-commercialisation, different market and/or development strategy, and so forth). This replacement, inherently to it being conjectural, either (i) cannot be determined; and/or (ii) its effects cannot be measured suitably for a comparison.[32]

For this reason, this thesis does not take a stand on the desirability of computer programs' patentability. Instead, we straddle the fence of this debate: not taking any particular position, we assess different means available to private software developers—firms as well as individual computer programmers and engineers—and public policy makers to reach the same objectives as the patent rationale, i.e., fostering SII in the long run. However, computer programs' patentability is not ignored. In lieu of simply straddling the fence of computer program patentability, this fence, and its unique position in the software

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[31] See, e.g., Adam D Moore, "Intellectual Property: Theory, Privilege, and Pragmatism" (2003) 16 Can J L & Juris 191 at para 60; Mann, *supra* note 16 at 965-67; and Norman Siebrasse, "The Structure of the Law of Patentable Subject Matter" (2011) 23 IPJ 169 at 182-83. Ironically, one of the closest evaluations thus far is based on the results of a patent game simulation software; see Andrew W Torrance & Bill Tomlinson, "Patents and the Regress of Useful Arts" (2009) X Colum Sci & Tech L Rev 130.

[32] This paragraph draws on the introduction of an unpublished article by the author: Mathieu Bruneau, "History Does Not Speak: the Case of James Watt and the Steam Engine in Patent Theory" (2012) [unpublished, archived in author's files, available at request].

technology-stimulating toolbox in reason of its TRIPS implications, is used to delineate the environment in which these software-stimulating instruments should be assessed. More particularly, we look for measures efficient on both sides of the fence and examine the particularities that the fence, patents, might yield regarding the impact of these measures. As national patent systems worldwide differ in their treatment of computer programs' patentability, assessing these software-stimulating actions on the backdrop of these diverging national positions provides an additional advantage as this pragmatic method incorporates these diverging approaches to computer programs' patentability. Finally, being positioned on the fence widens the horizon of software-stimulating actions compared to the view we would obtain should we ground ourselves on a particular side: this heightened viewpoint helps to see farther than the question of patents, the means, and appreciate the wider horizon of technological creativity, the end.

A meticulous reader will have noticed that *software* and *computer program* are used in different contexts and not as synonyms. *Software* is usually meant to refer to a sector of technology in itself: firms and inventors that produce software mostly as an end-product or as a means for further software end-products, for instance, Google and Microsoft. *Computer program* embraces *software*, but it is also broader, large enough to cross over to non-software industries which also create computer programs to enhance their non-software products, processes or services. This undertaking in technology stimulation focuses primarily on *software*; nonetheless, the legal debate regarding patent-eligibility is not limited to *software*, but rather expands to *computer programs*. There is no need to clearly define or pigeonhole these two terms; in fact, they often overlap. Readers merely need to understand the different contexts in which they are used.

Nevertheless, one needs to understand how patents interrelate with computer programs. As the one-click patent epitomises, patents in this industry do not cover single products, but useful processes in software products—*functions*. Therefore, unlike in some other industries, commercialised computer applications can

incorporate thousands of patented software functions. Implications of this peculiarity appear all over this thesis.

Structure

Put simply, this thesis purports to assess tools to stimulate SII. To assess them, one needs to identify criteria. This endeavour's criteria are pragmatism—based on TRIPS—and consequentiality—predicated on the potential of these tools to kindle SII. Since the patent system actually exists for the purpose of stimulating the creation and dissemination of new technology, its current rationale is used to build the consequentialist criterion. Once these two criteria expounded, a number of tools are discussed.

This undertaking is divided into three chapters. In Chapter 1, we reach the conclusion that the current international IP superstructure, consisting foremost of TRIPS, allows WTO Members to exclude computer programs from patent-eligibility. Following this analysis, Canadian legislation and case decisions with respect to computer programs' patent-eligibility are examined. Even if the fence of computer programs' patentability is straddled, patents are one of the tools in the toolkit of means available to kindle SII, and examining the Canadian situation shows its full complexity. Though Canadian case law, mainly composed of the *Schlumberger*[33] and *Amazon.com* decisions, shows a strong slant in favour of computer programs' patentability, these decisions contain some blanks and interpretational inconsistencies that leave the issue still to be debated and refined. In others words, the tool needs to be sharpened. This analysis is not only an end in itself, but a means for the rest of this undertaking: the concepts discussed in the analysis of computer programs' patent-eligibility in Canada, primarily disembodiment, are revisited in the next two chapters.

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[33] *Schlumberger Ltd v Canada (Patent Commissioner)*, (1981), [1982] 1 FC 845, 56 CPR (2d) 204 (Fed CA), Pratte J [*Schlumberger*].

Following this review of computer programs' patent-eligibility in Canada, we move to a similar exercise in U.S. law, but for a completely different objective: instead of studying U.S. patent law in itself, it is used to extract the patent rationale's imperatives for barring patentability of abstract subject matter, the most important concept in the issue of computer programs' patent-eligibility. This way, four meaningful aspects are identified: pre-emption, the building-block structure of the inventive process, the risks posed by patent thickets and disembodiment. Their specific effects are then discussed in relation with software technology and, relying on this discussion, standards of computer programs' patent-eligibility are perused as an instantiation of the consequentialist analysis.

In Chapter 3, we take a closer look at some of the other means stimulating SII found in the toolbox while straddling the fence, and they are examined pragmatically and consequentially. These instruments are reverse-engineering, path dependency, covenants not to compete, network configuration, patent-related arrangements and their control, and competition between F/OSS and the exclusionary scheme to SII. On the pragmatic point, TRIPS' analysis is resumed. Though TRIPS is silent on computer programs' patent-eligibility, patent systems and other tools stimulating SII must still comply with TRIPS' minimum standards which, among other things, provide that the availability and enjoyability of patents cannot be treated—positively or negatively—in a discriminatory manner as to the field of technology. Other TRIPS provisions, notably those regarding copyright, the protection of undisclosed information and control of anti-competitive practices in contractual licenses, are also considered because of their potential effects on measures stimulating SII. Regarding these instruments' consequential benefits, they are explored in relation with how they serve the same objectives as the patent rationale, particularly by analysing their implications with imperatives elaborated in Chapter 2 in the context of software technology.

Chapter 1

De-Abstracting Computer Programs' Patent-Eligibility

In Canadian principles of statute interpretation, international norms are widely recognised as "relevant sources for interpreting rights domestically".[34] Still, with respect to IP law, the Supreme Court of Canada has strongly recognised in the field of copyright,[35] and implicitly in the case of patents,[36] that Canadian law should not be interpreted in isolation but rather, unless the circumstances do not allow it, in harmony with "like-minded jurisdictions".[37] In the context of TRIPS, for which violation of the provisions can lead to retaliatory measures from Canada's commercial partners, circumscribing the meaning of these international obligations takes an additional importance. Indeed, this is not to suggest that TRIPS' text has substantive implications in Canadian law but merely, as stated above, that it acts as a source "for interpreting rights domestically". As it shall be concluded, it appears that[38] TRIPS does not require WTO Members to provide patent protection for computer programs. The reasoning herein should be stored in mind because it is revisited in the more extensive review of TRIPS that follows in Chapter 3.

As a consequence of this TRIPS analysis, to determine patent-eligibility of computer programs in Canada, little attention needs to be paid to the international

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34 *R v Sharpe*, [2001] 1 SCR 45 at para 175, McLachlin CJC.

35 *Théberge v Galerie d'Art du Petit Champlain inc*, [2002] 2 SCR 336 at para 6, Binnie J [*Théberge*].

36 See the strong dissidence of Binnie J. in *Harvard College v Canada (Commissioner of Patents)*, [2002] 4 SCR 45 at paras 12-13 [*Harvard College*]. Also, in *Monsanto Canada Inc v Schmeiser*, [2004] 1 SCR 902 at 137, Arbour J., in the concurring section of her reasons, relies on TRIPS' paragraph 27.3(b) to confirm her interpretative conclusion regarding the patentability of a process of creating a transgenic cell culture.

37 *Harvard College*, *ibid*.

38 As the issue has never been discussed within the WTO Dispute Settlement Mechanism, it would be imprudent to infer herein a firm conclusion on the question of computer programs' patentability within TRIPS.

IP law superstructure. The doctrinal enquiry, then, should focus on construction of the *Patent Act*[39] and examination of Canadian case law. In fact, most of the controversy in Canada rests upon the statutory definition of the word *invention*, a word that is left undefined within TRIPS. Any idea of *abstract subject matter*, the other contentious concept, shares the same fate. Patents being a preeminent tool for stimulating SII, studying computer programs' patent-eligibility in Canada is a first step in reviewing the toolkit.

Despite expectations that the *Amazon.com* decision by the Federal Court of Appeal in 2011 would clarify the controversy of computer programs' patent-eligibility, observers would be well-advised to hold their horses before concluding that the debate is now resolved. Inconsistencies in the principles used in the *Amazon.com* decision and in earlier case law it relies on render the arguments expressed in it shaky and open to later refining. As well, its commentary regarding the exclusion of abstract subject matter recognises the... *abstraction* of its application! and thus shrewdly refers back to the seminal *Schlumberger* decision to resolve the case. This exercise shows the difficulty of defining an appropriate scope for patent-eligibility. It suggests that this tool is one difficult to sharpen at an appropriate acuteness. At the end of the day, *Schlumberger*, standing in three pages of concise and limpid text, might well remain the wisest available decision in Canada on computer programs' patent-eligibility. Thirty years later, it still stands out as the case most consistent with the text of the *Patent Act* and with teachings of the Supreme Court of Canada. *If it ain't broke, don't fix it*?

[39] *Patent Act*, *supra* note 10.

1.1. Computer Programs' Patentability within TRIPS' Structure

1.1.1. TRIPS as a Superstructure

International intellectual protection treaties first emerged at the end of the nineteenth century as a response to the growing threat of spying on foreign competitors' inventions presented in international fairs and expositions.[40] These major events brought together industrialists' and inventors' latest knowledge and inventions in times when transportation and communication means did not permit frequent contacts between like-minded spirits scattered around the world. As patent protection followed different rules in different jurisdictions, those rules often favouring nationals, a growing number of inventors feared the potential for their foreign competitors to copy the inventions they disclosed in these events. For instance, Country B could have had rules for novelty[41] that required prior art to have been published within the territory of Country B. Should Inventor X from Country A present an invention (unpatented in Country B) in an exposition, Inventor Y from Country B examining the invention and understanding its mechanism could submit it to Country B's patent office and obtain a patent for it, thus precluding Inventor X from exploiting his own invention in Country B. This fictitious instance is but only one example of rules that could favour domestic inventors.

Therefore, following threats of American inventors not to participate to the 1873 Vienna Fair, western states initiated discussions that would eventually lead to the *Paris Convention* of 1883.[42] For patents, the purpose of this treaty was not to harmonise practices between jurisdictions or to introduce minimum standards, but to grant national treatment to inventors: national legislation would not

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40 Pires de Carvalho, *supra* note 8 at para 2.3.

41 For an abridged summary of the novelty requirement for patentability, see generally Subsection 1.2.1 below.

42 *Paris Convention for the Protection of Industrial Property*, 20 March 1883, 828 UNTS 305.

discriminate between domestic or foreign patent applicants.[43] At that time, Switzerland had not yet instituted a patent system, and the Netherlands had abolished theirs,[44] so a treaty integrating minimum standards of protection in lieu of or in addition to national treatment would not have allowed these two countries to join in.

The *Paris Convention* was soon integrated within the broader *Bureaux Internationaux Réunis pour la Protection de la Propriété Intellectuelle* ("BIRPI"), an organisation whose role was to supervise the *Paris Convention* and its equivalent counterpart for copyright, the *Berne Convention*[45]. Both agreements were supplemented at numerous occasions; in the case of the *Paris Convention*, the 1967 Stockholm revision constitutes the latest version.[46] At the same time that this version was adopted, the World Intellectual Property Organisation ("WIPO") was founded.[47] This new organisation would administer these and other IP-related treaties within the United Nations framework in replacement of BIRPI.

Meanwhile, following the Bretton Woods conference of 1944 that led to the World Bank and the International Monetary Fund, discussions were taking place to institute a third organisation, the International Trade Organisation, also known under the label *Havana Charter*.[48] Despite failing to create this third organisation due to the refusal by the United States Congress to ratify the *Havana Charter*, a certain number of states decided to "extract" from it substantive provisions and entered into an agreement among themselves that would be called the *General Agreement on Tariffs and Trade* (the "GATT").[49] As no organisation *per se* had

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43 Pires de Carvalho, *supra* note 8 at para 2.4. See *supra* note 19 at art 2.

44 Eric Schiff, *Industrialization without National Patents: The Netherlands, 1869-1912; Switzerland, 1850-1907* (Princeton: Princeton University Press, 1971) at 21, 85.

45 *Berne Convention for the Protection of Literary and Artistic Works*, 9 September 1886, 828 UNTS 221.

46 *Paris Convention*, *supra* note 19.

47 *Convention Establishing the World Intellectual Property Organization*, 14 July 1967, 828 UNTS 3. Why people generally say "WIPO" instead of "the WIPO" eludes me.

48 Peter Drahos & John Braithwaite, *Information Feudalism* (London: Earthscan, 2002) at 108.

49 *General Agreement on Tariffs and Trade*, 30 October 1947, 58 UNTS 187 (entered into force 1 January 1948). As our historical review implies, the GATT remains applicable today as part of the WTO framework. See Geneviève Dufour & Nicolette Kost De Sèvres, *Droit*

been created, members of the GATT referred to themselves as "Contracting Parties".[50] The GATT's purpose was and still is to reduce barriers and restrictions pertaining to trade on goods[51] and some incidental aspects. In the next decades, GATT Contracting Parties entered into rounds of negotiations to further reduce barriers to trade on goods and increase Contracting Parties' commitments.[52] As a customary practice, the discussions' content always had to be agreed upon consensually to be adopted.

In the 1980s, tensions grew among WIPO members regarding the lack of minimum standards in many Members' IP legislation and frustrations resulting from "free riding" practices.[53] As the *Paris Convention* provided only for national treatment, a Member could adopt low standards of protection (or absence thereof) allowing a third party to use an invention without obtaining a license from the inventor, paying a satisfactory compensation or risking infringement threats as long as these low standards (or absence thereof) of patent protection equally applied to domestic inventors. These free riding practices were particularly complained of by patent-holders for pharmaceutical products, which many countries expressly excluded from patent-eligibility or for which non-voluntary licenses were widely granted. Attempts to resolve these issues within WIPO by negotiating new substantive terms failed in 1986 due to disagreements between developed and developing countries and because a more expansive language would not prevent free riding occurring in countries not parties to WIPO, notably India.[54]

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international économique: Notes et documents (Montréal: LexisNexis, 2008) at 8-9 for a better understanding of the current legal position of the GATT adopted in 1947 and its homonymous but separate counterpart adopted in 1994.

50 Drahos & Braithwaite, *supra* note 48 at 108.

51 See particularly Articles I, III and XI.1.

52 The Tokyo Round probably being the most remembered prior to the Uruguay Round because of its high success in reducing the importing tariffs of major developed Contracting Parties. See Drahos & Braithwaite, *supra* note 48 at 108-09.

53 Pires de Carvalho, *supra* note 8 at 2.14.

54 *Ibid*.

Developed countries, however, began to approach the issue from a new angle: as a trade-off of minimum standards of IP protection by developing countries for market access in developed countries for agricultural goods.[55] To achieve this objective, developed countries had to switch the negotiating forum for IP protection from WIPO to the GATT. A new round of negotiations was set to begin in 1986, and developed GATT Contracting Parties pushed for some discussions in the Uruguay Round regarding "trade-related aspects of intellectual property rights, including trade in counterfeit goods" to be included:

> In order to reduce the distortions and impediments to international trade, and taking into account the need to promote effective and adequate protection of intellectual property rights, and to ensure that measures and procedures to enforce intellectual property rights do not themselves become barriers to legitimate trade, the negotiations shall aim to clarify GATT provisions and elaborate as appropriate new rules and disciplines.
>
> Negotiations shall aim to develop a multilateral framework of principles, rules and disciplines dealing with international trade in counterfeit goods, taking into account work already undertaken in the GATT.[56]

The Uruguay Round negotiations ended with the Marrakesh Agreement, which incorporated the GATT and adopted multiple new multilateral trade agreements within a new organisation, the WTO.[57] One of the new agreements negotiated during the Uruguay Round and incorporated into the WTO is TRIPS, which created, as flimsily envisioned in the Punta Del Este Declaration, "new rules and disciplines." TRIPS' preamble elaborates on its objectives: "[d]esiring to reduce distortions and impediments to international trade, and taking into account the need to promote effective and adequate protection of intellectual

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55 *Ibid*.

56 GATT, *Punta del Este Declaration*, *Ministerial Declaration on the Uruguay Round*, MIN.DEC, 20 September 1986.

57 *Agreement Establishing the World Trade Organization*, 15 April 1994, 1869 UNTS 154, WTO.

property rights, and to ensure that measures and procedures to enforce intellectual property rights do not themselves become barriers to legitimate trade".[58]

In addition to sector-specific provisions, TRIPS contains articles that apply equally to all sectors of IP, three of which stand out for this enquiry. First, Article 2.1 incorporates some articles of the *Paris Convention* into TRIPS. This inclusion applies equally to WIPO Members and non-WIPO Members. Second, Article 3 provides national treatment between WTO Members. However, this requirement differs in two ways from the *Paris Convention*'s national treatment: (i) Members must provide *no less favourable* treatment to nationals of other Members, which means that Members may provide less protection for their nationals than for foreigners; and (ii) unlike in the *Paris Convention*, national treatment is not sufficient to comply with TRIPS, for the latter includes minimum standards that Members are compelled to give effect to in accordance with Article 1. Third, Article 4 requires that "any advantage, favour, privilege or immunity granted by a Member to the nationals of any other country shall be accorded immediately and unconditionally to the nationals of all other Members." This principle, called the most-favoured nation "MFN" treatment, takes particular significance in the context of bilateral and plurilateral trade agreements.[59]

As of 2 March, 2013, the WTO counted 159 members, including *inter alia* Argentina, Australia, Brazil, Canada, China, the European Union, Hong Kong (China), India, Japan, Mexico, Norway, Russia, South Africa, Switzerland, the United Kingdom and the United States.[60] In 2001, a new round of negotiations was launched, the Doha Development Agenda ("DDA"), initially planned to be

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58 TRIPS, *supra* note 11, Preamble. For more detailed information on the specific negotiations during the Uruguay Round that led to TRIPS, see Daniel Gervais, *The TRIPS Agreement: Drafting History and Analysis*, 4th ed (London: Sweet and Maxwell, 2012), Part One. For a very critical account of these negotiations, see Drahos & Braithwaite *supra* note 48.

59 See the Conclusion below.

60 Understanding the WTO: the Organization: Members and Observers, online: WTO <http://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm>.

concluded by 1 January 2005.[61] As of this date, DDA negotiations are still under progress, and pundits do not expect them to be completed anytime soon.

1.1.2. Implementing and Giving Effect to "Invention": Articles 27.1 and 1.1

TRIPS' Article 1.1 enunciates one of the agreement's core principles: "Members shall give effect to the provisions of this Agreement. [...] Members shall be free to determine the appropriate method of implementing the provisions of this Agreement within their own legal system and practice." Generally speaking, in public international law, two different approaches are used to implement an international agreement in national law: a Monistic approach, that directly incorporates the agreement into national law—and makes its language substantive—as the Member ratifies it, and a Dualist approach, by which the member to an agreement has to adopt its own legal means in order to give effect to the agreement.[62] As the first sentence of Article 1.1 clearly expresses, a Monistic approach is not required to comply with TRIPS. More interesting, though, is the wording of Article 1.1's last sentence: it does not require TRIPS to be implemented by national legislation, but merely within Members' own legal system and practice.

In one of the first TRIPS cases to be disputed within the WTO Dispute Settlement Mechanism, the Appellate Body provided an indication of these terms' meaning:

> Members, therefore, are free to determine how best to meet their obligations under the TRIPS Agreement within the context of their own legal systems. And, as a Member, India is 'free to determine the appropriate method of implementing' its

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[61] The Doha Declaration Explained, online: WTO <http://www.wto.org/english/tratop_e/dda_e/dohaexplained_e.htm>.

[62] Jason Taketa, "Notes: The Future of Business Methods Software Patents in the International Intellectual Property System" (2002) 75 S Cal L Rev 943 at 960-61.

> obligations under the TRIPS Agreement within the context of its own legal system.[63]

One of the drafters' impetuses to keep this open language was to accommodate the two major legal systems worldwide: civil law and common law.[64] Legislation, regulations, case law, executive or administrative decisions, and other practices are all available and sufficient means of giving effect to TRIPS, inasmuch as they provide a degree of certainty.[65] The context of the word *practice* is even more noteworthy. According to Nuno Pires de Carvalho, it "refers to practical options or solutions that may be adopted by WTO Members in view of the lack of explicit rules in the TRIPS Agreement."[66] These options and solutions, continues Pires de Carvalho, extend to defining terms left undefined in TRIPS on the basis of some form of legal practice.[67] Pertinent examples include concepts like *novelty*, *non-obviousness* or, pointedly for this examination, *invention*. This approach coheres with the aforementioned WTO interpretation given to TRIPS' Article 1.1.

Additionally, paragraph 31.3(b) of the *Vienna Convention on the Law of Treaties* expresses that "any subsequent *practice* in the application of the treaty which establishes the agreement of the parties regarding its interpretation" shall be taken into account in interpreting a treaty.[68] The *Vienna Convention*'s guidelines are widely used by WTO panels and the Appellate Body to interpret TRIPS' terms.[69] So far, most national patent systems require some form of test grounded in the definition of the word *invention* to determine patent-eligibility. Such a *practice* (*Vienna Convention*), therefore adds interpretative force to the

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63 *India—Patent Protection for Pharmaceutical and Agricultural Chemical Products (Complaint by the United States)* (1997) WTO Doc WT/DS50/AB/R at para 59 (Appellate Body Report), online: WTO <http://docsonline.wto.org>.

64 Gervais, *supra* note 58 at paras 2.24-2.25; Pires de Carvalho, *supra* note 8 at para 1.6.

65 Pires de Carvalho, *ibid* at para 1.13.

66 *Ibid* at para 1.8.

67 *Ibid*.

68 *Vienna Convention on the Law of Treaties*, done at Vienna, 23 May 1969, 1155 UNTS 331 [emphasis added—*practice* here does not share the same meaning as in TRIPS, and so it is preferable to point it out] [*Vienna Convention*].

69 See, e.g., *Canada—Term of Patent Protection (Complaint by the United States)* (2000) WTO Doc WT/DS170/AB/R at para 53 (Appellate Body Report), online: WTO <http://docsonline.wto.org> [*Canada—Term of Patent Protection*].

construction of TRIPS to the effect that Members are free to define some terms by reliance on their legal *practice* (TRIPS). This understanding of Article 1.1, fully consistent with the letter and spirit of TRIPS and public international law, is particularly relevant to Canada because the *Patent Act* and its related case law do circumscribe what counts as an *invention*.

Nonetheless, before addressing that, the next task in this undertaking is to verify whether TRIPS defines what an invention is in a way that would limit Members' freedom to define it by their practice. For instance, should TRIPS define *invention* as encompassing some specific elements, a list that would include computer programs, any method of implementing TRIPS in a Member's law not rendering computer programs patent-eligible would contravene TRIPS. Anyhow, as it is, TRIPS does not elaborate on the notion of invention. TRIPS' Article 27.1, which many consider the core provision and main purpose of the whole agreement,[70] enunciates what constitutes patentable subject matter:

> Subject to the provisions of paragraphs 2 and 3, patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application.[5] Subject to paragraph 4 of Article 65, paragraph 8 of Article 70 and paragraph 3 of this Article, patents shall be available and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced.
>
> [5] For the purposes of this Article, the terms 'inventive step' and 'capable of industrial application' may be deemed by a Member to be synonymous with the terms 'non-obvious' and 'useful' respectively.

Paragraphs 2 and 3 are briefly reviewed below. Paragraph 1 lists four elements to determine patentability: a (i) new (ii) invention (iii) involving an inventive step—non-obviousness—and (iv) capable of industrial application—useful. It also states one basic rule: non-discrimination for the availability and enjoyability of

[70] Among others, Pires de Carvalho, *supra* note 8 at para 27.1.

patents, whether as to the place of invention, the field of technology or the location of production. As it stands, however, the only indication stemming from this article to determine what is an invention is that it must include processes and products. One should note, however, that TRIPS provisions constitute only minimum standards.[71] Consequently, Members are free to grant patents for non-inventive subject matter, such as paintings, mathematical concepts *per se* or master's theses discussing computer programs' patentability.

Bringing in the discussion on TRIPS' Article 1.1, and provided it is not eventually impugned by a Panel or the Appellate Body of the WTO, Members would be free to define *invention* by their legal practice. Two common practices, both present in Canada, are to exclude abstract subject matter from the scope of *invention* or to define *invention* by reference to an exhaustive list of elements.[72] Depending on a Member's legal practice to circumscribe *invention*, computer programs could be excluded from patent-eligibility without this situation resulting in a violation of TRIPS. Unlike other doctrinal arguments encountered on this issue, some of which are tackled below, this one is convincing. It is implied in Pires de Carvalho's book, although he recommends that Members extend patent protection or a *sui generis* protection system to computer programs.[73]

Before taking a look to another reasoning expressed to exclude computer programs from patentability, it is relevant to say a few words about the patentability exclusions listed in paragraphs 2 and 3 of Article 27 of TRIPS. Among them, only one could, farfetchly, be considered relevant: the exclusion for inventions "the prevention within [a Member's] territory [...] of the commercial exploitation of which is necessary to protect *ordre public* [...] provided that such

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[71] TRIPS, *supra* note 11 at art 1.1: "Members may, but shall not be obliged to, implement in their law more extensive protection than is required by this Agreement, provided that such protection does not contravene the provisions of this Agreement." Based on the second part of this sentence in combination with the language of Articles 27.1 and 32, eliminating the requirements of novelty, non-obviousness and utility, unlike extending the reach of patent-eligible subject matter, might constitute such a contravention. See Pires de Carvalho, *supra* note 8 at para 27.49.

[72] *Patent Act*, *supra* note 10 at s 2 "invention" and para 27(8). See Subsection 1.2.1 below.

[73] Pires de Carvalho, *supra* note 8 at paras 27.36-27.37.

exclusion is not made merely because the exploitation is prohibited".[74] As Daniel Gervais points out, the use of the French expression "*ordre public*" in lieu of "public order", as was the case in earlier drafts during the Uruguay Round negotiations, is significant: it thus refers to the much broader French legal concept "whose meaning is closer to 'public policy'."[75] To illustrate the extent of this concept with which common law jurists might be less in touch, Gervais aptly refers to the fact that in the civilist tradition, the necessity of state approval to marry or divorce is often justified by *ordre public*.[76] Still, imaginative as one can be, the text of Article 27.2 is very limited, and whatever ambit is given to *ordre public*, the road sign to a public policy motive for which it is *necessary* to *prevent* the *commercial exploitation* of computer programs as a general category is missing.[77]

1.1.3. A Tenuous Reaching of Copyright: Articles 9.2 and 10.1

Moving away from TRIPS' Article 27 but staying in TRIPS territory, two copyright-based lines of reasoning have been asserted to support the excludability of computer programs from patentable subject matter. The most prevalent of these arguments is predicated on the explicit grant in TRIPS of copyright protection to

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74 TRIPS, *supra* note 11 at art 27.2.

75 Gervais, *supra* note 58 at para 2.360.

76 *Ibid*.

77 It is not by lack of trying, but a careful reading of Article 27.2 of TRIPS shows it to be a very limited exception to Article 27.1. One has to find a public policy motive to *prevent* (not *restrict*, not *limitate*, not *monitor*, but *prevent*) the *commercial exploitation* (not the *patenting*) of unwanted inventions. As most (if not all) policy makers agree that society benefits from SII, a sound view to the contrary is difficult to imagine. Besides, this is not yet sufficient: this public policy should also be *necessary*. For a Panel interpretation of the term *necessary*, see, e.g., *European Communities—Protection of Trademarks and Geographical Indications for Agricultural Products and Foodstuffs (Complaint by the United States)* (2005), WTO Doc WT/DS174/R at paras 7.298-7.300 (Panel Report), online: WTO <http://docsonline.wto.org>. At best, one can imagine some specific computer programs to be excluded (e.g., computer programs which primary purpose is the dissemination of viruses or with a primary military purpose), but not computer programs as a general category. (As we are discussing an agreement that is part of the World *Trade* Organisation, one can skip outright the possible view that *commercial* exploitation of computer programs is undesirable.) For a detailed analysis of the wording of this provision, see Carlos M Correa, *Trade Related Aspects of Intellectual Property Rights: A Commentary on the TRIPS Agreement* (New York: Oxford University Press, 2007) at 290-91.

computer programs.[78] This argument is located in TRIPS' Article 10.1: "Computer programs, whether in source or object code, shall be protected as literary works under the Berne Convention (1971)." Despite the obvious theoretical issues that may be raised by the double protection—triple, when adding the wide use of licensing agreements in the software industry[79]—of computer programs, some of which are discussed herein, there is no legal reasoning that would permit not granting patent protection to a subject matter on the ground that it is also protected under another IP regime. Nowhere is it stated in TRIPS or WTO case law that double protection is invalid, nor can it be supported by a principle of treaty interpretation.

Besides, supposing that this argument had legal validity, it would spread wider than the mere double protection of computer programs by copyright and patents. For instance, to mention only one extension of this reasoning, it would also imply that because figurative elements "capable of distinguishing the goods or services of one undertaking from those of other undertakings" are protectable trademark subject matter under TRIPS,[80] a Member would not be required to provide copyright protection for such figurative designs. The reason why points similar to the one presented herein have not been encountered is that their underlying principle about double protection does not stand on any legal grounding.

Moreover, Pires de Carvalho adds a layer to this reasoning: not only would it legally justify Members not to extend patent protection to computer programs, he surmises that an argument could also be built to preclude it.[81] This inference is based on a joint reading of Article 10.1 of TRIPS with Article 9.2, which specifies that "[c]opyright protection shall extend to expressions and not to ideas, procedures, methods of operation or mathematical concepts as such." Read

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[78] See, e.g., Taketa, *supra* note 62 at 966 and Pires de Carvalho, *supra* note 8 at para 27.37. At 267, n 613, Pires de Carvalho also mentions that this view was supported by Brazil in the review of its TRIPS implementation by the TRIPS Council.

[79] Phillips, *supra* note 15 at xii.

[80] TRIPS, *supra* note 11 at art 15.1.

[81] Pires de Carvalho, *supra* note 8 at para 27.38.

together, Pires de Carvalho suggests, these two articles "seem to indicate that computer programs are, as a matter of law, deemed to be expressions, and therefore they may not be perceived as ideas. It follows that, if computer programs are not ideas, but rather expressions, they may not be considered to be inventions."[82] It is not explained here why expressions, *per se*, could not be considered to be inventions, so it is preferable not to elaborate on this hole. On the other side of the statement, it is implied that computer programs could only be patentable if deemed as ideas. Yet, it is exactly because of this idea attribute that some advocate against their patent-eligibility under the exclusion of abstract subject matter.[83] Moreover, the argument being put forward shows a misunderstanding of copyright principles.

Imagine a work typically protected by copyright: novels. What TRIPS' Article 9.2 instructs is that for novels, only the expression of the story is protected by copyright. This is often referred to as the idea/expression dichotomy. The text of the novel is protected, but the idea behind it is not. Importantly, it does not suggest that the novel does not contain an idea, but that the protection granted by copyright does not extend to the novel's underlying idea.[84] The same analysis applies to computer programs: the joint reading of Articles 9.2 and 10.1 of TRIPS does not mean that computer programs are only constituted of *expression*, but that the copyright protection shall not extend "to ideas, procedures, methods of operation or mathematical concepts" that may be used in the computer program. No mutual exclusivity can be deemed from a combined reading of these articles; computer programs involve both idea—and possibly more elements listed in Article 9.2—and expression, but only the latter is protected. Ultimately, this argument, to be binding, relies on a prior contention that the extension of copyright protection to computer programs is a sufficient claim to exclude

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82 *Ibid*.

83 According to Brett M Frischmann, *Infrastructure: The Social Value of Shared Resources* (New York: Oxford University Press, 2012) at 291, 295-301, the objective in both copyright and patent law is to leave the building blocks of the intellectual infrastructure, ideas, in the commons—i.e., the public domain—while allowing appropriation of ideas' creative expression or inventive implementation.

84 The same reasoning applies *mutatis mutandis* to patents; see *ibid*.

computer programs from patent protection. This line of reasoning, as discussed above, has no legal or interpretative grounding.

Despite the rejection of the arguments relying on *ordre public* or copyright protection to allow Members to exclude computer programs from patent-eligibility, the same conclusion is still reached through Members' freedom to rely on their legal practice to implement concepts that are left undefined in TRIPS. This way, WTO Members can each decide whether or not to grant patents for computer programs in their jurisdiction. This TRIPS analysis is resumed in Chapter 3 to examine pragmatically the constraints that TRIPS imposes on Members choosing to allow patents for computer programs in their national practice. For now, the next step is to review, as an illustrative examination of patents as a tool to stimulate SII, how this freedom to implement TRIPS is exercised in Canadian law.

1.2. Computer Programs as Patent-Eligible Subject Matter in Canada

1.2.1. Patent-Eligibility Subject Matter: Sections 2 and 27(8)

In Canada, the legislative process to determine the grant of patents is quite straightforward. It begins with Subsection 27(1) of the *Patent Act*, which provides that a patent shall be granted "for an invention [...] if an application for the patent in Canada is filed in accordance with this Act and all other requirements for the issuance of a patent under this Act are met." (For this analysis, it is best to ignore non-substantive elements in accordance with which a patent must be filed, such as fees and delays.) The term *invention* here leads to its definition in Section 2 as "any new and useful art, process, machine, manufacture or composition of matter, or any new and useful improvement in any art, process, machine, manufacture or composition of matter". To meet the novelty requirement set out in the definition,

the patent application must respect Section 28.2 which, as a general rule,[85] expresses that the subject matter of a patent claim "must not have been disclosed [...] more than a year before the filing date by the applicant". Usefulness is not defined in the *Patent Act*, but jurisprudence has developed the concept in a two-prong requirement: the invention must function as disclosed, and it must have some commercial use.[86] Moreover, judges had historically taken into consideration a criterion of non-obviousness, eventually incorporated legislatively as Section 28.3: the subject matter of a patent claim must not be obvious "to a person skilled in the art or science to which it pertains".[87] Finally, Subsection 27(8) states that "[n]o patent shall be granted for any mere scientific principle or abstract theorem."

Despite the clearly settled differences between the majority and the dissent of the Supreme Court in the *Harvard College* decision, both camps agree on two basic qualities of the statutory definition of *invention*: it is expansive, yet exhaustive. The *expansive* characteristic of this definition is inferred by the broad nature of its elements, the use of the word *any* and the inherent mechanism of patent law—granting exclusivity over the use of new and useful inventions—which should be able to protect new and unforeseen technologies.[88] Despite this expansiveness, the list is closed to five elements; it is thus exhaustive, and any patentable subject matter must fit within one of these five broad elements.[89] It is undebated that only two of the five elements pertain to our computer programs' patent-eligibility: *process* and *art*. These notions are further examined in the next subsection.

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85 For purposes of clarity and simplicity, it is better not to expand on this subset of rules and refer the reader interested in a more detailed analysis to Sections 28.1 and 28.2 and to *Apotex Inc v Sanofi-Synthelabo Canada Inc*, [2008] 3 SCR 265 at paras 24-37, Rothstein J [*Sanofi-Synthelabo*].

86 Daniel J Gervais & Elizabeth F Judge, *Intellectual Property: The Law in Canada*, 2d ed (Toronto: Carswell, 2011) at 724; see also *Wellcome Foundation*, *supra* note 5 at paras 55-70.

87 The date at which such an analysis must be conducted is the claim date, which is, as a general rule, the date the patent was filed: *Patent Act*, *supra* note 10 at s 28.1. For more detailed information on non-obviousness, the reader is directed to *Sanofi-Synthelabo*, *supra* note 85 at paras 61-71.

88 *Harvard College*, *supra* note 36 at paras 158 for the majority, 10 and 43 for the dissent.

89 *Ibid* at paras 158 for the majority, 42 for the dissent.

In *Amazon.com*, Justice Sharlow for the Court divides the analysis for patentable subject matter into five components: (i) inclusion into one of the taxonomies of Section 2's definition of *invention*; (ii) novelty; (iii) usefulness; (iv) non-obviousness; and (v) not a mere scientific principle or abstract theorem.[90] However, the separation of conditions (i) and (v) should merge as one condition of *patent-eligible subject matter*. The two provisions involved need to be read together to be given their proper meaning. In fact, it is precisely through this merged method that the Supreme Court has instructed to interpret the elements constituting the definition of *invention*:

> [T]he generality of the meaning of the word 'art' in the definition of 'invention' was effectively circumscribed, not only by s. 28(3) [of the then *Patent Act*, now Subsection 27(8)] but also by other statutes such as the *Design Act* and the *Copyright Act*. This principle obviously applies equally to the construction of the word 'process' with which we are concerned in this case.[91]

Relying on the insightful instructions of Justice Pigeon, criteria (i) and (v) of *Amazon.com*'s analysis of conditions for patentability are herein unified. This is what *patent-eligibility* refers to. The attempt in the *Amazon.com* decision to arrive at an appropriate interpretation of *art* could have been more fruitful if the condition for patent-eligibility subject matter had been approached holistically.

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90 *Amazon.com*, *supra* note 27 at para 38.

91 *Tennessee Eastman Co et al v Commissioner of Patents*, [1974] 1 SCR 111 at 116-17, Pigeon J [*Tennessee Eastman*]. At p. 117, Justice Pigeon repeats this method: "Just as in the case of 'art', the scope of the word 'process' in s. 2(*d*) is somewhat circumscribed by the provision of s. 28(3) excluding a 'mere scientific principle or abstract theorem'."

1.2.2. "Art": From Chemical Compounds to One-Click, But, Whew, no Jackson Pollock

In *Amazon.com*, the analysis pertaining to whether the one-click process[92] is patentable subject matter mostly revolved around what constitutes *art* under the *Patent Act*'s definition of *invention*. On this issue, the Federal Court of Appeal substantively approved the Federal Court's decision,[93] which itself discusses and derives its conclusion from two prior decisions, respectively by the Supreme Court and the Federal Court, elaborating on the notion of *art*: *Shell Oil*[94] and *Lawson*.[95]

The *Amazon.com* case has a long history.[96] In 1998, Amazon.com applied for a patent in Canada over the one-click process. Finding the invention's claims to be obvious and constituting ineligible subject matter as they cover a business method, the patent examiner rejected the application.[97] On appeal, the Patent Appeal Board found that the patent examiner had erred in finding the patent obvious, but maintained the conclusion that business methods were ineligible as subject matter.[98] On revision by the Federal Court, Justice Phelan overturned the Patent Appeal Board's decision, found the one-click process to be patent-eligible

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92 For a reminder to the reader of what is this process, see the Introduction above, *Computer Program Patents and the Patent Rationale* and the patent's specification and claims, *supra* note 26.

93 *Amazon.com, Inc v Canada (Attorney General)*, 2010 FC 1011, Phelan J [*Amazon.com/Phelan*]. See *Amazon.com*, *supra* note 27 at para 50 for the approval.

94 *Shell Oil Co v Commissioner of Patents*, [1982] 2 SCR 536, Wilson J [*Shell Oil*].

95 *Lawson v Canada (Commissioner of Patents)* (1970) 62 CPR 101, Cattanach J [*Lawson*].

96 See Haewon Chung, "Lessons from Bilski" 9 CJLT 179 at 197-201 for a detailed account of the pre-Federal Court proceedings in this case, both in Canada and in the United States.

97 *Ibid* at 198. The patent-eligibility of business methods is as hotly debated, if not more, as the patent-eligibility of computer programs. The two issues are closely related because, just like the *Amazon.com* case exemplifies, a computer program can be assimilated to a business method. More importantly, many business methods patents are implemented in computer programs. Yet, this thesis' approach eschews the need to explore the business method controversy: the issue of computer programs' patentability is merely straddled. This method aims at understanding patent-eligibility irrespectively of the technological field at issue by examining the meaning of *art* in the *Patent Act*.

98 *Re Kaphan Patent Application No 2,246,933*, 2009 LNCPAT 2 (QL), 75 CPR (4th) 85.

subject matter as *art*, and decided the patent should be granted.[99] The Federal Court of Appeal mainly upheld the Federal's Court interpretation of *art*, but overturned the patent grant, finding it preferable for the Commissioner of Patents, in light of the Court's legal interpretation of *art*, to review if the claims constituted patent-eligible subject matter.[100] The Commissioner of Patents issued the patent on 23 December, 2011.[101]

Linguistically, it appears bizarre that the patent-eligibility of a patent granted over a process was debated through the idea of *art* instead of *process*. This oddity is a direct consequence of the Commissioner's decision, which did not review the notion of *process*.[102] Nor did Justice Phelan's; relying on *Lawson* and *Refrigerating Equipment*[103] he posited that "[i]t is generally accepted that 'method' and 'process' are the same thing and that 'art' may include either".[104] The path to the next step of his enquiry was already traced: what is *art*? His findings on this issue are predominantly predicated on *Shell Oil*'s interpretation of it,[105] which is explored below. He also rejects *Lawson*'s particular interpretation of *art*, which involves "an act or series of acts performed by some physical agent upon some physical object and producing in such object some change either of character or of condition",[106] finding it too limited to be reconcilable with the wide interpretation

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99 *Amazon.com/Phelan*, *supra* note 93.

100 *Amazon.com*, *supra* note 27.

101 *Supra*, note 26.

102 *Amazon.com/Phelan*, *supra* note 93 at para 48.

103 *Refrigerating Equipment Ltd v Drummond & Waltham System Inc*, [1930] 4 DLR 926 [*Refrigerating Equipment*].

104 *Amazon.com/Phelan*, *supra* note 93 at para 48. The original citation from *Refrigerating Equipment*, *ibid* at 937 reads as follows: "The Patent Act recognizes a method or process as having the same title to protection as a machine or article of manufacture; I conceive method and process to be one and the same thing, but in any event that 'art' may include a method or process patent is well settled." The decision then discusses in what circumstances the case's patented invention could be considered a machine or a manufacture. It is agreed that *method* and *process* are the same. However, there is a difference between saying that art 'may include a [particular] method or process patent', the statement in *Refrigerating Equipment*, and 'art includes the categories of *method* and *process*', which is the sense that has been given to this statement. Kant would be unimpressed. Problems arising from this interpretation are discussed below.

105 *Amazon.com/Phelan*, *supra* note 93 at paras 49-50, 52.

106 *Lawson*, *supra* note 95 at 109-10.

effected by the Supreme Court in *Shell Oil*.[107] Noting rightly that despite this passage of *Lawson* being cited in *Shell Oil*, Justice Wilson refers to it neutrally, not as a support nor as a rejection of its substantive content, he declares Justice Cattanach's statement as non-authoritative.[108] As a result, patent-eligibility of the one-click process would rest entirely on *Shell Oil*'s interpretation of *art*.

In *Shell Oil*, the Supreme Court had to determine whether the application of old chemical compounds to a new use constituted patent-eligible subject matter. By concluding in the affirmative, the Supreme Court construed the term *art* widely:

> I think the word 'art' in the context of the definition must be given its general connotation of 'learning' or 'knowledge' as commonly used in expressions such as 'the state of the art' or 'the prior art'. The appellant's discovery in this case has added to the cumulative wisdom on the subject of these compounds by a recognition of their hitherto unrecognized properties and it has established the method whereby these properties may be realized through practical application. In my view, this constitutes a 'new and useful art' and the compositions are the practical embodiment of the new knowledge.
>
> If I am right that the discovery of a new use for these compounds which is capable of practical application is an "invention" within the meaning of the definition, I can find nothing in the statute which would preclude a claim for these compositions.[109]

This interpretation is erroneous, for two sets of reasons. First, it conflicts with a coherent construction of the *Patent Act*. More importantly but yet related, it clashes directly with the traditional rule in the English patent law tradition, inscribed in Subsection 27(8) of the *Patent Act*, that excludes patents for abstract subject matter.

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[107] *Amazon.com/Phelan*, *supra* note 93 at paras 49, 51-52.
[108] *Ibid* at para 51, citing *Shell Oil*, *supra* note 94 at 555.
[109] *Shell Oil*, *supra* note 94 at 549.

1.2.3. Interpreting Art

Owing to the multiplicity of methods, legal interpretation is an intricate exercise. The Supreme Court relies regularly on legal interpretation, summarising its methodology this way: "It is now trite law that the words of an Act and regulations are to be read in their entire context and in their grammatical and ordinary senses harmoniously with the scheme of the Act, the object of the Act and the intention of Parliament."[110] Often, a result depends entirely on the choice of the method of interpretation in a particular case, whether grammatical, contextual, historical or any other. Mostly grounded in Roman law, these principles were initially used in the common law tradition before their apparition in other contemporary legal systems. The common law *stare decisis* imperative led judges to repeat the same legal principles in their decisions, an iteration that elevated some of them at the level of rules of interpretation.[111] In the end, these rules and their consistent application permit coherence in the legal system.

The only reason that can be extracted from the *Shell Oil* decision to support the wide sense attributed to *art* is that it leans on the "same word, same meaning" principle: according to this rule, in patent law, *art* should always be used with the same meaning.[112] In their comments about this rule of interpretation, Professors Côté, Beaulac and Devinat qualify it as creating a "presumption of low persuasive weight", mostly due to the inconsistent quality of statute drafting, especially in bilingual statutes.[113] Commenting on the "same word, same meaning" rule of interpretation, Justice Fauteux, as he then was, declared: "This rule of interpretation is only tantamount to a presumption, and furthermore, a presumption which is not of much weight."[114] In *Shell Oil*, using this rule of

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[110] *AstraZeneca Canada Inc v Canada (Minister of Health)* [2006] 2 SCR 560 at para 26, Binnie J.

[111] Pierre André Côté, in collaboration with Stéphane Beaulac and Mathieu Devinat, *The Interpretation of Legislation in Canada*, 4th ed (Toronto: Carswell, 2011) at 36-37.

[112] Ruth Sullivan, *Sullivan on the Construction of Statutes*, 5th ed (Markham: Butterworths, 2008) at 215-16.

[113] Côté, Beaulac and Devinat, *supra* note 111 at 354.

[114] *Sommers and Gray v The Queen*, [1959] SCR 678 at 685.

statutory construction was particularly ill-advised with respect to the bilingual context of the *Patent Act*, and it should not have been retained because it directly conflicts with two other rules of statute construction.

To begin with, it conflicts with the rule of shared meaning that applies for bilingual statutes.[115] According to this principle, "[w]hen there is a discrepancy between the two versions of bilingual legislation, the meaning that is common to both ought to be adopted unless that meaning is for some reason unacceptable."[116] For instance, when trying to define *composition of matter* and *manufacture*, two other categories listed in the *Patent Act*'s definition of *invention*, the Court examined their grammatical definitions in both English and French to check that its reasoning would be consistent.[117] Again, this rule creates only a presumption and applies only if a shared meaning is available and makes sense in accordance with other relevant interpretation rules. Nonetheless, its rebuttability does not justify leaving it aside without prior analysis.

The *Patent Act* uses the word *art* in only three types of circumstances: (i) as "any [...] art"; (ii) "prior art"; and (iii) "skilled in the art".[118] In its version applicable in 1982, when the *Shell Oil* case was decided, only the same three types of uses could be found, with only one trivial difference.[119] In the French versions, these three meanings in both versions are respectively worded as (i) *toute réalisation*; (ii) *antériorité*; and (iii) *versé dans l'art ou dans la science*. One need not be bilingual to notice that a single English word equates to three

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115 Sullivan, *supra* note 112 at 100-21; Côté, Beaulac and Devinat, *supra* note 111 at 347-53. As a federal statute, the *Patent Act* is bilingual, and both versions share equal legal strength. This was also true in 1982, when the *Shell Oil* case was decided.

116 Sullivan, *ibid* at 112.

117 *Harvard College*, *supra* note 36 at paras 159, 163.

118 *Patent Act*, *supra* note 10, at ss 2, 27(3), 28.3, 34.1, 38.2(3) and 48.1.

119 *Patent Act*, RSC 1970, c P-4 at ss 2, 36(1) and 45(4). Use (iii) is worded "skilled in the art *or science*" [emphasis added]. It is worth noting that interpreting *art* as "learning or knowledge" was broad enough to fully encompass *science*—use (iii)—in its grammatical meaning and probably made these words statutorily insignificant in the version of the *Patent Act* applicable in 1982. This shows another statute construction inconsistency with the *Shell Oil* interpretation of *art*: it conflicts with the presumption against tautology. This rule is further discussed below.

different French terms, each based on the specific context of the *Patent Act*. *Réalisation* can be translated as "fulfillment, carrying out, achievement."[120] Whereas *art* as "learning or knowledge" fits for uses (ii) and (iii), it is manifestly broader than *réalisation*, and a shared meaning should at least have been attempted by the Court.

One must be careful in explaining this point. Patent law in Canada is of English heritage, and so its English-language conceptions are richer than its French equivalent. Just like *ordre public* earlier had to be given its French, civilist connotation, the meaning of the *Patent Act*'s English terms should be given prior consideration. For this reason, more important than the actual French term employed, the most interesting result of this exercise is the hint that *art* is used in at least two distinct contexts in the *Patent Act*. As later discussed, accepting this dual meaning of *art* in patent law is not only essential to make it coherent with the French version of the *Patent Act*, but with patent law and theory in general.

Moreover, *art* as "learning or knowledge" is so broad that it is understood as completely encompassing *process*, thus making this term redundant in the statutory definition of *invention*. The width of this interpretation conflicts with the presumption against tautology.[121] According to the presumption against tautology, every provision and word of a statute is presumed to be given a meaning by Parliament. When reading an enumeration of different terms that can each be given a different interpretation, the interpretation of one of these terms should not render any of the other terms useless. Their meaning can share a common ground, but they are presumed to be necessary to the statute in at least some circumstances. In fact, the Supreme Court has already relied on this rule to interpret Section 2's definition of *invention* in the *Patent Act*: "If the words

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[120] *The Oxford French-English Dictionary*, *sub verso* "réalisation", online: Oxford Dictionaries <http://oxforddictionaries.com/translate/french-english/r%C3%A9alisation?q=r%C3%A9alisation>.

[121] Sullivan, *supra* note 112 at 210-13; Côté, Beaulac and Devinat *supra* note 111 at 295-96. Côté, Beaulac and Devinat describe the rule under its French designation, "la règle de l'effet utile".

‘composition of matter’ are understood this broadly, then the other listed categories of invention, including ‘machine’ and ‘manufacture’, become redundant. This implies that ‘composition of matter’ must be limited in some way.”[122] If the Supreme Court applies this rule to circumscribe some of the statutory categories of *invention*, it cannot coherently accept another of the categories, *art*, defined as “learning and knowledge”.

Figure 1 below explains how the presumption against tautology should be applied in the case of *art* and *process*. On one hand, an interpretation tantamount to the right-hand side drawing, where all instantiations of *process* are encompassed by *art*, should be presumed invalid. On the other hand, interpretations resulting in each of these two words to be necessary in at least some cases, though possibly overlapping in some other cases, do not conflict with the presumption against tautology.

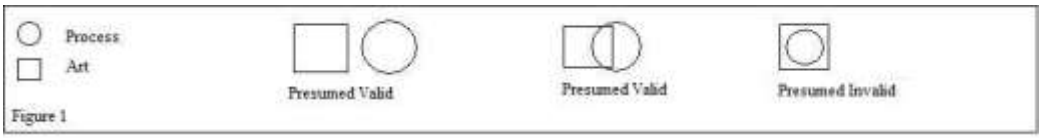

Figure 1

To be tautological ourselves, this rule of interpretation merely creates a presumption, which can be rebutted if it is shown that the statute is voluntarily redundant, or if the redundancy purports to facilitate its reading—as an effort to forestall potential misunderstandings or to avoid an absurd result.[123] Nevertheless, unless this presumption is rebutted, *art* should be re-reconceptualised in a way that gives significance to *process*. We are unaware of any explanation that has been given so far to effectively rebut this presumption as to justify rendering *process* useless.

As a result, a strong case can be made that the interpretation of *art* in the *Shell Oil* decision is inconsistent with other principles of statute construction. Any

[122] *Harvard College*, *supra* note 36 at para 160.
[123] Sullivan, *supra* note 112 at 213-14; Côté, Beaulac and Devinat, *supra* note 111 at 295-96.

person familiar with law is aware that such inconsistencies are occasionally inevitable due to the sometimes poor drafting quality of statutes; still, before rejecting these alternative rules, an attempt to find a meaning harmonious with all three principles at play should have been made. By strictly following the *Shell Oil* interpretation, the Federal Courts in the *Amazon.com* case reproduced the same inconsistencies. Unless this interpretation is eventually refined or formally defended by law or case law, it can be expected that debates over the notions of *art* and *process*—and thus of patent-eligibility of computer programs and any other type of inventive activities dependent of the definition of *art* to assess its patent-eligibility, like business methods—will continue. The best way to find this coherence is probably to inscribe *art* into its full patent theory context, in which abstract subject matter is not considered patent-eligible. *Art* as "learning or knowledge" obviously conflicts with this principle of patent theory and law. This is probably the most striking realisation, pun intended, of the *Amazon.com* decision.

1.2.4. Applying Abstraction

Had the Supreme Court followed its own guidance set forth in *Tennessee Eastman* as to circumscribing the definition of *art* with the exclusion of abstract subject matter, it would instantly have realised that interpreting *art* as "learning or knowledge" was effectively too broad, as "learning and knowledge" evidently includes scientific principles and abstract theorems.[124] Instead of defining *art* coherently with more relevant rules of interpretation and in an easily applicable manner, the Court interpreted it widely and shifted the analysis to the identification of a "practical application" of this "learning or knowledge". Thirty years later, as *Amazon.com* clearly illustrates, courts are still struggling with understanding what is a practical application and what place should it have within patent law.

[124] See note 91 above and accompanying text.

In *Shell Oil*, Justice Wilson explains that "[a] disembodied idea is not *per se* patentable. But it will be patentable if it has a method of practical application."[125] These two sentences are very difficult, probably impossible, to understand. An idea is knowledge. Knowledge, following *Shell Oil*, constitutes patentable *art*. Therefore, we must understand when applying the first of these two sentences that what makes a disembodied idea *per se* unpatentable is not that it is an idea, but that it is disembodied. This disembodiment must then be assimilated to abstract subject matter to be in line with the statutory exclusion of Subsection 27(8).

Conversely, the second sentence suggests that what embodies (de-abstracts?) an idea (art) is its incorporation in a method of practical application. The Federal Court of Appeal blatantly exposed the limitations of this "unpatentable abstract disembodied idea/patentable non-abstract practical application of an idea" dichotomy:

> [I]t is axiomatic that a business method always has or is intended to have a practical application. And in this case, the difficulty with a bare "practical application" test for distinguishing patentable from unpatentable business methods is highlighted because the particular business method—itself an abstract idea—is realized by programming it into the computer by means of a formula or algorithm, which is also an abstract idea.[126]

Plainly, should *Shell Oil*'s instructions be applied in *Amazon.com*, it is likely that it would produce the following mathematical formula: Abstract + Abstract = Non-Abstract. How could adding a layer of abstraction to something abstract de-abstract it? This interpretation is obviously difficult to defend when considering Subsection 27(8) of the *Patent Act*. Unfortunately, the Federal Court of Appeal did not try to erect a coherent solution to the problem it underscored. Instead, it simply overturned Justice Phelan's decision to grant the one-click patent and sent

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125 *Shell Oil*, *supra*, note 94 at 554.
126 *Amazon.com*, *supra* note 27 at para 61.

the application back to the Commissioner of Patents. On Justice Sharlow's order, the Commissioner had to re-examine the patent's claims using purposive construction[127] to determine whether they constitute patent-eligible subject matter in light of the Court's (insufficient, for the aforementioned reasons) legal clarifications.

The Federal Court of Appeal recommended to the Commissioner to base this re-examination by relying on the *Schlumberger* decision.[128] In *Schlumberger*, a patent application over a computer program executing mathematical operations had been rejected on the basis that the computer program merely incorporated what was non-patent-eligible—mathematical formulae.[129] Mere incorporation into a computer program had not affected the nature of the subject matter. Following *Amazon.com*'s instructions to the Commissioner, should a purposive construction of the one-click patent claims be distinguishable from *Schlumberger*, the patent could be granted; otherwise, Amazon.com's practical application of a disembodied idea should meet the same fate as Schlumberger's practical application of some mathematical formulae: rejection. Apparently, as the patent grant suggests, the Commissioner did find a distinguishing element.

1.2.5. What Place for Schlumberger Thirty Years Later?

In Canada, the *Schlumberger* decision is, in many ways, unmatched. It resolves an important and intricate legal issue: on what basis can an invention containing a computer program be patented. Unlike *Shell Oil* or *Amazon.com*, *Schlumberger* merges the analyses of Section 2 and Subsection 27(8) of the *Patent Act*, as instructed by the Supreme Court in *Tennessee Eastman*, the method

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[127] In *Free World Trust v Électro Santé Inc*, [2000] 2 SCR 1024, Binnie J at 31 [*Free World Trust*] and *Whirlpool Corp v Camco Inc*, [2000] 2 SCR 1067, Binnie J at 49-50 [*Whirlpool*], the Supreme Court confirms that a patent's claims must be interpreted using principles of purposive construction. Rules of interpretation are unavoidable in this question.

[128] *Amazon.com*, *supra* note 27 at paras 62-63.

[129] *Schlumberger*, *supra* note 33.

advocated herein. It is what distinguishes *Schlumberger* and allows it to settle this complex question with such limpidity and concision (three pages):

> As the *Patent Act* contains no provision specifying or even implying a limitation of the meaning of the word 'invention' in section 2 of the Act so as to exclude inventions involving computers, there does not exist any reason for saying that the discovery claimed by the appellant, assuming it to be new and to have required inventive ingenuity, is not a patentable invention within the meaning of section 2 of the Act.
>
> [...]
>
> If those calculations were not to be effected by computers but by men, the subject-matter of the application would clearly be mathematical formulae and a series of purely mental operations; as such, in my view, it would not be patentable. A mathematical formula must be assimilated to a 'mere scientific principle or abstract theorem' for which subsection 28(3) [now Subsection 27(8)] of the Act prescribes that 'no patent shall issue'. As to mental operations and processes, it is clear, in my view, that they are not the kind of processes that are referred to in the definition of invention in section 2. [...] If the appellant's contention were correct, it would follow that the mere fact that the use of computers is prescribed to perform the calculations prescribed in the specifications, would have the effect of transforming into patentable subject-matter what would, otherwise, be clearly not patentable. The invention of the computer would then have the unexpected result of giving a new dimension to the *Patent Act* by rendering patentable what, under the Act as enacted, was clearly not patentable. This, in my view, is unacceptable. I am of opinion that the fact that a computer is or should be used to implement discovery does not change the nature of that discovery.[130]

It is difficult to repress a smile of irony at coming back to *Schlumberger* at the end of this journey. In the last decades, this decision received two sets of direct or indirect critiques. The first is that it would supposedly have made computer programs unpatentable. Paragraph 4 of the decision, cited above, explicitly recognises that the use of a computer does not make a patentable invention

[130] *Ibid* at paras 4-5.

unpatentable. Paragraph 5 complements it by reformulating a legal precept: one should not be able to do indirectly what one cannot do directly. In addition, though it is accurate that *Schlumberger* does limit what inventions incorporating computer programs can be patented, there is empirical evidence that the *Schlumberger* decision did not fully stop patents from being granted over computer programs. Soon after the *Schlumberger* decision was published, the Patent Appeal Board granted a number of patents for applications incorporating computer programs for applications that had been rejected prior to the *Schlumberger* decision.[131] The Patent Appeal Board, for these decisions, applied the then new principles of *Schlumberger* and found that, in these patent applications, the computer program involved "some change effected from calculations to produce a useful result, and more than mere information, calculations or algorithms."[132]

The second critique is its opposite: that the *Motorola*[133] decision would have overturned the authority of *Schlumberger*. Yet this is not exactly accurate either: *Motorola* can be distinguished in that it does not claim a computer program, but hardware: "The applicant was seeking to exclude others from using the hardware, not the algorithms performed by the hardware."[134]

To illustrate *Schlumberger*, one can visualise it as creating a "subject matter/computer program" dichotomy similar to the "message/medium" dichotomy in media communications. To determine if the subject matter is patent-eligible, only the analysis of subject matter should count, regardless of whether it is practised by a computer program or otherwise. Patent law, *Schlumberger* insists, should resist the assertions of the many Marshall McLuhan's[135] of

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131 Teresa Cheung & Ruth M Corbin, "Is There a Method to the Madness? The Persisting Controversy of Patenting Business Methods" 19 IPJ 29 at 41.

132 *Ibid*.

133 *Motorola Inc Patent Application No 2,047,731, Re* (1998), 86 CPR (3d) 76 [*Motorola*].

134 Cheung & Corbin, *supra* note 131 at 41.

135 A renowned media theorist, famous for asserting that "the medium is the message". See Marshall McLuhan, *Understanding Media: The Extensions of Man* (Toronto: McGraw-Hill, 1964).

computer programs of this world who pretend that “the computer program is the subject matter”; rather, the patent-eligibility analysis should continue to focus on the subject matter itself. Admittedly, the incorporation of an inventive subject matter into a computer program is not inconsequential to the subject matter, just like the choice of a medium affects its message. Yet, this effect must not overthrow the substance; the inventive content must be found in the subject matter, whether or not affected by a computer program, not in its container. Thirty years of experience later, as *Amazon.com* implies by redirecting the Commissioner to *Schlumberger*, it seems that nothing more relevant has been written on computer programs’ patent-eligibility in Canada than these three concise pages by Justice Pratte. We wish we had been imbued with his ability for concision.

Chapter 2
The Complexity of Abstraction, Innovation and Software

In the previous chapter, the question of computer programs' patent-eligibility in Canada was reviewed. Through the analysis of the statutory definition of *invention* and exclusion of abstract subject matter, a concern was raised regarding the need for a coherent approach to determine patent-eligibility, notably for computer programs. The *Amazon.com* decision, though highly relying on an inconsistent analysis of the Canadian Supreme Court, aptly points to re-invigorating the *Schlumberger* rationale of granting patents to applications that incorporate computer programs only if the overall claimed invention is patentable; under this principle, the computer program should merely be treated as a means, a medium, not as substantial matter to analyse the invention's nature. This overview shows the difficulty of sharpening the patent system tool at the desired acuteness to stimulate SII. Still, as is observed at the end of this chapter, a patent-eligibility standard like the one enunciated in *Schlumberger* is more likely to foster SII than the *Shell Oil* standard. To reach this conclusion, though, one needs to explore appropriate criteria to assess the consequentiality of tools stimulating SII, which is the guiding line of this chapter.

As expressed at the outset, this thesis' method consists in straddling the fence of computer programs' patentability. Having studied the most important patent-related aspect to determine patent-eligibility, namely the exclusion of abstract subject matter, and understanding the intricacy of the different ways it can be applied, this chapter examines its role within the patent rationale of stimulating overall invention and innovation. In the process, this exclusion's purpose and some of its interactions with economic, sociological and philosophical theories of invention and innovation are identified. The lines of argument outlined in this

way, as well as the revisiting of TRIPS in Chapter 3's first half, serve as foundations to assess pragmatically and consequentially the measures to stimulate SII that are depicted in Chapter 3's second half.

To achieve this objective, we first turn to decisions of the Supreme Court of the United States to study the underlying reasoning that undergirds the exclusion of abstract subject matter in the patent rationale. Drawing on the recent *Mayo*[136] decision and other precedents of the Supreme Court that comment on patent-eligibility, this analysis converges on three elements: (i) pre-emption, (ii) the building-block structure of inventive endeavour and (iii) the hazards of patent thickets, to which is added (iv) an important element stemming from Chapter 1, disembodiment. Shifting the study from Canadian to U.S. case law does not affect its value at this stage: first, the two jurisdictions share similar legal principles for the exclusion of abstract subject matter; second, this chapter focuses on the patent rationale, and both Canadian and U.S. patent systems are guided by utilitarian principles. Though this exercise could have been achieved with Canadian case law, we believe U.S. case law explains it in a richer and more limpid manner, underpinning the transition to invention and innovation theories.

Each of these aforementioned elements and part of their role inside economic, sociological and technological theories are then discussed in relation with SII. This detailed view of SII exposes a multifaceted perspective in the context of this technology, a sector particularly affected by abstraction. This methodology underscores various ways by which SII is best served, which are significant in the next chapter.

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[136] *Mayo Collaborative Services v Prometheus Laboratories, Inc*, 132 S Ct 1289 (2012) [*Mayo*].

2.1. Bringing Abstraction to Concrete Effects

2.1.1. The Utilitarian Nature of the Canadian and U.S. Patent Systems

Confirming MacLeod's approach of the patent system as a technological creation, in Canada, case law has widely recognised that the patent system acts as an instrument to stimulate invention and innovation by encouraging inventive firms and individuals to publicly disclose their inventions and by enabling future inventors and innovators to build on the knowledge disclosed in this way.[137] This bargain theory of the patent system purports to maximise invention and innovation in the long run. In this manner, it is widely recognised as utilitarian. Utilitarianism is a moral and political theory that, in the words of John Rawls, asserts "that society is rightly ordered, and therefore just, when its major institutions are arranged so as to achieve the greatest net balance of satisfaction summed over all the individuals belonging to it."[138] In a nutshell, utilitarianism is all about the maximisation of utility, though how to conceptualise utility is open to different schools of thought. Since it is claimed that utilitarianism is nowadays the theoretical background on which most social institutions are built or on which social institutions are mostly built,[139] it is herein assumed that the utility sought in social institutions, including the patent system, is social welfare.

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[137] See, e.g., *Consolboard*, *supra* note 9 at 517; *Whirlpool*, *supra* note 127 at para 37; *Wellcome Foundation*, *supra* note 5 at para 37 and *Teva Canada Ltd v Pfizer Canada Inc*, 2012 SCC 60 at para 32 [*Teva*].

[138] John Rawls, *A Theory of Justice*, revised ed (Oxford: Oxford University Press, 1999) at 20. Rawls was critical of utilitarianism.

[139] Will Kymlicka, *Contemporary Political Philosophy: An Introduction* (New York: Oxford University Press, 2002) at 9. Any survey of social institutions or speeches in Canada makes it difficult to refute the prevalence of utilitarianism in social institutions. TRIPS' Article 7, agreed to by most States in the world, itself specifies that an objective of the protection and enforcement of intellectual property rights is to promote technological innovation and its transfer and dissemination in a manner conducive to social and economic welfare.

A detailed examination of utilitarianism is outside the scope of this thesis; likewise, conceptualising *social welfare* is not necessary.[140] What matters is that the Canadian patent system finds in it its theoretical foundation, which obviously influences its functional purpose. The utilitarian nature of the patent system can be understood in two ways. First, the objective behind the bargain theory, of maximising invention and innovation, can be seen analogically to the utilitarian objective—to maximise utility. Under this perspective, it is utilitarianism as a mechanism that is reproduced in the patent system. Second, one can argue that maximising invention and innovation results in maximising utility—defined as "social welfare". Here, the patent system becomes a means for the utilitarian end.

Whereas the utilitarian nature of the Canadian patent system provides mostly theoretical context, this attribute has legal, indeed constitutional, implications in the United States. The constitutional proviso granting Congress the power to "secur[e] for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries" specifies that it should purport "[t]o promote the Progress of Science and useful Arts".[141] This utilitarian objective of "promoting the Progress of Science and useful Arts", whether envisaged under the mechanism analogy or the means-to-an-end standpoint, limits how patent law in the United States can be interpreted. In the words of the Supreme Court, "patent validity 'requires reference to [the] standard written into the Constitution.'"[142] This explains an important difference between the treatment of the exclusion of abstract subject matter in Canada and in the United States: in the former, it is treated as a statutory limitation first, and its utilitarian nature has at most interpretative upshots; in the United States, it is integrated in the constitutional,

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140 The reader interested in this philosophical theory is invited to begin his study with Jeremy Bentham, often called the founder of utilitarianism, *The Principles of Morals and Legislation*, revised ed (London: Oxford University Press, 1823) online: Google Books <http://books.google.ca/books/about/The_Principles_of_Morals_and_Legislation.html?id=EfQJAAAAIAAJ&redir_esc=y>..

141 US Const art I, § 8, cl 8.

142 *Graham v John Deere Co*, 383 US 1 (1966) at 6 citing *Great Atlantic & Pacific Tea Co v Supermarket Equipment Corp*, 340 US 147 (1950) (Douglas J, concurring) at 154.

utilitarian limitation. For this reason, unlike in Canadian decisions, the underlying principles and implications of abstraction for patent-eligibility are reviewed at length in U.S. case law. Moreover, *Mayo* points to giving greater consideration to the effects of patenting "mathematical formulae, scientific principles or abstract ideas" on inventive and innovative activities. This explains why U.S. decisions are reviewed in this chapter, instead of Canadian case law, to study the impact to SII of the patent-eligibility exclusion of abstract subject matter.

This method does not simply reproduce to the U.S. jurisdiction the review of patent-eligibility in Canada that was achieved earlier. There is no point in this enquiry for that. This chapter's objective is rather to explore means to consequentially evaluate the desirability of tools to foster SII. By straddling the fence of computer programs' patentability, these measures are assessed by reference to the same purposes as the patent rationale. The upcoming review of U.S. case law aims not at studying patent-eligibility itself, but the utilitarian patent rationale and its reasons for keeping abstract subject matter out of patent-eligibility. For this reason, little attention is paid to *Bilski*[143] in comparison with *Mayo*: despite *Bilski* being the major decision for computer programs' patent-eligibility, *Mayo* is proven more pertinent for this enquiry.

2.1.2. Prometheus Also Cared for the Fire of Genius[144]

A lot of ink has been spilled over the question of abstraction in U.S. case law in the last forty years, leading to a unanimous Supreme Court decision in 2012:

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[143] *Bilski v Kappos*, 130 S Ct 3218 (2010) [*Bilski*]. Frischmann's overview of *Bilski* summarises this study's little focus on *Bilski*: "The Court's 'analysis' […] is not particularly helpful as guidance for differentiating abstract ideas from patentable inventions. The Court does not indicate any reasons or characteristics that distinguish abstract ideas from nonabstract ideas." See Frischmann, *supra* note 83 at 294.

[144] This reference alludes to a famous dictum by Abraham Lincoln about IP law: "The patent system [...] added the fuel of *interest* to the *fire* of genius, in the discovery and production of new and useful things."Abraham Lincoln, *Collected Works of Abraham Lincoln: Volume 3* (Ann Harbor, Michigan: University of Michigan Digital Library Production Services, 2001) at 363, online: University of Michigan Digital Library <http://name.umdl.umich.edu/lincoln3> [emphasis in the original]. As for Prometheus, it is the name of one of the parties in *Mayo*.

Mayo. Understanding the stream (of ink) that led to this decision is crucial to understanding it and its significance for the role of abstraction in inventive and innovative practices. In a nutshell, one can consider this long track as a dynamic pushing-and-pulling: the Supreme Court applying the rule against the patentability of abstract subject matter on a case-by-case basis, taking into consideration its utilitarian aspects, while lower courts try to apply this rule through a more unambiguous, predictable and uniform methodology.[145] The courts' two methods sometimes contradicted each other. *Mayo* somewhat produces a *tabula rasa* to this irresolution.

It all began in the 1877 *Cochrane* decision, over an invention that was far from being abstract in modern standards: a process of bolting flour, in which blasts of air are used to separate superfine flour from impurities, the latter being then purified and reground.[146] The validity of this invention's patent was challenged mostly on the basis that each of the process' steps was conventionally known. However, the Supreme Court found, the combination of all of these steps, more particularly the use of air blasts to separate the good-quality flour from impurities, was a new, patentable process. In doing so, the Court defined the term *process*: "A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject-matter to be *transformed* and *reduced* to a different state or thing."[147] As most patents that are inquired on the exclusion of abstract subject matter claim a process invention—for instance, Amazon.com's one-click process patent—this formulation took a particular importance in the trilogy of decisions over computer programs' patent-eligibility: *Benson*, *Flook* and *Diehr*.[148]

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[145] Any lawyer or jurist is aware that this dynamic between a jurisdiction's highest court and lower courts is not unique to patent law or to the U.S. jurisdiction.

[146] *Cochrane v Deener*, 94 US 780 (1877) at 784-86 [*Cochrane*].

[147] *Ibid* at 788 [emphasis added].

[148] *Gottschalk v Benson*, 409 US 63 (1972) [*Benson*]; *Parker v Flook*, 437 US 584 (1978) [*Flook*] and *Diamond v Diehr*, 450 US 175 (1981) [*Diehr*].

In these decisions, the Court had to determine if and when computer programs were patent-eligible. In *Benson*, the Court was presented a process of converting binary coded numerals to pure binary numerals.[149] It designed two sets of reasons by which these claims were rejected under the exclusion of abstract subject matter. First, drawing from the *Cochrane* definition of *process*, it expressed 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",[150] a test that would then be phrased the "machine-or-transformation test". Still, the Court specified that processes could qualify for patents even if they did not meet this test or other requirements set by the Court's prior decisions.[151] Second, the Court explained that since this patent's claims covered all uses of an algorithm, granting the patent would completely pre-empt the algorithm.[152] The decision could have resulted differently for claims covering a "practical application" of this algorithm.[153]

In *Flook*, the patent also claimed a process over an algorithm, but this one was limited to the calculation of alarm limits in a process comprising the catalytic chemical conversion of hydrocarbons.[154] Confirming the *Benson* lines of argument in refusing to grant the patent, the Court added that simply subjecting the unpatentable principle to a post-solution activity is not sufficient to render it patent-eligible.[155] The claims still pre-empted a broad scope of uses of the mathematical formula, not a mere practical application. In *Diehr*, the Court found the claimed invention significantly different: it covered a new and reliable process of calculating the temperature inside a moulding press for rubber, which calculations were used in a computer program that then signaled, after computing

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149 *Benson*, *ibid* at 67.
150 *Ibid* at 70 [emphasis added].
151 *Ibid* at 71.
152 *Ibid* at 72.
153 *Ibid* at 71. Compare with Subsection 1.2.2's discussion of *practical application* in Canadian case law.
154 *Flook*, *supra* note 148 at 586.
155 *Ibid* at 591.

a specific mathematical calculation, a device to open the press.[156] While still respecting the reasons in the *Benson* and *Flook* decisions, the Court confirmed the patent's validity as to patent-eligibility; when taking into consideration *the claims as a whole*, it found that it appropriated a single practical application of the mathematical formula, while not pre-empting other applications.[157] Therefore, it involved a patent-eligible process.

The United States Patent and Trademark Office (the "USPTO") extracted many guidelines out of this trilogy to assess patent-eligibility. Whereas abstract subject matter is not patent-eligible, practical applications of these abstract discoveries are. However, mere post-solution activity is not sufficient to transform a principle into a practical application. Despite the Court underscoring that the pre-emptive effect of appropriating abstract subject matter to reach its conclusions, the USPTO and courts widely adopted the machine-or-transformation test to solve the abstraction conundrum. After all, the Court had consistently recognised the test as *the clue* to distinguish a non-patent-eligible principle from a patent-eligible process. Particularly noteworthy, albeit the machine-or-transformation test was not the exclusive test, it was one that, when satisfied, was thought to ascertain patent-eligibility.

As the Supreme Court mentioned that other tests could be developed, the Court of Appeal for the Federal Circuit ("CAFC") later established the "useful, concrete and tangible result" test to determine patent-eligibility.[158] While physicality was somehow indispensable when applying the machine-or-transformation test, it was not necessary in order to produce a useful, concrete and tangible result, and so physicality eventually lost its status as a requirement. As a

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156 *Diehr*, *supra* note 148 at 178.

157 *Ibid* at 191-92.

158 See *In re Alappat*, 33 F 3d 1526 (Fed Cir 1994); *State Street Bank and Trust Company v Signature Financial Group, Inc*, 149 F 3d 1368 (Fed Cir 1998) [*State Street*]; and *AT&T Corp v Excel Communications, Inc*, 172 F 3d 1352 (Fed Cir 1999). The "useful, concrete and tangible result test" was basically applied exactly as its name entails.

consequence, the *State Street* decision, in 1998, carried on the tendency to broaden the scope of patent-eligibility by asserting business methods' patent-eligibility. This decision led to a massive inflation of patent applications for computer programs and business methods,[159] raised numerous concerns over the qualifications of USPTO examiners to face this new wave of applications[160] and reinvigorated the debate over patents' effects in the software industry.[161]

These controversies naturally led to the Supreme Court being re-involved into this matter in the *Bilski* case, about a business method (process) for risk hedging funds.[162] In the *In re Bilski* decision, a majority of the CAFC judges had held the patent invalid.[163] In doing so, it decided that the machine-or-transformation test was the sole test to determine patent-eligibility of claimed inventions,[164] effectively rejecting the "useful, concrete and tangible result" test.[165] The Supreme Court confirmed the invalidity of the patent, but on the mere ground of abstraction by reference to the trilogy's principles, without relying on the

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[159] See, e.g., Bessen & Hunt, *supra* note 13 at 169. Using a specific algorithm to identify and quantify software patents, these authors identify a rise of software patent applications at the USPTO from 12,262 in 1997 to 19,335 in 1998. No other reason than *State Street* appears plausible to explain this increase of more than 50% in one year. The USPTO, using a method of identification and calculation based on its patent classification system, observed an unconventional rise of patent applications for "modern business data processing" in 1998 and 1999. See United States Patent and Trademark Office (USPTO), "Automated Business Methods" (2000) White Paper, Section III, Class 705, online: USPTO <http://www.uspto.gov/patents/resources/methods/afmdpm/class705.jsp>.

[160] See, e.g., Julie E Cohen, "Reverse Engineering and the Rise of Electronic Vigilantism: Intellectual Property Implications of "Lock-Out" Programs" (1995) 68 S Cal L Rev 1091 at 1175-1181. But see John R Allison & Emerson H Tiller, "Internet Business Method Patents" in Wesley M Cohen & Stephen A Merrill, eds, *Patents in the Knowledge-Based Economy* (Washington, DC, USA: National Academies Press, 2003) 259.

[161] See, e.g., Stuart JH Graham & David C Mowery, "Intellectual Property Protection in the U.S. Software Industry" in Wesley M Cohen & Stephen A Merrill, eds, *Patents in the Knowledge-Based Economy* (Washington, DC, USA: National Academies Press, 2003) 219 at 253-56; Julie E Cohen & Mark A Lemley, "Patent Scope and Innovation in the Software Industry" (2001) 89 Cal L Rev 1 at 11-14; Boldrin & Levine, *supra* note 12 at 15-23, 57-59, 83-84; and Torrance & Tomlinson, *supra* note 31.

[162] *Bilski*, *supra* note 143 at 3223-24. 35 USC §100 includes *method* within the definition of *process*, and so the analysis of a patent claim labelled as a "business method" remains the same as for a process.

[163] *In re Bilski*, 545 F 3d 943 (Fed Cir 2008) [*In re Bilski*].

[164] *Ibid* at 955-56.

[165] *Ibid* at 959-60.

machine-or-transformation test. The majority found the claimed invention to be an "abstract idea" to which granting a patent would pre-empt any use of the idea of hedging funds.[166] Nevertheless, the Court unanimously rejected CAFC's finding that the machine-or-transformation test is the *sole* test to determine patent-eligibility; it rather iterated its precedents to the effect that it constitutes merely a clue.[167] Besides, a majority confirmed the CAFC's rejection of the "useful, concrete and tangible result" test.[168]

At last, this leads us to *Mayo*, where the Supreme Court unanimously offered a new orientation. *Mayo* is different from the aforementioned decisions as it is completely unrelated with computer programs: the disputed patent claimed a method of medical treatment comprising the administration of a specific drug and measuring metabolites to calibrate the subsequent dosages.[169] Still, the patent-eligibility of a process patent remains the disputed question. In examining it, the Court referred to all of the aforementioned precedents. Regarding the machine-or-transformation test, it went one step further than *Bilski* to diminish its importance: not only is it not the sole test to determine patent-eligibility, it is not even a sufficient test to apply the rule excluding abstract subject matter. Therefore, for the first time, the Court posited that an invention can satisfy the machine-or-transformation test and yet not be patent-eligible.[170] A process patent whose claims satisfy the machine-or-transformation test meets the §101 requirement, which does not mean it cannot be excluded for abstraction.[171]

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166 *Bilski*, *supra* note 143 at 3231. Frischmann, *supra* note 83 at 300, aptly points out that the Court should stop using "abstract ideas". There are no reasons theoretically or legally to make a distinction between 'abstract ideas' and 'non-abstract ideas'. Grammatically, it is a pleonasm. It only adds a layer of confusion. The relevant dichotomy is between ideas and applications—'implementations' in Frischmann's terms—not between two branches of ideas.

167 *Bilski*, *ibid* at 3226-27, 3232.

168 *Ibid* at 3232, n 1, 3259.

169 *Mayo*, *supra* note 136 at 1295.

170 *Ibid* at 1303.

171 Satisfying 35 USC §101 is the U.S. equivalent of satisfying the Canadian's definition of *invention* in Section 2 of the *Patent Act*. As we have seen in Subsection 1.2.1 above, for an invention to be patent-eligible in Canada, it must both satisfy the categories of inventions defined in Section 2 of the *Patent Act* and not be abstract (Subsection 27(8)). This simplified

Figure 2 below illustrates the three positions that courts have taken regarding the machine-or-transformation test in determining patent-eligibility. In CAFC's *In re Bilski* decision, the machine-and-transformation test was tantamount to patent-eligibility, hence the reason why the two squares are indistinguishable. Other pre-*Mayo* decisions considered the machine-or-transformation test as one ascertaining patent-eligibility, while acknowledging that some space was left to confer patent-eligibility to inventions that did not satisfy the machine-or-transformation test. *Mayo* changed this: the machine-or-transformation test can fail to assert patent-eligibility.[172] Therefore, a conscientious judge should not simply declare an invention patent-eligible because it satisfies the test. This clear departure from the machine-or-transformation test gives additional weight to the importance of the exclusion of abstract subject matter, effectively shifting the spotlight for the patent-eligibility enquiry on abstraction.

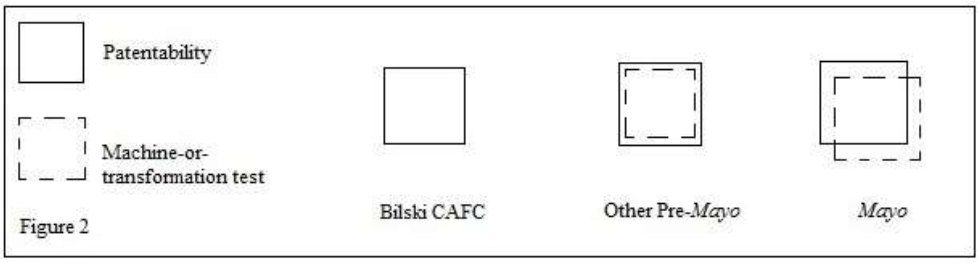

Figure 2

view also applies for U.S. patent law. But see how the *Mayo* approach of separating patent-eligibility into two steps somewhat departs but is not irreconcilable from our position above that patent-eligibility should constitute a single condition of patentability in which the two criteria of statutory subject matter and abstraction should be reviewed together. This also serves as a reminder of acting circumspectly when using decisions from foreign jurisdictions.

172 It is worth noting that although nothing in the trilogy suggested that it was possible for patent claims to satisfy the machine-or-transformation test and still not be patent-eligible, the wording used by the Court in the trilogy—"the clue"—was broad enough for *Mayo* not creating a clashing inconsistency. This footnote also provides an opportunity to specify that we do not take position on the *Mayo* decision or its reasoning. *Mayo* already faced important criticism; for a brief yet well-argued deconstruction of the Court's rationale, see, e.g., Robert R Sachs, "Punishing Prometheus: The Supreme Court's Blunders in Mayo v. Prometheus" *Patently-O* (26 March 2012), online: Patently-O <http://www.patentlyo.com/patent/2012/03/punishing-prometheus-the-supreme-courts-blunders-in-mayo-v-prometheus.html>. As in Canada, the search for a coherent and consistent approach for patent-eligibility is probably still a (perpetual?) work-in-progress. As a reminder, the goal of this exercise is to stress that *Mayo* does hint us at interesting aspects of the relationship between the exclusion of abstract subject matter and innovation. More interestingly, it appears that assessing these elements over patent applications is the approach privileged by the Court to determine abstraction within patent-eligibility.

If the machine-or-transformation test must be separated from the rule excluding abstract subject matter, then how should this exclusion be assessed? As is often the case, the Court does not provide a clear-cut and easily-usable legal technique to do so. What can be inferred from its own analysis of *Bilski* and *Mayo*, nonetheless, is the Court's high reliance on the reasons within the patent rationale of stimulating invention and innovation that vindicate the exclusion of abstract subject matter. Interestingly, the Court comments on the effects that granting the patent to the applicants would have on these elements. They are herein gathered into three categories: (i) pre-emption; (ii) the building-block structure of the inventive process; and (iii) the potentially disincentive effects of patent thickets for abstract subject matter. In the forthcoming review, a fourth element, sketched in Chapter 1, is also assessed: disembodiment.

Not only are these four elements useful to construct this analysis of the fundamental aspects to examine when considering SII; the fact that the Court decides these two recent cases only with a scrutiny of these aspects suggests that it expects the USPTO and other courts to rely on them to determine whether an invention is abstract or not, which provides notable interest for jurists working in U.S. patent law. Most importantly, these four elements are the patent rationale justifications for the exclusion of abstract subject matter, confirming Brett M. Frischmann's analysis of *Bilski*: ideas, whether one calls them *abstract* or not, are not patent-eligible, nor should they be because they are the basis of the intellectual infrastructure, viz. of the intellectual public domain.[173] Measures and tools that cohere with these imperatives are likely to reach the same objectives as the patent system.

[173] Frischmann, *supra* note 83 at 283, 300.

2.2. Pre-emption: The Harm of Preventing Alter-Invention

Pre-emption opens this study for a simple reason: as the review of Pre-*Mayo* Supreme Court decisions shows, the pre-emptive effects of allowing patents for abstract subject matter have been relevant in all decisions by the Court since *Benson*. It is, therefore, a natural starting point. The pre-emptive effects of patents come from the exclusive right granted to the patentee to use and exploit commercially the patented invention, thus pre-empting any use of the invention by third parties—without the authorisation of the patent-holder. For inventions that are the subject matter of patent law, it is believed in the classical theory of patents that the benefits from the incentive to invent and innovate created from this exclusivity is greater than the disbenefits that pre-emption generates. As patent law under utilitarian theory is a tool to maximise invention and innovation, this exclusivity is consequently warranted for.

Abstract subject matter, however, is not patent-eligible exactly for the same reason: permitting their pre-emption is believed to stifle inventive activity, hence not maximising invention and innovation. In the words of the Supreme Court, "[p]henomena of nature, though just discovered, mental processes, and abstract intellectual concepts […] are the basic tools of scientific and technological work."[174] Allowing their appropriation "might tend to impede innovation more than it would tend to promote it."[175] Not allowing patents to appropriate abstract subject matter reflects the Court's recurring preoccupation not to extend patent exclusivity to purposes unknown to or unanticipated by the patentee.[176] This

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[174] *Benson*, *supra* note 148 at 67.

[175] *Mayo*, *supra* note 136 at 1293. The Court goes on specifying that this exclusion must not be construed too broadly "[f]or all inventions at some level embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas." *Ibid*.

[176] See *Mayo*, *ibid* at 1301 for references to that concern in *Benson*, *Bilski* and *Flook*. The principle has first been established in the telegraph case *O'Reilly v Morse*, 56 US (15 How) 62 (1854) [*Morse*], where Samuel Morse was denied a patent for the use of electric or galvanic current for writing. See Frischmann, *supra* note 83 at 298-300 for an analysis of this case. But see Robert Plotkin, *The Genie in the Machine: How Computer-Automated Inventing Is Revolutionizing Law and Business* (Stanford, CA: Stanford University Press, 2009) at 118 for

subsection concentrates on the reasons why, unlike for patents for non-abstract subject matter, rendering abstraction patent-eligible stifles inventive and innovative activities, the whole according to traditional patent theory.

2.2.1. Against Monopolisation and Seeing Monopolies Everywhere

In textbook economic theories, monopolies are seen with a negative predisposition. As a firm in the situation of a monopoly for a product[177] does not face competition, it is not bound by market conditions to set its prices. Consequently it has the latitude to adopt rent-seeking practices.[178] Referred to as a "dead weight loss", one of the detrimental results of this latitude is that the inflated prices inhibit some consumers who would normally have purchased the product at a competitive price not to purchase it at a monopolistic price. If it is more profitable to increase a price, unless constrained or incited in any way to act otherwise, the rational monopolist will do it as it looks for the most profitable marketing option and/or the easiest to implement.

A monopolist's power fluctuates according to mostly two variables: (i) demand for the product and the correlated importance of the need(s) it takes care of, and (ii) the availability of substitutes for the correlated need(s).[179] Yet, following Schumpeterian theory, even a monopolist advantaged with respect to these two variables would lose its position if it does not continue innovating to

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a different analysis, where *Morse* is confined to an interpretation that one cannot claim an invention that a person skilled in the art cannot reproduce with mere reliance on the patent specification. According to Plotkin, the Court rejected the claim merely because Morse had failed to explain his invention sufficiently for a person skilled in the art to use electric or galvanic current for writing. Analyses of *Morse* by the Court in *Bilski* and *Mayo* conflict with Plotkin's narrow interpretation, written prior to these decisions being rendered.

177 *Product* includes both wares and services.

178 Boldrin & Levine, *supra* note 12 at 68-69.

179 Peter Drahos, *A Philosophy of Intellectual Property* (Burlington USA: Dartmouth Publishing Co, 1996) at 146.

stay ahead of the industry.[180] Otherwise, the process of "creative destruction"[181] intervenes: the promise of a monopoly position will stimulate other entrepreneurs to "create" new innovations and beat the monopolist, and so the current monopolist will be "destroyed" and replaced with a new leading firm, that will in turn become a monopolist. Summarised by Joseph A. Schumpeter, "a monopoly position is in general no cushion to sleep on. As it can be gained, so it can be retained only by alertness and energy."[182]

This observation is narrow. Non-innovative monopolists do not merely sleep on their cushion; "alertness and energy" may be spent on other undertakings than inventive and innovative activities. Aware of their impermanent position, monopolists hardly hesitate to rely on their bigger market size, incommensurable assets and deep political influence to slant the economic game in their advantage.[183] This perspective is particularly true if some of these assets are protected by legal tools and opposable to competitors, like, say, one that *randomly* comes to mind, patents.

Nonetheless, most firms qualified as "monopolies", whether or not they are in any way protected by patents or by any other form of IP, see this attribute stemming from the industry itself. The context by which the alleged monopolist holds this position of power is often based on the uniqueness of the product it supplies. Pires de Carvalho explains: "Uniqueness does not arise from the patent system, for patented technologies compete very often with other patented technologies as well as off-patent technologies. Uniqueness arises from the head start, that is, the time advantage that a pioneer has over his or her competitors."[184]

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[180] Boldrin & Levine, *supra* note 12 at 170.

[181] Joseph R Schumpeter, *Capitalism, Socialism, and Democracy*, 4th ed (New York, NY: Harper Colophon, 1976) at 83 describes this phenomenon as the "process of industrial mutation—if I may use that biological term—that incessantly revolutionizes the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one." [Emphasis in the original.]

[182] *Ibid* at 102.

[183] Boldrin & Levine, *supra* note 12 at 171.

[184] Pires de Carvalho, *supra* note 8 at 1 n 1.

This statement, of course, oversimplifies the economic reality. Other conditions might be responsible for uniqueness, among which, yes, IP protection. Still, it epitomises the actual birth of a large share of "monopolies", which are begotten from pro-competitive industrial conditions. In this sort of context, therefore, the alleged monopolistic position is (i) somehow earnestly deserved; and (ii) inherently temporary—limited to the duration of the uniqueness afforded by the head start or other favourable industrial condition(s). Trying to move away from Schumpeter, one comes back to his apologetic view of monopolies.

The importance of the first-mover advantage to create market power is empirically confirmed by a 1994 survey of manufacturing firms conducting research and development ("R&D"). The survey's respondents rated lead time as the most effective means of appropriability of product innovations, and the third most effective for process innovations.[185] Secrecy, another industry-designed condition usually accepted in market economies, was also considered of the utmost importance, ranked as a close second for product innovations, while being first by far for process innovations.[186] Similar results can be observed from a 2008 survey of high-technology startups, where first-mover advantage is ranked as the most important strategy of appropriability.[187] Secrecy also scored as moderately important for high-technology startups, although slightly less for software/internet startups.[188]

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[185] Wesley M Cohen, Richard R Nelson & John P Walsh, "Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (Or Not)" (2000) NBER Working Paper No 7552 at 10. Note that in the survey's results, firms in the "computers", "semiconductors and related equipment" and "communication equipment" sectors, the three surveyed industries that are most likely to also deal with computer programs, rated lead time as a more effective means of appropriability than the average answers, both for product and process innovations. For this Subsection, "first-mover advantage" and "lead time" are used interchangeably to better compare the two surveys that are reviewed.

[186] *Ibid*.

[187] Stuart JH Graham et al, "High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey" (2009) 24:4 Berkeley Tech LJ 1255 at 1289-90. *High-technology startups* comprise firms in four industries: biotechnologies, medical devices, software/internet and venture-backed startups in information technology hardware.

[188] *Ibid*.

As important as the effects of monopolies over consumers can be, it must be remarked that this thesis is concerned by their impact on inventive and innovative decisions and how these decisions interact with abstraction. With respect to monopolies rooted in "natural" mechanisms of the market (first-mover advantage and secrecy, among others, but excluding IP and other schemes of legal protection), there are few barriers to innovation. In fact, Schumpeter's creative destruction model supports the opposite: the motivation to become the market leader and thus a "monopolist" is itself an additional impetus to innovate. Although Michele Boldrin and David K. Levine are right in pointing that leading firms in the market use their position in numerous ways to strengthen their position, this situation is not inherently harmful because it is difficult to distinguish practices that would hinder innovation and those that would not. For instance, while "monopolies" can keep their position by acquiring startups, the perspective for a startup to be acquired by a large firm can act as an impetus to invent and innovate. Likewise, for several reasons, it can be in the best interest of a large firm to encourage its competitors to invent and innovate, for instance, when competitive products complement the "monopolistic" product in a way spurring market demand for the monopolist's product.

What the aforementioned surveys also show, however, is the use of "artificial" mechanisms of appropriation like patents. In the 1994 survey, a significant number of respondents, though less than for other means, considered patents as an effective means to appropriate product and process innovations.[189] Firms that do patent, moreover, answered that they did foremost with the intention of blocking rival patents on their innovations, products or processes, and to prevent copying.[190] In addition, 39% of the general representative sample of high-technology startups held or applied for at least one patent; this number drops at 24% for firms in the software/internet industry.[191] These ratios are not

[189] Cohen, Nelson & Walsh, *supra* note 185 at 9-10.
[190] *Ibid* at 17.
[191] Graham et al, *supra* note 187 at 1276-77.

insignificant. High-technology startups that filed for at least one patent application likewise answered that the most important reason to patent was to prevent copying.[192] These responses highlight a concern for obtaining freedom to operate around their product(s) and capitalise the results of their operations.[193]

The core of patent rights is that patent-holders may exclude their competitors from using or reproducing their patented inventions. How can this hindrance of competition translate in hindering inventive and innovative activities? If competitors wish to use or commercialise a product that is or part of it is patented, or that is produced through a patented process, they either (i) are blocked altogether from using or commercialising their products or (ii) have to enter into an agreement with the patent-holder. In the first scenario, rational firms do not waste their time and financial resources for products that they are not able to use or commercialise. In the second scenario, firms most probably have to pay a "rent"—which can take a myriad of forms, for example, licensing fees, use conditions or granting cross-licenses on their own patented technology—in order to use or commercialise their products.[194]

This entry fee almost certainly affects innovation in either of two possible ways. First, it is possible that a firm is not able to afford the entry fee, or rationally calculates that because of it, the intended inventive or innovative activities are no longer worth it. Second, if the new firm does enter into an agreement, it incurs costs in time and financial resources and/or sees its expected benefits from the invention or innovation eroded. These costs or benefit losses in turn diminish the resources available for inventive or innovative development. Adding to this the aforementioned possibility of a patentee blocking the use of its patented technology, patent-holders' exclusive rights have a high potential of

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192 *Ibid* at 1297. This survey did not list "blocking rival patents" in its answers. For startups in the software/internet industry, "prevent copying" is still listed as a preeminent reason to file for a patent, equal with "enhancing company reputation and/or product image". *Ibid* at 1301.

193 O'Connor, *supra* note 21 at 210.

194 See generally Mann, *supra* note 16 at 990-92.

negatively affecting inventive and innovative activities. However, these disincentive effects must be weighed against the stimuli that patents generate according to the classical theory of patents. Generally speaking, the benefits are expected to offset the collateral damages, which can be mitigated.

As these disincentive effects exist when the new inventive or innovative firm wishes to use or commercialise the patented invention, competitors can mitigate the effects of the rent or blocking patent(s). Competitors remain free to rely on alternative means to compete with the "monopolistic" patent-holder. These alternatives comprise using or commercialising pre-existing inventions and alter-inventing. Alter-inventing consists in "invent[ing] a different, non-overlapping, and non-infringing solution for the same technical problem. Alter-inventions may be entirely different or they may be careful variations of the original invention so as to avoid infringement (so-called inventing around)."[195] Alter-inventing is a beneficial activity for maximising invention and innovation, even when it serves to reproduce an existing product by inventing around a patented process. The reason for this benefit is that alter-inventing adds to the aggregate technical knowledge of society by inventing something new or finding a new way to produce an already-existing product. In this way, alter-inventions fall in what the patent rationale aims at promoting.

Remember that a "monopolist's" power is limited by the possibility of alternatives or substitutes to the need(s) its products respond to. Inasmuch as acquiring a patent or a strong market position is not tantamount to appropriating the means for inventing (or alter-inventing), innovating or competing, the conditions for innovation are likely to remain favourable, thence our uneasiness to tag firms acquiring an important market position as "monopolies". In these circumstances, a monopoly is no different than any other property right.[196] It is the

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[195] Pires de Carvalho, *supra* note 8 at 256, n 586. Alter-inventing differs from re-inventing.

[196] Drahos, *supra* note 179 at 146. But see Boldrin & Levine, *supra* note 12 at 123-24, who rather contend that the "intellectual monopolist" also controls all copies of the idea, and so cannot be

appropriation of the means for inventing, innovating or competing that seriously threatens inventive and innovative efforts, and which therefore should be limited. There are mainly two ways for this sort of appropriation: sweeping portfolios of IP rights—mostly patents—which are discussed later,[197] and pre-emption of access to the "basic tools of scientific and technological work", i.e., "mathematical formulae, scientific principles and abstract ideas".

If a patent-holder has or can have competitors through different products that fulfill the same market or technical need or through the same product manufactured with a different process, the impetus for competitors to invent or innovate in order to capture a position in this market stays intact. The context differs, however, if abstract subject matter is patented. As the Supreme Court numerously explained, in these cases, a whole range of technical solutions are pre-empted as long as the patent is valid. To refer to *Bilski*, if a firm could patent the idea of hedging funds, it is impossible or extremely difficult for any competing firm to invent or innovate a substitute or alternative to this process, and thus compete in the patentee's market of hedging funds. In these cases, it is highly reasonable to conclude that the deleterious effects to inventive and innovative activities dwarf the incentives that patents create. As a result, invention and innovation would not be maximised, and the patent rationale would be thwarted. It is, in fact, the conclusion that the textbook theory of innovation reaches, and exactly why abstract subject matter is non-patent-eligible. So long as inventors and innovators are not pre-empted from using the "basic tools of scientific and technological work" in their endeavours, invention and innovation are under an auspicious environment.

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compared to the ordinary property owner. Most of the upshots of controlling the copies of ideas impact consumers as consumers, very little as inventors and innovators (which are also consumers). As serious as they can be, the consequences on consumers as consumers are outside the scope of this thesis. As for the effects on inventors and innovators, these authors' position is so sweeping that it nowhere acknowledges the availability of alter-inventing and the benefits to the aggregate technical knowledge that alter-inventing generates.

[197] See Section 2.4 below.

2.3. Playing With Blocks

When the Court refuses to grant patents for "mathematical formulae, scientific principles and abstract ideas", it recognises that they belong to the public domain or, as the expression goes, are "part of the storehouse of knowledge of all men… free to all men and reserved exclusively to none."[198] Upholding patents for abstract subject matter "would risk disproportionately tying up the use of the underlying natural laws, inhibiting their use in the making of further discoveries."[199] In itself, the fundamental attribute of this knowledge under the spectrum of ideas would suffice to justify their preservation within the public domain[200] as the discussion on pre-emption supports. In spite of that, it deserves an enhanced recognition when one understands the building-block nature of inventive activities, an aspect that particularly affects the software industry. In the previous section, economic benefits of invention and innovation were reviewed; here, observations highlight the scientific and technological considerations inherent to the structure of invention and innovation.

2.3.1. Standing on the Shoulders of Giants[201]

In his widely influential paper on the ethos of science, Robert K. Merton identified "the extension of certified knowledge" as the institutional goal of

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198 *Bilski*, *supra* note 143 at 3225, citing *Funk Brothers Seed Co v Kalo Inoculant Co*, 333 US 127 (1948) at 130.

199 *Mayo*, *supra* note 136 at 1294.

200 See Frischmann, *supra* note 83 at 281-82.

201 After Abraham Lincoln earlier in this chapter, the spotlight is now on a famous citation by Isaac Newton, who exclaimed that if he managed to see that far, it was because he was standing on the shoulders of giants. Robert K Merton, *The Sociology of Science: Theoretical and Empirical Investigations* (Chicago: University of Chicago Press, 1973) at 275, n 14 adds an interesting remark to this citation: "It is of some interest that Newton's aphorism is a standardized phrase which had found repeated expression from at least the twelfth century." Newton was not simply evoking a smart quip; he was actually performing it.

science.[202] *Science*, here, is meant as the institution of science and its cultural structure.[203] This goal connects with the patent rationale of maximising long-term innovation by encouraging inventors to disclose their inventions.[204] Patent disclosure expands the pool of technical knowledge available to society, with the hope of increasing the end-amount of invention and innovation.

In Merton's theory, *communism* is one of the four moral imperatives of modern science.[205] How this imperative is articulated, how it translates into Abbott Payson Usher's technological theory of invention[206] and these two concepts' influences in the early software community are the subject of this subsection. Three essential, interconnected elements need to be discussed to understand the communal imperative.

First, scientific knowledge is the result of cooperative work.[207] Scientists build on a pool of common, cultural heritage, and thus their achievements are the result of cumulative efforts of which their own contribution is minute. Second, being the result of social, and often intergenerational, collaboration, scientific knowledge should be assigned to the community.[208] *Communism*, therefore, is meant in a way that resonates for lawyers: *commons*.[209] In short, scientific knowledge should morally belong to the public domain because the scientist's discovery draws too much on its colleagues' work for him to be morally entitled to appropriate it. For their discoveries, scientists are at most entitled to recognition and esteem by their

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202 *Ibid* at 270. For a perspective of the historical and social context surrounding Merton's writings on science, see Adrian Johns, *Piracy: The Intellectual Property Wars from Gutenberg to Gates* (Chicago: The University of Chicago Press, 2009) at 401-30.

203 Merton, *ibid* at 268.

204 The goal connects with the patent rationale for *disclosure*, not the correlated part of the "bargain" which grants a temporary exclusivity over the use of the invention. Merton strongly repudiated patents as they allowed private appropriation of knowledge. *Ibid* at 275.

205 *Ibid* at 270. It is unrelated with the Marxist notion of *communism*. The other three imperatives are universalism, disinterestedness and organised scepticism. *Ibid*.

206 Abbott Payson Usher, *A History of Mechanical Inventions*, (New York: McGraw-Hill, 1929).

207 Merton, *supra* note 201 at 273-75.

208 *Ibid* at 273.

209 There are Mertonian echoes in Frischmann's view that ideas, the intellectual infrastructure, are part of the commons, left out of appropriation by IP law. See *supra* note 83 at 301-05.

community. Third, as the substantive findings of science should belong to the community and not to the scientist, scientists are morally bound to communicate their findings.[210] Not sharing knowledge that is the fruit of scientific endeavour is tantamount to keeping for oneself something that belongs to others, i.e., the community. As a result, secrecy should be proscribed for science.

This communal approach to scientific activities, which existed well prior to Merton though not expressed as eloquently, meets up patent theory as discussed by the Supreme Court. When it qualifies abstract subject matter as "part of the storehouse of knowledge of all men… free to all men and reserved exclusively to none", Merton could not do otherwise but applaud. This does not mean that the Court and Merton share the same views on science, far from it. The Court, for instance, would not approve a requirement for scientists to communicate all their findings. Similarly, whereas the Court limits its thoughts on the public domain nature of science to abstract subject matter, Merton extends it to any knowledge that is the result of scientific findings. Merton's view would effectively extend the communal approach to most, if not all, of what is patented nowadays, which explains that he found his communal ethos "incompatible with the definition of technology as 'private property' in a capitalist economy."[211] IP law, on the other hand, acts as a semicommons arrangement that keeps ideas in the public domain while permitting the appropriation of their expression by copyright and their implementation or application by patents.[212]

The first element of the communal imperative, that scientific knowledge is the result of cumulative efforts, had been studied in greater depth prior to and after Merton with respect to inventive activities, by Usher among others. Usher recognised that inventions were most often the result of a

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[210] Merton, *supra* note 201 at 274.
[211] *Ibid* at 275.
[212] Frischmann, *supra* note 83 at 301-05.

"combination/accumulation model"[213]. Inspired by Wolfgang Köhler's gestalt psychological experiments, Usher was highly attentive to the mental processes by which an inventor would fulfill a need by finding, inventing a new solution. He believed that the "distinctive feature" of inventive activity lied in "the constructive assimilation of pre-existing elements into new syntheses, new patterns, or new configurations of behavior."[214] This, in effect, establishes a building-block perspective on inventive activities: invention consists in taking a certain number of pre-existing "blocks" —which can be physical substances, mental processes, designs, and so forth—and combining/accumulating them in a certain configuration. Expounding this approach, Usher set forth a three-stage model of the inventive process:

> First came the 'recognition of a new or an incompletely gratified want.' The second step Usher referred to as 'setting the stage,' in which the inventor reviewed all the elements of potential use […]. Setting the stage was the 'crucial bridge between the past experience of the individual and the actual completion of the new configuration.' Setting the stage prepared the way for the 'act of insight,' by which the elements of the inventory were rearranged into a new configuration capable of gratifying the obstructed want.[215]

The Usherian model of the inventive process also calls for not appropriating the primary building blocks of this process, abstract subject matter. One can imagine himself in the position of an architect who does not have access to substances that can serve as the construction's foundation; it will be very difficult, if not impossible, for him to erect a structure that does not crumble. In

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[213] David McGee, "Making up mind: the early sociology of invention" (1995) 36 Technology and Culture 773 at 783.

[214] Usher, *supra* note 206 at 11.

[215] McGee, *supra* note 213 at 785, citing Usher, *ibid* at 17-19. McGee completes his summary of Usher's theory with a fourth stage, critical revision, "in which the new configuration was brought into successful order." McGee, *ibid*. McGee is mistaken in his description of critical revision. Critical revision consists in analysis and reasoning of prior inventions and scientific principles, opposed to synthesis. As such, it is a separate phenomenon in the process of invention, occurring in all three stages, though predominantly in the third. It may or may not result in new inventions. See Usher, *ibid* at 23-24.

comparison, someone else appropriating an upper-level element, such as chimney bricks, is less impactful for the building process: the imaginary architect, especially if he is as ingenious as classical economic history has conceived inventors to be,[216] can build around or simply accept this hole in the structure without it falling apart.

2.3.2. Software Is Complex

The debates over the technical and moral norms of science that raged during the first half of the twentieth century, in which Merton held a preeminent position, transferred to the technical and moral norms of early software developers. At the heart of the debate over the ethos of science were practices like pirate radio and *phreaking*—pirating of the telephone network—common for users of high technology of the time.[217] Radio-telecommunications and telephones were deemed by some high-technology users to be the fruits of scientific endeavour, and those who held the communal imperative at heart did not hesitate to pirate them. As technology gradually moved to computing, the same individuals moved their interest from radio and phreaking to computing, carrying with them the communal norm.[218] A digital ethos was already taking shape:

> When contemporaries sought to understand what was happening in [the] transition [to the digital realm], they often appealed to an ethos of antiproprietorial creativity that digital networks supposedly favored. That is, they sketched a cluster of morally consequential "norms" to which true digerati were supposedly committed—norms of sharing, access, and technocracy—and which characterized the emerging culture. The perspective made sense not only because it captured something about the technical

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[216] See generally the treatment of James Watt in HW Dickinson & HP Vowles, *James Watt and the industrial revolution* (Toronto: Longmans, Green & Co, 1948) and MacLeod's discussion of the heroic treatment history generally reserves for inventors of the industrial revolution; *supra* note 4 at 39-41.

[217] Johns, *supra* note 202 at 412-13, 464-65.

[218] *Ibid* at 465-473.

> properties of digital networks, but also because it evoked a widely believed account of the nature of true science.[219]

In fact, the structure of digital technology possibly makes it the most representational of the Usherian combination/accumulation model. The creative process by which software is developed is coding. Programmers work with source code, their own languages that consist in instructions and statements written by the programmer, their input. Once assembled and/or compiled, this input can be read in binary language into a processor to produce the output requested by the programmer's coded instructions.[220] The fact that the inventive process is codified in writing—that it can be read, compared, shared, copied, adjusted and so forth, all in a matter of seconds—makes software technology unique. All three steps of the Usherian model—recognising the need, identifying the elements that can be used and reconfiguring—are facilitated for SII. No wonder that the communal imperative has been so highly acknowledged in this industry since its early days, to the point that it still lives strong in the F/OSS community.[221]

Economists have also observed that inventive processes differ through cross-industry distinctions, identifying four different models of industry patterns, two of which deserve our attention: discrete and complex technologies.[222] Discrete technologies are well-defined, composed of few inventive input components, and their output does not enable a wide array of applications.[223] The safety razor and the ballpoint pen count among discrete technologies.[224] For discrete inventions,

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219 *Ibid* at 464.

220 Phillips, *supra* note 15 at 61-62. Plotkin, *supra* note 176 at 37-41.

221 See generally the preamble of the GNU General Public License, Version 3 (29 June 2007), online: GNU <http://www.gnu.org/licenses/gpl-3.0.en.html>. One should also note that the software community is not separately divided between exclusionary software development and F/OSS. Programmers who work for exclusionary firms are usually the same who work in F/OSS, only in their free time (or at work—usually, but not always, unbeknownst to their employer). See Phillips, *supra* note 15 at 159-60.

222 Robert P Merges & Richard R Nelson, "On the Complex Economics of Patent Scope" (1990) 90:4 Colum L Rev 839 at 880. The other two models are industry-specific and so have little value in this thesis: chemical and science-based technologies.

223 *Ibid* at 880-81.

224 *Ibid* at 880.

the building-block model of the inventive process stays relevant but its thrust is less overreaching. Since they require little prior input components, they can be used autonomously. Likewise, they are open to few subsequent output applications outside of basic improvements or customisation within their design. On the other hand, complex, or cumulative, inventions are incremental, they comprise a large number and variety of components, and their inventive output can likewise be integrated into a large number and variety of technologies.[225] The combination/accumulation model fits impeccably in complex technologies. Software, by its coding process, is possibly the technological sector that allows the widest array of input and output, both in quantity and in diversity. It is the paragon of a complex technology.

Because of their peculiar inventive structure, complex technologies are affected differently by patents. If an invention inherently used in a complex technology is patented, a wider range, both in number and in variety, of further inventions are pre-empted. Therefore, firms in complex technologies tend to act differently with patents than firms in discrete technologies. Responses in the aforementioned 1994 survey suggested that firms in complex industries are more likely to use their patents to obtain licensing revenue and in cross-licensing arrangements.[226] This is logical. Cross-licensing consists in two firms granting reciprocal licensing rights to some or all of their patent rights, either royalty-free or with a reduced royalty for the party with the smaller patent portfolio.[227] If one needs a comprehensive scope of inventive (and possibly patented) input to invent or innovate, one is likely either (i) to choose a branch of the industry where firms have tacitly or expressly chosen not to patent, or (ii) to patent in order to cross-license with the firms that patented the needed input. This decision process reflects the need for freedom to operate. Likewise, if a firm expects its invention

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225 *Ibid* at 881-82.

226 Cohen, Nelson & Walsh, *supra* note 185 at 23-26. See accompanying text for more contexts on this survey.

227 Carl Shapiro, "Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting" (2000) 1 Innovation Policy and the Economy 119 at 127.

to be itself used as input in other firms' technology because of the complex structure of the industry, patenting it opens the door to profitable rent-seeking practices. These managerial decisions explain the presence of large patent portfolios through the accumulation of patents, and consequently of patent thickets, notably in the software industry.

2.4. Can One Avoid Being Scratched by a Thicket?

In *Mayo*, the Court also made explicit a concern over the risk of creating "a vast thicket of exclusive rights over the use of critical scientific data".[228] This problem is expressed with respect to medical data and their use over the human body's natural responses, but thickets' potentially hazardous outcomes cross over to all forms of abstract subject matter.[229] The patent-thicket situation is eminently explored by Carl Shapiro, who describes it as "a dense web of overlapping intellectual property rights that a company must hack its way through in order to actually commercialise new technology."[230] The Court expresses this concern in its *Mayo* decision: "The exclusion from patent law of basic truths reflects 'both… the enormous potential for rent-seeking that would be created if property rights could be obtained in them and… the enormous transaction costs that would be imposed on would-be users [of those truths].'"[231] Empirically, even when patent thickets do not block entry into an industry, their presence still means that substantial costs are incurred to enter the industry. These observations converge with those just made regarding pre-emption and the use of patents in complex industries.

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228 *Mayo*, *supra* note 136 at 1305.

229 If a vast thicket of patents limits the use of basic software algorithms, the patent thickets' pitfalls envisioned by the Court in *Mayo* also apply.

230 Shapiro, *supra* note 227 at 120.

231 *Mayo*, *supra* note 136 at 1302, citing William A Landes & Richard A Posner, *The Economic Structure of Intellectual Property* (Cambridge, MA: Harvard University Press, 2003) at 305-06.

2.4.1. Sticky Disclosure

An ironic aspect about patent portfolios and thickets in the software industry is that, despite their existence being widely recognised, it is nigh impossible to know where they begin and where they end. This issue, in itself, deserves its own review because the uncertainty it leads to increases transaction costs, "the cost of establishing property rights and engaging in compensated exchanges of property."[232] Prior to "engaging in compensated exchanges of property", one first has to determine whether there is property and whether compensation is called for. The problem with the exact identification of patent portfolios lies mostly at the level of patent disclosure.

As counterpart to patents' exclusive rights granted in the bargain theory, the invention must be disclosed in such a way that a person skilled in the art may reproduce it. This *quid pro quo* is clearly expressed in Canadian[233] as well as U.S. patent law.[234] For computer programs, however, patent-holders are not required to disclose their inventions' source code.[235] In the United States, CAFC ruled that disclosing the computer program's function is sufficient, and even preferable to source code disclosure considering the existence of in-firm source code languages

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[232] Carliss Baldwin & Eric von Hippel, "Modeling a Paradigm Shift: From Producer Innovation to User and Open Collaborative Innovation" (2010) Harvard Business School Finance Working Paper No 10-038 at 11.

[233] The Canadian Supreme Court has expressed this principle at numerous occasions. See, e.g., *Pioneer Hi-Bred Ltd v Canada (Commissioner of patents)*, [1989] 1 SCR 1623 at para 29: "The description must be such as to enable a person skilled in the art or the field of the invention to produce it using only the instructions contained in the disclosure." For this reason, in *Teva*, *supra* note 137, the Canadian Supreme Court invalidated the Viagra patent on the basis that it was inappropriately disclosed. See Subsection 27(3) of the *Patent Act*, *supra* note 10 for the disclosure requirement in Canada.

[234] 35 USC §112 ¶1 sets forth the enablement and best mode requirements:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

[235] In Canada, see Canadian Intellectual Property Office, *Manual of Patent Office Practice*, ch 16 at 13-15 (last updated December 2010).

which might not be understandable to people skilled in the art from outside the firm.[236] In principle, this tempering in the enablement requirement is acceptable because "normally, writing code for such software is within the skill of the art, not requiring undue experimentation, once its functions have been disclosed."[237] As patent claims are to be read by a person skilled in the art, this person would presumably know how to code a computer program whose patented functions have been disclosed. However, many are sceptical of this assumption,[238] Julie E. Cohen and Mark A. Lemley among others:

> It is simply unrealistic to think that one of ordinary skill in the programming field can necessarily reconstruct a computer program given no more than the purpose the program is to perform. The Federal Circuit's peculiar direction in the software enablement cases has effectively nullified the disclosure obligation in software cases.[239]

The difficulty for even a person skilled in the art to reproduce a disclosed computer function without relying on special or ingenious skills rests upon the intrinsic nature of the disclosed knowledge. From Michael Polanyi's writings, two categories of knowledge can be identified: articulate and tacit.[240] On one hand, articulate knowledge is explicit, relatively easy to understand and does not require much explanation to be conveyed reliably.[241] Source code is obviously encoded, articulate knowledge for a programmer. On the other hand, tacit information is very difficult to transfer, even when written down; human skills, know-how and

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236 See *Fonar Corp v General Electric Co*, 107 F 3d 1543 at 1549 (Fed Cir 1997).

237 *Ibid*.

238 See, e.g., Boldrin & Levine, *supra* note 12 at 168-69 and Mann, *supra* note 16 at 1025-26.

239 Cohen & Lemley, *supra* note 161 at 24, n 87. A famous free software proponent, Richard M Stallman, *Free Software, Free Society: Selected Essays of Richard M. Stallman* (Boston, MA: GNU Press, 2002) at 99, expresses the same concern.

240 Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (Chicago, IL: University of Chicago Press, 1958). Theorists who developed on Polanyi's theory often refer to articulate knowledge as *encoded* or *codified*.

241 *Ibid* at 204-07. The descriptions herein of articulate and tacit knowledge simplify Polanyi's theory for the sake of the argument. For instance, their distinction is not clear-cut. Polanyi, at 91-92 and, in fact, everywhere in the book, makes it clear that behind any articulate transfer of knowledge is a tacit component. Nevertheless, this simplification does not invalidate the forthcoming argument in any way.

expertise are of this sort.[242] Transferring tacit information is costly as it either requires the information transferor to show it to the transferee in the manner of a master to an apprentice[243] or the transferee to develop the specific skills and knowledge necessary to understand and use the tacit information.[244]

Leaving source code aside, programmers' skills in this industry are widely recognised as (tacit) know-how. Their knowledge about software products, the particular functions that they include and the way(s) to code them are embedded in their skills.[245] Reproducing this knowledge without access to source code is long and costly.[246] Despite knowledge in this industry being tacit, it can be articulated through two practical methods: in a master-apprentice relationship or source code, these technology-specific languages that programmers read and write.[247] Software history exemplifies this dual mechanism to transfer software knowledge. The early software tinkerers invested a lot of efforts at (i) building communities that met regularly, such as the well-known Homebrew Club and (ii) sharing source code through cassette swaps or newsletters.[248] These two knowledge-sharing methods respectively emulate the master-apprentice relationship (in which everyone was master and apprentice at the same time) and source code methods of articulation.

Consequently, programmers trying to reproduce a computer program disclosed in a patent application are generally trying to apply written-down but yet inarticulate tacit knowledge. Unless they know at the outset about the

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242 Eric von Hippel, ""Sticky Information" and the Locus of Problem Solving: Implications for Innovation" (1994) 40:4 Management Science 429 at 430.

243 Polanyi, *supra* note 240 at 53.

244 Von Hippel, *supra* note 242 at 430-31.

245 Ronald J Gilson, "The Legal Infrastructure of High Technology Industrial Districts: Silicon Valley, Route 128, and Covenants not to Compete" (1999) NYUL Rev 575 at 595; AnnaLee Saxenian, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128* (Cambridge, MA: Harvard University Press, 1994) at 37.

246 Mann, *supra* note 16 at 1026.

247 Polanyi, *supra* note 240 at 77, explains that articulation proceeds through the mechanisms of language.

248 Johns, *supra* note 202 at 477-79.

particular computer program or can read its source code in a language they master, even they, the public skilled in the art, do not receive a sufficiently clear indication to reproduce the invention.

This lack of clear indication makes it difficult for even software inventors or innovators who make patent searches to know if they infringe a patent. This uncertainty is worsened by non-literal patent infringement. In the United States, the triple-identity test of the doctrine of equivalents considers that an invention infringes a patent if it performs substantially the same function in substantially the same way to produce substantially the same result as the claimed invention.[249] This analysis applies to each element of the claims.[250] As the triple-identity test is to be applied at the date of infringement, however, the doctrine of equivalents opens the door for subsequent modifications, unforeseen by the patentee when the patent was published, to still infringe the patent.[251] By allowing this risk, the U.S. Supreme Court is inconsistent with its own approach in *Morse*, where it warned against the dangers of patent claims that would preclude unforeseen results.[252]

The Canadian approach on non-literal patent infringement is not free of shortcomings with respect to identifying the scope of a computer program patent. Patent construction in Canada requires that a person skilled in the art determines if each element of a claimed invention would be essential or not for the inventor, as

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[249] See *Graver Tank & Manufacturing Co v Linde Air Products Co*, 339 US 605 at 608 (1950) and *Warner-Jenkinson Company, Inc v Hilton Davis Chemical Co*, 520 US 17 at 35 (1997) [*Warner-Jenkinson*].

[250] *Warner-Jenkinson*, *ibid* at 29.

[251] *Free World Trust*, *supra* note 127 at para 38, Binnie J, criticising this aspect of the U.S. approach.

[252] *Morse*, supra note 176 at 113:

> For aught that we know, some future inventor, in the onward march of science, may discover a mode of writing or printing at a distance by means of the electric or galvanic current, without using any part of the process or combination set forth in the plaintiff's specification. […] But yet, if it is covered by this patent, the inventor could not use it, nor the public have the benefit of it, without the permission of this patentee. […] The court is of the opinion that the claim is too broad, and not warranted by law.

of the date of the publication.[253] A court would find infringement if all essential elements of the claimed invention are used by the alleged infringer, notwithstanding an omission or modification in non-essential elements. However, distinguishing in advance essential elements from non-essential elements is a challenging exercise.

The consequence of the tacit nature of knowledge in the software industry is that information is costly to transfer when not articulated in source code. The insufficiency of disclosure in patent applications combined with the U.S. doctrine of equivalents and its Canadian counterpart make it difficult for inventors and innovators in the software industry not only to overcome the obstacles resulting from patent thickets, but to be aware that they are inside a thicket to begin with. Inventors or innovators trying to assess whether they infringe patents inevitably incur significant transactions costs.

2.4.2. A Maze with Invisible Walls

Despite the issues of disclosure, a large number of software startups do not show interest to patent searches in their early stage.[254] Tellingly, most of these entrepreneurs ignore this step not because they are unaware of the problem of patent thickets, but exactly because they know about it. They acknowledge from the outset that they are non-deliberately infringing patents.[255] They do not worry either, for a simple reason: the patent thicket has no sensor that buzzes and notifies its patent-holder(s) the moment someone tries, willingly or not, to penetrate it. So long as the startup is merely developing a product without patent-

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[253] *Whirlpool*, *supra* note 127 at para 55.

[254] Graham et al, *supra* note 187 at 1321-22, echo that less than a quarter of software/internet startups surveyed in 2008 reported doing regular patent searches, a share of which did only after beginning product design; even for venture-backed software/internet startups, which apply more often for patents and for more patents, this number stays below 30%. In his qualitative survey, Mann, *supra* note 16 at 1004 reported that *no* representatives for software startups reported a patent search for prior art before launching product development.

[255] Mann, *ibid* at 1004-05.

holders being aware of its existence, the startup is usually unencumbered by the thicket in its endeavours.

Yet innovation implies commercialisation, and any patent-holder soon becomes aware of a competing firm's existence once this new competitor supplies its product(s) in the market. Most of the time, rational firms trying to move within a patent thicket look for a form or another of arrangement to minimise its effects.[256] Large patent portfolios are usually found in complex industries, like software.[257] Patents in this industry are relatively easy to circumvent (or alter-invent around) because of the multiplicity of possible input and output, opening many roads to accomplish the same or substitute functions.[258] Alter-inventing is socially beneficial to maximise invention and innovation because it expands the overall technical knowledge, so a context that opens the door for more alter-inventive practices is not much of a problem for SII.[259]

The advantage for a firm to build a large patent portfolio, however, lies in its negotiating leverage for licensing and cross-licensing agreements. Large firms are not expected to tackle one another, as they are often assuming that they do infringe each other's patents, and thus have little benefit from litigating one

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[256] Shapiro, *supra* note 227 at 126. Shapiro lists cross-licensing, patent pooling, standard setting, package licensing and litigation settlements as means to navigate through patent thickets. The line dividing patent pools from standard setting organisations is not clear-cut. For additional information on these two mechanisms, see respectively Richard Gilbert, "The Essentiality Test for Patent Pools" in Rochelle C Dreyfuss, Harry First and Diane L Zimmerman, eds, *Working Within the Boundaries of Intellectual Property: Innovation Policy for the Knowledge Society* (New York: Oxford University Press, 2010) 325 and Daniel A Crane, "Patent Pools, RAND Commitments, and the Problematics of Price Discrimination" in Rochelle C Dreyfuss, Harry First and Diane L Zimmerman, eds, *Working Within the Boundaries of Intellectual Property: Innovation Policy for the Knowledge Society* (New York: Oxford University Press, 2010) 371.

[257] See note 226 and accompanying text.

[258] Mann, *supra* note 16 at 978-79. See also David J Teece, "Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy" (1986) 15 Research Policy 285 at 287 for non-software-specific comments to the same effect.

[259] See note 195 and accompanying text.

another; instead, they often choose to cross-license.[260] Likewise, incumbent firms desire to preserve their freedom to operate, so they accept arrangements with startups that develop, and often patent, new inventions that can serve as valuable input in the large firm's technology. In exchange for cross-licensing their technology or paying a licensing revenue, new entrants are thus allowed to take place in the thicket.[261] Nevertheless, these practices do create transactions costs, and these costs hinder SII. Still, these disincentive effects need to be compared with beneficial aspects of patents, for instance, freedom to operate for startups.

Patent portfolios become an unequivocal threat for SII (i) when the portfolio is large enough to block entry into a market, (ii) when competitors pool their resources to such an effect or (iii) when a patent-holder or pool of patent-holders appropriate a technology design and hold it up.[262] It is important to differentiate these cases from some of the available means proposed by Shapiro to navigate within the patent thicket: cross-licensing, patent pooling, package licensing and standard (design) setting.[263] Walking in the footprints left by the toolbox metaphor, these corporate practices must themselves be understood as instrumental technologies:[264] they are somewhat neutral means that can be wielded to reach positive—solving the patent thicket conundrum—and negative—appropriating market segments—ends. Although these instruments have inherent

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[260] Mann, *supra* note 16 at 996, 1008. See, for instance, how Facebook and Yahoo settled their litigation by cross-licensing some of their respective patents, *supra* note 25. But see the slowly but surely growing tensions between Apple and Google: Susan Decker, "Google's Motorola Files New Patent Case Against Apple" *Bloomberg* (18 August 2012), online: Bloomberg <http://www.bloomberg.com/news/2012-08-17/google-s-motorola-files-new-patent-case-against-apple-at-itc.html>.

[261] Mann, *supra* note 16 at 1005-06, 1009; Shapiro, *supra* note 227 at 130.

[262] For the first two cases, see Boldrin & Levine, *supra* note 12 at 77-78. Their implying that patent pools *systematically* prevent entry of new participants and lead to an oligopolistic market exaggerates the actual risk. However, history—anti*trust* law, another significant legal tool to promote invention and innovation, has not been set up randomly—has proven that it *can* have this effect. For an historical review of antitrust with respect to patent pools, see Gilbert, *supra* note 256 at 329-34. For design hold-ups, see Shapiro, *ibid* at 124-26.

[263] Shapiro, *ibid* at 127-28.

[264] Darin Barney, *The Network Society* (Cambridge, UK: Polity Press, 2004) at 36-37. Instrumentalism has its shortcomings as a theory, but it satisfyingly describes this point, though oversimplified. Exploring the technological nature of legal tools will have to wait for its own enquiry.

features that dictate how they are used, the wielder and the context in which they are introduced are more pivotal.

In these three scenarios, the patent-holder or patent pool effectively succeeds in preventing entry of competitors that could have invented and innovated. As the software industry distinguishes itself from other industries by its almost-infinite array of potential input and output, it is probably less vulnerable to these torments than other sectors. Still, these scenarios' occurrence remains a possibility and one full of pitfalls. Therefore, it is crucial for SII that antitrust authorities are equipped to prevent them from happening. Conversely, Shapiro and other authors contend that unrestrained antitrust investigations and measures can have the adverse effect of exacerbating the upshots of patent thickets by limiting the instruments to overcome them.[265] Antitrust law needs to strike at a right balance.

2.5. Disembodiment

2.5.1. Distinguishing Tangibility and Embodiment

Having explored three aspects of abstract subject matter germane to SII inside the patent rationale, it is time to move to a fourth aspect brushed in the review of the *Shell Oil* decision.[266] Highlighting the difficulties of applying the patent exclusion for abstract subject matter and of determining what a disembodied idea's *practical application* is, it is plain that the abstract nature of algorithms, central to the question of computer programs' patent-eligibility, has confused many patent lawyers, students, judges and programmers alike in their analyses.

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[265] Shapiro, *supra* note 227 at 144. See also Gilbert, *supra* note 256 at 334-46.
[266] See Subsection 1.2.4.

Unlike algorithms, computer programs are not abstract. They are tangible, yet disembodied. This necessitates an important terminological review.

Tangible is defined as "perceptible by touch".[267] To make software, programmers insert some input instructions in source code, which is then assembled and/or compiled in object code to be read in binary language by a processor in order to produce an output. Tangibility in software takes place at the level of processors: binary language is processing through input voltage, which consequently has physical and tangible results.[268] So tangible are these results that it is technically possible to reverse-engineer this process, i.e., to disassemble/decompile the object code in order to obtain an approximation of the source code.[269]

Should one consider *abstract* to mean *intangible* or any of its linguistic equivalent, then one should conclude that computer programs are not abstract. In this thesis, abstract subject matter is understood as ideas or, in the U.S. Supreme Court's longer qualification, "mathematical formulae, scientific principles and abstract ideas".[270] From this point of view, although algorithms are abstract, their implementation in computer programs is not. Software is rather *disembodied*, in the word's basic linguistic meaning: not part of a physical body. Nonetheless, it is primordial, to understand the nature of a programmer's creativity and thus the root of SII, to recognise the primary position that abstract algorithms, ideas, occupy in computer programs. For all the reasons explored in this chapter, patent appropriation of algorithms is likely to hinder SII. In addition, computer

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[267] *The Oxford English Dictionary*, *sub verso* "tangible", online: Oxford Dictionaries <http://oxforddictionaries.com/definition/english/tangible>.

[268] Phillips, *supra* note 15 at 58-59; Plotkin, *supra* note176 at 37-41.

[269] See Cohen & Lemley, *supra* note 161 at 16, n 52.

[270] It is worth repeating that there are no reasons theoretically or legally to make a distinction between *abstract ideas* and *non-abstract ideas*. Some additional confusion may come from the technical meaning that *abstraction* receives in computer science. See Plotkin, *supra* note 176 at 38.

programs' numerical characteristics bring their own implications to SII, notably non-rivalry.

2.5.2. The Conundrum of Non-Rivalry

The non-rivalrous property of ideas is not consensually agreed upon. It is best summarised by a citation attributed to George Bernard Shaw: "If you have an apple and I have an apple and we exchange these apples then you and I will still each have one apple. But if you have an idea and I have an idea and we exchange these ideas, then each of us will have two ideas."[271] For non-rivalrous goods, "one person's consumption does not limit the ability of others to consume it."[272] As can be expected, the implications of non-rivalry are not that simple. A first required qualification is that two persons cannot use the same copy of the "inherently" non-rivalrous good simultaneously.[273] For instance, if X launches a web browser on Computer A, Y can hardly launch the same web browser on the same computer while X still uses it. If Y launches the same version of the web browser on Computer B, it will be another copy of the same software product that Y will use; only in using different copies is the computer program non-rivalrous.

Another necessary qualification relates to the value associated to the non-rivalrous knowledge. In some circumstances, particularly but not exclusively in relation with trade secrets, the use of information by someone, even if he has his own copy, can constrain the benefits that someone else was expecting to reap from the use of his own copy.[274] For instance, Software Programmer X develops a new and marketable technique to debug a default in Computer Program C. As

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[271] Kanye West must be thanked for bringing this citation to popular attention. See Shirley Halperin, "Kanye West Launches Twitter Rant About Fame, Fashion, Education, Jetsons" *The Hollywood Reporter* (4 January 2012), online: The Hollywood Reporter <http://www.hollywoodreporter.com/news/kanye-west-launches-twitter-tirade-rant-278186>.

[272] Boldrin & Levine, *supra* note 12 at 156.

[273] Phillips, *supra* note 15 at 64-65.

[274] *Ibid* at 65; Pires de Carvalho, *supra* note 8 at para 39.120.

long as he is the only one to hold this information, his market is wide, and he can demand a high price for his services. Nevertheless, the moment Y and Z learn and market the same technique, competition forces X to lower his tariff to stay in the market. X still owns a copy of that knowledge, but its value is not the same. One alternative to avoid this aspect of trade secrets is to patent this knowledge if possible, and thus temporarily appropriate its implementation.

For software users who have access to a computer and to internet or to a portable storage device, software can be copied infinitely at no costs. This, Douglas E. Phillips called the "zero-marginal-cost conundrum" (the "ZMC conundrum").[275] Marginal costs are the costs of producing each copy of a product after the first copy and the facilities to produce it are accounted.[276] Textbook economic theory has it that in the early stage of a product's commercialisation, limited capacity, market demand for the new product and lead time permit the innovative firm to charge a rent in excess of the marginal cost, enabling an innovator to recoup its initial costs.[277] However, in the long term of the product's commercialisation, it is expected that competition, drop of demand—depending on the type of product, consumers who already purchased it might switch to substitutes or alternatives or no longer demand it—and capacity expansions reduce rent sufficiently for the charged price to equal the marginal cost.[278]

While costs for distributing information are very low, possibly null with digital technologies, acquiring, creating or articulating that piece of information may be very costly. The moment a piece of information is disclosed once, unless appropriated by other means such as IP or digital rights management devices, its value drops significantly as it can then be reproduced at little or no costs.[279] When

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[275] Phillips, *ibid* at 65-66.
[276] Boldrin & Levine, *supra* note 12 at 131.
[277] *Ibid* at 159.
[278] *Ibid*.
[279] Kenneth J Arrow, "Economic Welfare and the Allocation of Resources for Invention" (1959) Rand Corporation at 9. As is exemplified by disclosure of patents for computer programs,

taking into consideration the ZMC conundrum, the possibility for the inventor or innovator to charge a rent in excess of the marginal cost (zero) is limited, a situation that significantly impairs his ability to recoup his initial investment.[280] On this point, there is rivalry. SII developed in the F/OSS community is probably not affected much by this aspect, but SII developed by programmers who intended to profit from their inventive and innovative efforts through an exclusionary scheme might find the risks too high for them to undertake such activities.

2.6. The Maximising Equilibrium of Innovation

It is striking, when looking at the different contentions regarding computer programs' patentability, how both polarised positions in the software environment are proven wrong by history and empirical data. On one side, some suggest that patents are necessary for the software industry to progress and for innovation to follow. However, it cannot be denied that the software industry thrived consistently and witnessed important technological leapfrogs even (or *especially*, depending on the ideological standpoint) in the period when patents for computer programs received little recognition—in the United States, before the 1980s.[281] On the other side, other proponents submit that patents in the software industry hinder SII. Yet patents for computer programs have been massively granted in the United States since *State Street* in 1998,[282] and the technological advances that have been invented and marketed in software, and the rise in product accessibility through price deflation that has been observed, at least up until the moment of drafting this thesis on a four-year-old laptop on the verge of obsolescence, cannot be denied either.

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even though reproducing or distributing information is cheap, significant resources might still be required to articulate and implement it.

280 Phillips, *supra* note 15 at 66.

281 Boldrin & Levine, *supra* note 12 at 16-17; Mann, *supra* note 16 at 968-69; Johns, *supra* note 202 at 473-96.

282 See note 150 above and accompanying text.

Actually, patents are but one of the available policy and legal tools to foster SII. The patent system has beneficial and detrimental effects that must be juxtaposed with the beneficial and detrimental effects of the other implemented instruments, individually and in their interactions. For instance, as a theoretical threat, patent thickets represent a serious problem to SII. When one observes closely the contractual subset of interactions that now prevail to penetrate thickets without getting scratched, however, one understands that patents likely have less impact than their opponents are ready to admit. Likewise, patents are theoretically an excellent instrument to profit from one's inventive ingenuity—and profits are a remarkable incentive to invent and innovate. Nevertheless, when one considers the much larger importance attributed by software firms to lead time and secrecy to capture financial returns, the role of patents for SII is blemished. On the one element for which the two polarised camps agree—that the patent system has major effects on SII—this thesis shows them off track.

Therefore, it was important to analyse the core of the interaction between the patent rationale and software technology: abstraction. The review of pre-emption, the building-block structure of software invention, the effects of patent thickets in the software industry and disembodiment highlight a set of elements that cohere with the patent rationale and that are worthy of consideration when identifying and assessing available instruments to stimulate SII:

- Appropriation of abstract subject matter leads to their pre-emption. The software industry is particularly vulnerable to this as computers programs are made of algorithms, whose pre-emption could block market entry to software inventors and innovators, increase their transaction costs and/or reduce their expected benefits.
- The ethos prevalent in part of the software community that software development as part of scientific activities belongs to the public

domain is one that stems from long-lasting historical roots. This reality deserves to be taken into account when designing new policy and legal tools to stimulate SII.

- Software is a complex technological field, constituted of a wide array of input, but also one that has the potential to create an almost-infinite array of output. Understanding the building-block structure of this technology, and how one product's output equates to another's input, is primordial to understand SII.
- The knowledge that is mostly prevalent in the software industry is tacit know-how. It is best transmitted in the manner of a master-apprentice relationship. The software industry, with its peculiar use of programming languages, has an additional, intrinsic instrument to articulate its tacit knowledge: source code. This articulation is necessary to share technical knowledge in the field, a prerequisite to kindle SII.
- If rendering technical knowledge public is important to maximise SII in the long run, as is assumed in the patent rationale, the patent system's rules of disclosure for computer programs, fulfilled by disclosing tacit information on the patented software function, are far from optimal.
- The potentiality of a firm or a pool of firms to appropriate a whole industry segment through patents or design hold-up is probably less likely in the software industry than in other complex industries because of the almost-infinite array of input and output in software technology, but it is a startling threat, and antitrust authorities should remain alert to forestall its occurrence.
- The ZMC conundrum presents a serious concern to software inventors and innovators relying on an exclusionary scheme. Without effective guarantees to reap the fruits of their inventive and innovative activities, these programmers might find that their risks dwarf their profit

expectations. In these circumstances, additional incentive is welcome, the patent system being one.

Having reached these conclusions, two questions remain to complete this thesis' enquiry. First, what are the pragmatic international law restrictions to the measures available to policy makers who wish to adopt policy and legal tools to stimulate SII? Second, after having identified these international law limitations and taking the aforementioned elements as assessment criteria, what instruments are consequentially efficient to foster SII? These questions are the subject of the next, and final, chapter.

There is one tool, however, for which these questions can be answered immediately: the standard for computer programs' patent-eligibility, by comparing the results of a standard equivalent to *Schlumberger*'s teachings of a careful analysis of applications' subject matter in contrast with *Shell Oil*'s broad interpretation of *art* as "learning or knowledge".[283] Pragmatically, both approaches are feasible, as has been demonstrated in Chapter 1's TRIPS analysis. Consequentially, both provide an efficient solution to the ZMC conundrum by permitting appropriation of some software functions. However, *art* as "learning or knowledge" is such a broad standard that it is likely to lead to patent thicket appropriation of whole market segments, to pave the way for pre-emption of building-block input in the industry and to contrast sharply with the communal imperative. These effects are also possible but less likely under the *Schlumberger* standard. Therefore, the *Schlumberger* approach to patent-eligibility is more likely to stimulate SII than a patent-eligibility standard inspired by the *Shell Oil* decision.

[283] See Section 1.2 above.

Chapter 3

Stimulating Software Invention and Innovation within the TRIPS Superstructure

Before addressing measures that might spur SII and their pragmatic implementation, it would be wise to deepen the thoughts left at the end of the previous chapter by sparing a few words on one measure proposed by some: excluding computer programs altogether from patent-eligibility. This option is probably permitted by the international legal superstructure.[284] A certain number of actors question the actual efficacy of the patent system to spur inventive and innovative activities in general,[285] for computer programs in particular.[286] If their contention is found accurate, it implies that the measures addressed herein are only subsidiarily beneficial—as a "second-best" set of measures to fuel SII—behind dispensing with computer programs' patentability. Consequently, responding to this contention, albeit succinctly, turns into a prerequisite to appreciate the significance of this thesis.

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[284] See Section 1.1 above. Although our pragmatic component focuses on legal implications, it is not exhausted by legal considerations. In his study of the (re-)introduction of a patent system in the Netherlands and in Switzerland in the early 1900s, Schiff, *supra* note 44 at 77-81, 89-90 and 125-26, highlights the political role that the then *Paris Convention* played in adding pressure for these countries to adhere to the "rules of the game", as they were set out in international IP agreements. This political role in fencing the pragmatic patent law playground still applies today.

[285] See, e.g., Boldrin & Levine, *supra* note 12 and Torrance & Tomlinson, *supra* note 31. This view has nothing new. See Fritz Machlup & Edith Penrose, "The Patent Controversy in the Nineteenth Century" (1950) X The Journal of Economic History 1.

[286] See, e.g., Stallman, *supra* note 239 at 100-11 and James Bessen & Robert M Hunt, "An Empirical Look at Software Patents" (2004) Federal Reserve Bank of Philadelphia Working Paper 03-17/R (note that this article precedes and slightly differs from the Bessen & Hunt article in *supra* note 13; in this one, Bessen and Hunt advance that the rise in patent propensity for computer programs in the United States in the 1990s is negatively correlated to innovation expenditures).

Critiques against the alleged need of patents to stimulate SII originate mainly from either or both the F/OSS movement and pro-competition economics.[287] Their objection is mostly two-pronged: first, they raise most of the issues addressed in Chapter 2—the communal imperative, the risks of pre-emption and patent thickets and the complex nature of software technology. Second, they list marvellous F/OSS applications produced without relying on patents.[288] Sometimes, they are proven technically superior to their patented alternatives or substitutes. The former reasons, as the whole of this thesis suggests, are insufficient to infer that excluding computer programs from patentability is necessary or even desirable because others means exist to mitigate patents' negative effects while still pursuing the system's utilitarian purpose of maximising SII. More particularly, these critiques do not answer satisfactorily to the ZMC conundrum, to which patents are an efficient solution.

As for the F/OSS argument, it self-contradicts itself: the fact that brilliant free and open software could be produced "despite" patents and IP barriers in general shows that patents do not impede SII as much as these critics claim. In fact, many of these software programs were developed subsequently to the wave of patents granted to computer programs and business methods by the USPTO in the 1990s. This finding weakens a counter-argument to the effect that the early proliferation of software technology was possible because patents were rarely granted to computer programs prior to the 1990s.[289] Moreover, the contention obliterates the

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[287] Critiques of the patent system in general, not only for computer programs, usually rely on a more economically complex reasoning that is not addressed in this thesis. For an overview, see Machlup & Penrose, *supra* note 285. The following comments respond to the limited critique against patents for computer programs.

[288] Examples of software applications that are free and/or open, or have been at some stage of their exploitation, and which obtained widespread recognition and adoption, include Android, Apache, BitTorrent, Java, Libre/Open Office, Linux, Mozilla Firefox, Mozilla Thunderbird, MySQL, Ubuntu, VideoLAN, WordPress and everybody's dear friend the World Wide Web. For the particular distinction between free and open software, see Phillips, *supra* note 15 at 111-20, 147-51. For the case of the World Wide Web, dedication to the public domain is usually considered as a permissive open practice.

[289] *Weakens*, not *defeats*. The upcoming point founded on history and empiricism, initially outlined in the Introduction, on the difficulty to take a definite position against patents goes also in the other direction. For the argument this sentence answers to, see, e.g., Boldrin &

obvious: innumerable software programs were produced through an exclusionary scheme for which patents might have directly or indirectly acted as an impetus. It is possible that the technology's maturation, its intensification in industrial applications and the widening of its commercial market base to lay users made patent appropriation more attractive to kindle SII around this period. One can only speculate at best whether these programs would have been invented and innovated absent the availability of the exclusionary scheme.[290]

This position does not affirm that the patent system succeeds in maximising SII output, nor that it does not. As mentioned several times, this thesis contends that though empirical, historical and theoretical arguments can be presented in both directions, until someone invents (and patents?) a crystal ball to shed light on the uncertainty surrounding the alternative technological development that would have occurred, the exercise for interested parties of "choosing a camp" and sticking to it constitutes a risky bet. This position has nothing novel. It rather reformulates and adapts to software technology a famous statement by Fritz Machlup on the social benefits of the patent system:

> No economist, on the basis of the present knowledge, could possibly state with certainty that the patent system, as it now operates, confers a net benefit or a net loss upon society. The best he can do is to state assumptions and make guesses about the extent to which reality corresponds to these assumptions. [...] If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it.[291]

Levine, *supra* note 12 at 16, who point at 1981, the year the *Diehr* decision came out, as the key date, not to the 1990s as is preferred herein.

[290] For further discussion on the F/OSS movement, the exclusionary scheme and their interactions, see Subsection 3.2.5 below.

[291] Fritz Machlup, *An Economic Review of the Patent System* (Washington, DC: US Government Printing Office, 1958) at 79-80. Often unmentioned by those quoting Machlup, he then specifies that this conclusion must not be understood generally, but only for countries like the

In any case, invention and innovation are intricate activities, and encouraging them entails a discussion that must cover a much wider ground than Patentland or IP in general. Nevertheless, patents are part of the territory, and standing on the fence of computer programs' patentability, as Chapter 2 shows, has provided a strategic viewpoint to survey the "impetus country" of SII. Indeed, expressing that excluding computer programs from patent-eligibility is probably unnecessary does not mean that patents' concerns for stimulating SII should be ignored, as the comparison above of the *Schlumberger* and *Shell Oil* standards reminds us. On the contrary, it asks for a more careful and closer examination of the different policy and industry—firms and individuals—decisions that affect SII.

For these reasons, this final chapter aims at identifying policy and managerial decisions that *can* and *should* be contemplated to kindle SII. *Can* refers to pragmatic considerations: how does the international law superstructure, namely TRIPS for this investigation, relate with these decisions and prohibit, constrain or evoke their applicability? On this point, TRIPS' provisions are reviewed on five themes: (i) enjoyability of patent rights without discrimination, (ii) exceptions, (iii) patents' revocation, (iv) trade secrets; and (v) control of anti-competitive practices in contractual licenses. Along this review, two strictly patent-related aspects that could potentially promote SII are particularly analysed: working requirements and revocation. *Should* points at consequential considerations: assessed by reference to the elements elaborated in Chapter 2, how do these measures act upon maximising inventive and innovative endeavours in the software industry? Worded differently, since these elements cohere with patents' utilitarian rationale, how do they work in reaching for software technology the same purpose set forth by the patent system? Of course, such an analysis could go on forever, so it has been constrained to six instruments: (i) reverse-engineering, (ii) path dependency, (iii) covenants not to compete, (iv) network configuration,

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United States; for other countries, country-specific analyses should be conducted. This caveat deserves being echoed, especially for developing countries.

(v) patent arrangements and their control and (vi) competition between F/OSS and the exclusionary scheme. Some of these measures relate to patents while others do not. Some relate to public policy while others concern private management. Again, these effects result from the standpoint obtained by straddling the fence.

3.1. Resuming a Journey in the TRIPS Superstructure

TRIPS was examined earlier in relation with its implications for computer programs' patent-eligibility in Members' national law.[292] TRIPS, a multilateral agreement within the WTO that purports to facilitate legitimate trade between WTO Members by reducing barriers that IP might erect, sets out minimum standards that Members must give effect to in their law. Should a Member not comply with this superstructure, another Member can submit the situation to a dispute settlement process and, potentially, obtain compensation until the non-complying Member modifies its legislation and/or practice in conformity with TRIPS' provisions. For this reason, unlike other components of the international law superstructure for IP, TRIPS can be enforced, and so it plays a role that specially affects the tools that Members and their nationals can rely on to fuel SII.

3.1.1. No Discrimination

TRIPS' Article 27.1 constitutes a general non-discrimination proviso with respect to the availability and enjoyability of patent rights. Though it appears that Article 27.1, read in conjunction with Article 1.1, does not impose Members to extend patentability to computer programs, when Members do, it commands that "patent rights [are] enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced."

[292] See Section 1.1 above.

Discrimination was defined as the "results of the *unjustified* imposition of differentially disadvantageous treatment."[293] It can be found *de jure*—an explicit legislative differential treatment—or *de facto*—an identical legal treatment that causes differentially disadvantageous effects.[294] Applying the definition *a contrario*, a *justified* imposition of differentially disadvantageous treatment or a differential treatment with neutral effects could be found non-discriminatory.[295] As for patent rights' *enjoyability*, it includes but is not limited to Article 28 of TRIPS, which lists the exclusive rights that must be conferred by a patent, and to other provisions germane to the scope of patent rights. Article 27.1 covers three distinct forms of discrimination.

First, non-discrimination in relation with the place of invention equates, among other effects, to inserting the national treatment and most-favoured nation principles within enjoyability of patent rights.[296] If inventors from Member X enjoy particular rights in theirs or in Member Y's patent system, it is discriminating for inventors from other Members not to. Besides, the provision is broader in its scope than the national treatment or most-favoured nation principles: it also encompasses sub-national and supra-national rights that could be conferred to patentees. An example of the sub-national application can be found in industrial clusters. As discussed in greater length later, clusters are a pertinent way for a government to build an industry by gathering its actors inside a specific geographical area. Briefly, software industrial districts are recognised as

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[293] *Canada—Patent Protection of Pharmaceutical Products (Complaint by the European Communities)* (2000), WTO Doc WT/DS114/R, at 7.94 (Panel Report), online: WTO <http://docsonline.wto.org> [emphasis added] [*Canada—Patent Protection of Pharmaceutical Products*].

[294] *Canada—Patent Protection of Pharmaceutical Products*, *ibid*.

[295] Pires de Carvalho, *supra* note 8 at paras 27.7-27.8. Pires de Carvalho's argument is well-constructed. For instance, he exposes situations where not differentiating a treatment *de jure* could be differentially disadvantageous (discriminating) *de facto*. Nevertheless, he highlights inconsistencies in the *Canada—Patent Protection of Pharmaceutical Products* Panel decision which make it nebulous whether this position would be confirmed. Anyhow, the present discussion of *discrimination* is broad enough not to require in-depth analysis of differential treatment that is non-discriminatory and vice-versa, although comments on this question are insertedhere and there in footnotes.

[296] For a summary review of the national treatment and most-favoured nation principles, see TRIPS, *supra* note 11 at arts 3-4 and Subsection 1.1.1 above.

an efficient industrial network organisation for tacit knowledge to be articulated and entrepreneurial experience to be shared, which in turn are expected to lead to inventive and innovative benefits. To encourage the growth of software industrial clusters, governments could be tempted to adapt in different ways patent rights of products or processes invented in specific districts. However, this policy would discriminate with patent rights of inventions generated elsewhere, and so would probably violate Article 27.1.

This rule similarly applies to supra-national patent rights, which primarily arise from trade agreements. When a Member expands patent rights to nationals from another country—member or not of the WTO—as a concession in bilateral or plurilateral trade agreements, these more advantageous rights must be extended to nationals of all WTO Members, as a result of the most-favoured nation principle of Article 4 and the non-discrimination proviso. Whether sub-national, national or supra-national, if patent rights are adapted to satisfy policies that relate to the place a product or process has been invented, these adjustments must extend to all patent rights[297] and, of course, comply with other TRIPS minimum standards.

Second, patent rights cannot be modulated in a discriminatory manner on the basis of their field of technology. Computer or software technologies, obviously, represent separate fields, and so national patent rules that would set unjustifiably different standards or provisions regarding the enjoyability of patent rights for software or computer-related inventions would conflict with Article 27.1.

For software, a fair deal of patent reforms have been proposed to adapt patent rights to this technology's particular nature. For instance, following the controversy over the one-click patent grant in the United States at the end of the

[297] Unless, possibly, if they can be argued as necessary differentiations to prevent discrimination; see *supra*, note 295.

1990s, Amazon founder Jeff Bezos suggested that the term of patent rights for computer programs and business methods should be limited to three to five years.[298] The idea behind this proposal is to take into consideration the fast-evolving innovative rhythm in the software industry, where technological obsolescence and functional maturity appear more quickly than in other industries. In addition to violating TRIPS' Article 33, which requires that "[t]he term of protection available shall not end before the expiration of a period of twenty years counted from the filing date", this proposal, as others that suggest to take into account the peculiar nature of software technology, is very likely to constitute a discriminatory differential treatment with respect to the field of technology.[299] If so, it would breach Article 27.1.

Third, patents rights cannot discriminate whether a product is imported or locally produced. This proviso effectively disallows Members from adopting a *local working requirement*. To benefit from their patent rights under a *working requirement*, patentees can be required by Members to make their patented product available in the market and/or to substantially fill the market's demand. Paragraph 5(A)(2) of the *Paris Convention*, incorporated into TRIPS through its own Article 2.1, even qualifies *failure to work* as an *abuse* of the exercise of patent rights. A *local* working requirement brings the additional obligation that the patented good or service be "worked" *within* the Member's territory. Working requirements are still permitted by TRIPS, although restrained in a number of ways; however, since *local* working requirements discriminate between whether

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[298] Jeff Bezos, "An Open Letter from Jeff Bezos on the Subject of Patents" *O'Reilly* (9 March 2000), online: O'Reilly <http://oreilly.com/news/amazon_patents.html>. Bezos recently iterated his call for patent reform; see Day, *supra* note 22.

[299] Ignoring Article 33 of TRIPS, could one argue that this differential treatment *de jure* is required to prevent discriminatory *de facto* effects? Cynically, the answer is yes, as almost anything can be argued in legal practice. Nonetheless, this argument is not likely to succeed. Granting identical patent terms to software inventions and, say, toasters, is not discriminatory in the term of the patent rights: in both cases, patentees enjoy the same effective term of protection. Admitted, the indirect effects on their overall industry will not be the same because of these industries' respective technological growth rates, but is this discriminatory with respect to the actual enjoyability of patent rights in their duration, *de jure* or *de facto*? To answer yes would require a few mental contortions.

products are imported or locally produced, they conflict with Article 27.1. For software technology, this upshot is probably a divine blessing, as it avoids, at least in the context of TRIPS' patent provisions, asking the convoluted question of when and where software is produced in the context of cyberspace.

A working requirement discrimination regarding the *availability* of patent rights violates TRIPS. The first sentence of Article 27.1 requires that "patents shall be available for any inventions […] provided that they are new, involve an inventive step and are capable of industrial application." A patent right must therefore be available for any new, non-obvious and useful invention, even if it is not worked.

Nonetheless, TRIPS is silent about discrimination in patent rights' enjoyability between worked and unworked inventions. In the same vein, Article 33, which sets a minimum term of patent protection, also links it to its *availability*, not its *enjoyability*. *Available* has been defined as "available as a matter of legal right and certainty".[300] Although the rights that a patent confers to its patent owner under Article 28, worded in closed terms and thus unconditionally conferred once a patent is granted, constitute a wide part of how patents are to be enjoyed, they do not exhaust the concept. Abiding by these provisions, there are numerous ways for a Member to introduce a form of working requirement without violating TRIPS nor having to avail oneself of the exceptions set forth in Articles 30 and 31. One is expounded: enforceability.

Being conferred a patent right and being able to enforce it against infringers are two distinct aspects of a right. Enforceability, the ability to compel respect for one's rights against others, usually in courts, relates to patent rights' enjoyability, not to their availability. Therefore, the major TRIPS limitation to a policy

[300] See *Canada—Term of Patent Protection*, *supra* note 69 at para 90.

permitting patent rights' enforceability only to inventions that are worked is Article 41.2: enforcement procedures must be fair and equitable.

Supplying inventive products in a Member's market is a helpful, if not prerequisite, way to enhance technical knowledge in these inventions' fields. Accessing and using new inventions increase the knowledge and technical skills of an industry's workers, provide them with new technical tools and can spark their inventive creativity. These effects follow from the second step of the Usherian model of invention, where inventors review the elements that can be used to gratify their needs. A patentee not working its invention in a territory, whether directly or through licenses, locally produced or imported, deprives workers in the field and society of the knowledge, and thus benefits, accruing from an invention being worked. Under such circumstances, some Members could deem it desirable not to allow patent enforcement against infringers unless patented inventions are worked. Of course, this type of policy, to be fair and equitable, must not discriminate between different fields of technology, should take into account the time required for patentees to build appropriate facilities and distribution lines,[301] and, following TRIPS' Article 41.3, give patentees the opportunity to be heard. With respect to the time criterion, as it is specifically taken account of in Paragraph 5(A)(4) of the *Paris Convention* regarding applications for compulsory licenses[302] on the ground of failure to work or insufficient working, it would be incoherent to discard it for other responses to insufficient working.

In the software industry, this situation can arise when a firm does not incorporate a patented software function into its products distributed in the

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[301] On the specific aspect of taking account of the time required to build appropriate facilities and distribution lines to work an invention, here is an interesting case of a situation where *de jure* differentiation may be necessary to avoid *de facto* discrimination. As the time required for these activities fluctuates according to each industry's specificities, a uniform *de jure* standard applying to all industries alike could result, *de facto*, in some industries' patentees enjoying longer enforcement periods than patentees from other industries.

[302] The question of compulsory, or non-voluntary, licenses is examined below.

Member's market, nor does it make the patented invention available at reasonable royalty fees for other firms to license and use it in their products. Policies that restrict these patents' enforceability should a competitor infringe them would push patentees to work their patented inventions. As the patent right would not be extinguished but merely unenforceable during unworked periods, it would follow from this scenario that once inventions are worked, patentees be permitted to enforce them for prior unworked periods; yet, for the measure to keep its stimulus for working inventions and to be fair against competitors, remedies for unworked periods could be limited to what a reasonable license fee would have been. The access to and use of these inventions are likely to increase the knowledge and skills of the field's workers, bring new tools at their disposal and inspire inventive ideas. To this effect, a working requirement reflects the building-block structure of the inventive process, particularly for complex technologies like software. Moreover, making patented software functions accessible for workers in the field to use them in a marketed computer application is a good way to negate some of the difficulties relating to their tacit disclosure because running the application helps to understand its functions' inventive insight. Therefore, SII are likely to be stimulated by a working requirement policy.

3.1.2. Where There Is a Rule, Exceptions Lurk Around

Legal (and non-legal) rules have a propensity for exceptions. TRIPS' Article 28 is not an exception to this rule! Articles 30 and 31 of TRIPS respectively set forth general and specific exceptions to the patent rights conferred by Article 28. Therefore, for a Member to set out exceptions to these exclusive rights, they must fit in either of these two provisions. Before taking a look at them, it is important to note that the three forms of discrimination regarding patent rights' enjoyability

remain valid within these exceptions.[303] As an example, an exception, even if it follows Articles 30 and/or 31, could not apply only to software inventions, or inversely apply to all inventions but software, because it would discriminate patent rights' enjoyability with respect to the field of technology.

Article 30 exceptions need to comply with three cumulative conditions, which are easily identifiable in its text:

> Members may provide [i] *limited* exceptions to the exclusive rights conferred by a patent, provided that such exceptions [ii] do not unreasonably conflict with a normal exploitation of the patent and [iii] do not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties.[304]

Whereas the first condition is at a legal level, the other two relate to economic considerations.[305]

The condition for the exception to be limited has been interpreted as meaning 'narrow in scope', resulting only in a small diminution of rights.[306] For the second condition, the *normal exploitation of a patent* was interpreted as excluding competition that could detract significantly the economic return that the patentee anticipates obtaining from its patent.[307] Rightly, Pires de Carvalho argues that this interpretation is wrong. Article 30 refers not to the exploitation of the *invention*, but to "the normal exploitation of the *patent*", which does not necessarily require to exclude competitors,[308] as shown by the multifaceted functions of patents,

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303 *Canada—Patent Protection of Pharmaceutical Products*, *supra* note 293 at para 7.91. Regarding patent rights' availability, paragraphs 2 and 3 of TRIPS' Article 27 list a number of exceptions. Some of them were briefly discussed in Chapter 1, reaching the conclusion that they have no effect regarding computer programs' patentability. See Subsection 1.1.2 above.

304 TRIPS, *supra* note 11 at art 30 [emphasis added]. See *Canada—Patent Protection of Pharmaceutical Products*, *ibid* at para 7.20.

305 Pires de Carvalho, *supra* note 8 at para 30.4; Gervais, *supra* note 58 at para 2.398.

306 *Canada—Patent Protection of Pharmaceutical Products*, *supra* note 293 at para 7.30.

307 *Ibid* at para 7.55.

308 Pires de Carvalho, *supra* note 8 at para 30.7.

particularly in the software industry—patent pools, standard setting and cross-licenses, among others. These practices should be considered as part of a normal patent exploitation, distinguishing *normal exploitation* from the concept of market exclusivity. As for the third condition, *legitimate interests* are interests "supported by relevant public policies or other social norms."[309] Patentees' legitimate interests are thus shaped by the bargain theory as the patent system's public policy. In addition, the allusion to third parties' legitimate interests wisely alludes to a "balanced" test.[310] In the context of the patent rationale, the interests of society—a third party—ought to be considered.

If a Member authorises a use that impedes on the rights conferred by patents and that cannot fall under the exceptions permitted by Article 30, it must comply with the more limited Article 31 in order not to constitute a TRIPS violation.[311] Article 31 enumerates a diffuse list of conditions that need to be met in order for the exception to be allowed. In common parlance, exceptions authorised under Article 31 are habitually called *compulsory* or *non-voluntary licenses*.[312]

Other than understanding the particular position and role of Article 31 inside TRIPS' structure, it is not necessary in the course of this thesis to review its

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309 *Canada—Patent Protection of Pharmaceutical Products*, *supra* note 293 at para 7.69.

310 Gervais, *supra* note 58 at para 2.399.

311 See TRIPS, *supra* note 11 at n 7. Gervais, *ibid* at para 2.396, argues that an exception that falls in the scope of both exceptions should have to respect Article 31 instead of Article 30 in order to follow the statute interpretation principle that specialised provisions take precedence over more general provisions. As other rules of interpretation discussed in Chapter 1, this rule merely creates a rebuttable presumption. Gervais' contention appears hardly reconcilable with the grammatical reading of Article 31's chapeau in conjunction with note 7 of TRIPS: "Where the law of a Member allows for a [use other than that allowed under Article 30] […], the following provisions shall be respected: […]." This plain grammatical reading of Article 31 expressly suggests that it does not overlap with the scope of Article 30, directly opposing Gervais' point. By this express wording, the interpretation rule that specialised provisions should take precedence over general provisions is not breached as Article 31, read jointly with note 7, explicitly provides otherwise.
Article 73 of TRIPS also sets out general exceptions for security interests. As their effects on SII are particularly limited, they are not discussed herein.

312 See Pires de Carvalho, *supra* note 8 at 427, n 1014 for a discussion over the two terms' meanings. As *non-voluntary* is itself used in TRIPS' Article 37.2. *non-voluntary licenses* is preferred herein.

specific conditions. Some are mentioned when later discussing the effects of patent thickets and contractual practices to reduce thickets' hindrance of SII.[313] Article 30 is mostly elaborated while analysing reverse-engineering.[314] There is one exception that has not been covered so far: revocation.

3.1.3. Revocation and its Sensitivities

For centuries, the protection of property rights has been regarded as one of the state's primary missions.[315] In western states, laws on expropriation are usually very strict, and their exercise by governments inevitably foments controversies. Expropriation destroys proprietors' expectations about their assets and what they planned to achieve with them. These expectations are primordial in the capitalist economy: if property can be confiscated at any time, the risks of investing one's resources (capital) increase. If one's house has good chances to be expropriated, one is not likely to invest the necessary time, physical efforts and money to keep it in good condition. Although it conflicts with the state's mission of protecting property rights, expropriation may be necessary to fulfill its other missions. As patents have been included into the label of intellectual *property*, the different sensitivities about expropriation are transposed in patents' revocation. However, one should not forget that the patent system is a statutory creature, a legal tool to stimulate inventive and innovative endeavours. This state mission at the core of the patent rationale outweighs both in logical order and in importance the one of protecting this form of property.[316]

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313 See Subsection 3.2.4 below.

314 See Subsection 3.2.1 below.

315 One seminal source for this reasoning is John Locke; see *Two Treatises of Government*, 3rd ed by Peter Laslett (Cambridge: Cambridge University Press, 1988), at 302 and 330-31.

316 There is no intention or need herein to enter into the debate of whether copyright, patents and other regimes known under the label of *intellectual property* deserve this qualification, hence the neutral formulation pervasive in this thesis on this question.

When a patent is revoked, the exclusive rights conferred to its owner are terminated. As the invention has been previously disclosed in the specification, it becomes public, open for anybody to use without any cost or limitation. TRIPS' Article 32 provides that judicial review must be available for any decision to revoke a patent right. Obviously, the availability of judicial review has little to do with stimulating SII or not, so there is not much interest in this thesis for what Article 32 says. What Article 32 does not say, however, is stunning. On one of the most potentially invasive patent issues, TRIPS is basically silent. Earlier drafting efforts aimed at restricting grounds for revocation, but these versions were ultimately left out.[317] Members and pundits, as can be expected, are divided on the ways, if any, by which TRIPS limits Members in revoking patents.[318]

Except for TRIPS' Article 32, the only TRIPS limitations to revocation originate from Article 2.1's obligation to comply with Paragraphs 5(A)(3) and 5*bis*(1) of the *Paris Convention*. Whereas Paragraph 5*bis*(1) provides for a 6-month period of grace for patent revocations involving the non-payment of maintenance fees, Paragraph 5(A)(3) prevents revocation when non-voluntary licenses would have been sufficient to remedy abuses that result from the exercise of patent rights, as well as in the first two years following the grant of a non-voluntary license for a patent. Whether revocation on the ground of public interest

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[317] Gervais, *supra* note 58 at para 2.424.

[318] *Ibid*; see also Pires de Carvalho, *supra* note 8 at paras 32.4-32.12. Particularly relevant in this discussion is the question of non-violation and situation complaints at the WTO, which target situations or national practices that nullify or impair benefits accruing from a WTO agreement while not formally violating the agreement. Patents' revocation unequivocally falls in this category. TRIPS' Article 64 provided for a transitional period of five years starting from 1 January 1995—the date of entry into force of the *Agreement Establishing the World Trade Organization*, *supra* note 57—during which these complaints could not be heard in the WTO dispute settlement process. Meanwhile, the TRIPS Council was to submit recommendations regarding the acceptable scope and modalities for these complaints. Due to Members' opposing views on this issue, the TRIPS Council has not yet agreed on these recommendations, leading to a protracted moratorium. The current extension of the moratorium is valid up to 2013—see *Decision on TRIPS Non-Violation and Situation Complaints*, WTO Doc WT/L/842 (19 December 2011). As observers do not anticipate an agreement by Members on the scope and modalities of non-violation and situation complaints for TRIPS, this issue is not taken into account herein, assuming that the moratorium will remain in force in the short, and probably middle, term(s).

is permitted within this framework is probably the most debated of all concerns related to patent revocation. Because of this vacuum, taking a legal position here on this question is moot; the interest rather lies in identifying the circumstances under which public interest—understood, following the utilitarian patent rationale theory, as the maximisation of SII—could call for revoking a patent for a computer program.

To answer this question, one needs to remember the bargain theory of the patent rationale: an incentive to publicly disclose new, non-obvious and useful inventions in exchange for the invention's exclusive use. It is undebated that if an invention does not respect one of these four conditions—novelty, non-obviousness, utility and proper disclosure—it can, and should, be revoked. The ground for these revocations is that the patent should never have been granted in the first place since the patent does not comply with its legal requirements.[319] Instead, revocation for public interest involves patents that have been appropriately granted but that have, for some reason, either deleterious effects to subsequent inventive and innovative activities, or these patents could be more beneficial than they are to these activities without the exclusivity they grant. The textbook scenario is a patented software invention that is essential to a multitude of other SII—and the patentee not consenting to license.

The initial outline of the sensitivities regarding expropriation suggests that establishing whether a revocation results in greater beneficial inventive and innovative activities or not is an intricate calculation. Costs and benefits for revocation can be analysed from particular and general perspectives, and both ought to be considered in deciding whether a particular patent should be revoked for public interest. The particular impact relates to the case that is reviewed: the beneficial inventive and innovative endeavours that would be produced sooner than if the patent was to remain valid and, if the Member's revocation policy

[319] In Canada, see *Teva*, *supra* note 137 for a case of patent revocation for improper disclosure for Viagra.

provides for indemnification, the costs of indemnifying the patent holder. On the negative ramifications, one must mostly consider the disincentive effects on future inventors to disclose their inventions in the context of increasing risks of revocation, which in the long run harm the patent system's purpose of increasing the overall technical knowledge and amount and quality of inventions and innovations.

Three elements in this calculation deserve additional analysis: indemnification, justification and promptness. Whereas indemnification implies direct costs, it also mitigates the general costs by softening, though not nullifying, the effects of a potential revocation on inventors' incentive to disclose their invention in exchange for a patent. Similarly, allowing revocation only under specific justifications, publicly-known beforehand, erodes the risks as inventors would know them in advance and, from there, could decide not to patent or to adapt their practices as patentees in order not to see their patent revoked on these grounds. Last, in the context of the fast-evolving software technology, promptness of the revocation decision process has peculiar effects. To maximise the benefits of revocation in the context of software technology, the decision needs to be made promptly, but a fast decision-making process is also more likely to lead to inappropriate decisions and correlatively increase disincentives. In any case, Article 32 mandates the availability of judicial review to this process, which is likely to prolong it. An appropriate equilibrium between promptness and diligence is desirable.

Even though other factors would need to be considered in revocation's decision-making process, it is not necessary to delve further.[320] The point herein is

[320] For instance, the public good deriving from a better access to patented software components that, for any reason, are likely to be more easily accessible absent the patent. In some circumstances, for instance, educational or medical devices incorporating patented computer programs, in comparison with mere commercial applications, the public good extracted from their use is probably higher. In this example, students or patients find additional social benefits distinguishable from those to subsequent inventors. Yet, the decision-making process should

that although there are surely cases in which the end-result would favour revoking a patent, policies to this effect should be carefully implemented, and the revocation process ought to embrace both particular and general upshots into the decision-making equation. In any case, the possibility of using less overreaching measures, such as non-voluntary licenses, should also be taken into account. It is now time to move to non-patent TRIPS provisions that can also affect SII.

3.1.4. An Unexplored Ground So Far: Trade Secrets

The patent system purports to encourage inventors to disclose their work to increase publicly available technical knowledge and thence inventive and innovative activities. The main theoretical and practical alternative is secrecy. By straddling the fence of computer programs' patentability, this alternative constantly lingers in the backdrop of this undertaking, but its legal regime had not been examined yet. Trade secret protection has beneficial and detrimental effects to inventive and innovative activities. When inventors and innovators have some means to keep their works secret, they expect being able to exploit their works commercially. These expectations can translate in an impetus to invent or innovate. Conversely, keeping the invention or innovation secret renders it difficult for others to build on it, and/or forces them to re-invent it. Re-invention, unlike alter-invention, is not socially desirable because it adds nothing to the common technical knowledge—no new product or process is created, nor any new way to make an invention.[321] Of course, alter-invention stays available. It is possible that a competitor trying to recreate the secret invention will invent around it. Still, the invention or innovation being secret, it is probable that even its existence remains unknown, making less likely the scenario of an inventor alter-

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conversely consider the particularly desirable aspect of these inventions into the indirect disincentive effects. A disincentive to invent and innovate more socially-beneficial inventions has increasing negative effects compared to other disincentives. These issues are paralleled in the hot debate of affordable access to medical drugs in some regions of the world.

[321] Pires de Carvalho, *supra* note 8 at n 95.

inventing while trying to recreate a product. In addition, it remains that important resources would be spent in a way that simply recreates the invention or innovation, resources that add nothing to common technical knowledge. Governments and industry actors find both advantages and disadvantages to trade secret protection.

Following TRIPS' Article 39.2, protection must be available for any undisclosed information that fulfills six cumulative conditions:

> Natural and legal persons shall have the possibility of preventing information [i] lawfully within their control [ii] from being disclosed to, acquired by, or used by others without their consent [iii] in a manner contrary to honest commercial practices[10] so long as such information:
>
> (a) [iv] is secret in the sense that it is not, as a body or in the precise configuration and assembly of its components, generally known among or readily accessible to persons within the circles that normally deal with the kind of information in question;
>
> (b) [v] has commercial value because it is secret; and
>
> (c) [vi] has been subject to reasonable steps under the circumstances, by the person lawfully in control of the information, to keep it secret.
>
> [10] For the purpose of this provision, 'a manner contrary to honest commercial practices' shall mean at least practices such as breach of contract, breach of confidence and inducement to breach, and includes the acquisition of undisclosed information by third parties who knew, or were grossly negligent in failing to know, that such practices were involved in the acquisition.[322]

The last three conditions reflect the traditional legal conditions for trade secrets to receive legal protection: they are not generally known or accessible to actors in the industry, economic benefits can be extracted from them being

[322] [Emphasis added].

unknown, and their holders make reasonable efforts to preserve their secrecy.[323] These three conditions reflect the social benefits in inventive and innovative activities that can flow from trade secret protection by creating a free space to operate around a piece of information, which can fuel inventive and innovative activities. They define the criteria that make information worthy of protection. By contrast, the first three conditions frame when this protection can be enforced. It is the third condition, dishonest commercial practices in the acquisition, disclosure or use, that has the most significance herein.

The knowledge that builds software technology is primarily made of know-how, skills. When source code is not accessible, this tacit knowledge is difficult to articulate, and thus is not easy for others to use.[324] Outside of source code, it is best transmitted through a master-apprentice relationship. Moreover, software technology is complex: it combines different elements of input to produce a new output, which in turn serves as input for other inventions and innovations. With this background, the transfer and articulation of tacit knowledge lie at the forefront of SII stimulation. This knowledge, however, can receive trade secret protection. In this context, the third condition of TRIPS' Article 39.2, dishonest commercial practices, becomes particularly relevant because it distinguishes between some ways to acquire, disclose and use information that Members can permit and others that they must disallow. In other words, it delineates ways of sharing and articulating information that Members are free to approve or not and others that they must forbid. There are obviously multiple roles that trade secret protection can play within the software industry, two of which are explored below: reverse-engineering and covenants not to compete in employment contracts.[325]

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[323] See, e.g., Gervais & Judge, *supra* note 86 at 871.
[324] See Subsection 2.4.1 above.
[325] See respectively Subsections 3.2.1 and 3.2.2 below.

3.1.5. Controlling Trusts

Software firms can interact with one another to mitigate the negative effects that patent thickets can have in their industry, notably cross-licensing, patent pooling and standard setting. As discussed earlier, these practices can lead to the appropriation of a market segment, which is likely to hinder SII, particularly against new market entrants. Article 40.2 of TRIPS sets down the ways by which Members can control anti-competitive practices in contractual licenses relating to IP rights:

> Nothing in this Agreement shall prevent Members from *specifying in their legislation licensing practices or conditions* that may in particular cases constitute an abuse of intellectual property rights having an adverse effect on competition in the relevant market. As provided above, a Member may adopt, *consistently with the other provisions of this Agreement*, appropriate measures to prevent or control *such practices*, which may include for example exclusive grantback conditions, conditions preventing challenges to validity and coercive package licensing, in the light of the relevant laws and regulations of that Member.[326]

The first sentence of this article can appear misleading. At first sight, it presages of an exception to other TRIPS provisions. It is not. In itself, specifying in national law that certain practices abuse copyright, trademarks or patents does not permit Members to restrain the enjoyability of these rights. Whereas measures preventing or controlling these specified practices *do* affect the enjoyability of these rights, the second sentence of Article 40.2 is unmistakable: these measures must be consistent with TRIPS' other provisions.[327] As Article 40.2 does not act as an exception to TRIPS, Members' antitrust practices must respect TRIPS'

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[326] [Emphasis added].

[327] Here as well, the question of non-violation and situation complaints could have an intriguing interplay, but for the same reason as the one expressed in note 316 above, they are not herein taken into consideration. For a fuller explanation of the role of Article 40.2 inside TRIPS' structure, including its probable interaction with Article 8.2, see Pires de Carvalho, *supra* note 8 at paras 8.21-8.26.

provisions, including the rights conferred to patent holders by Article 28. It is worth noting, however, one subset of exceptions germane to antitrust authorities accruing from TRIPS: when remedying to anti-competitive practices, paragraph 30(k) lifts a few conditions for Members to authorise non-voluntary licenses. This aspect is relevant when examining the role of antitrust authorities to promote SII.

3.2. Surveying the Land of Software Invention and Innovation

Governments and industry actors have a wide array of tools in their kits to kindle SII. Indeed it is impossible to discuss them all in a satisfying manner in the following pages. Consequently, this review is confined to a select few that are specific to the software industry, or for which the software industry relates peculiarly: reverse-engineering, path dependency, covenants not to compete, network enterprise, contractual patent practices and technological competition between the exclusionary and F/OSS approaches. Interested readers are welcomed to expand around this non-exhaustive list. As for non-software-specific factors that can spur SII, also left out of this thesis, they include tax incentives, governmental subsidies and funding, university partnerships and research, the educational training of software programmers and engineers and reforms of the patent system.[328]

The instruments reviewed henceforth are analysed from two angles: first, if applicable, pragmatically, meaning their legal feasibility considering the TRIPS' superstructure; second, consequentially, by referring to the different elements expounded in Chapter 2. These elements cohere with the rationale that undergirds the exclusion of abstract subject matter from patent-eligibility, with a distinctive outlook at software technology. Therefore, measures that point in their direction

[328] See Jaffe & Lerner, *supra* note 12 at 178-207 for a very insightful reform proposal that is likely to make the system more efficient, thus more likely to stimulate inventive and innovate endeavours. Still, it is procedural, U.S.-specific and not particularly software-related, so it has been decided to not discuss it herein.

should work cohesively with the purpose of the patent system, whether computer programs are patent-eligible in a jurisdiction or not. Put differently, straddling the fence of computer programs' patentability keeps this thesis focused on the end, not the means.

3.2.1. Reverse-Engineering, or Codifying Tacit Software Functions

Reverse-engineering consists in "[reproducing] another manufacturer's product following detailed examination of its construction or composition."[329] When examining the construction of a product in detail, a reverse-engineer often de- or re-constructs the product. Software can be technically reverse-engineered. When a typical computer application runs, its source code is compiled and/or assembled into object code, which in turn is read in binary language into a processor. Technical means exist, called decompilation and/or disassembly, to reverse this process and obtain an outlook of the source code starting from the object code.[330] Once one assumes that maximising technical knowledge can enhance the quantity and quality of inventive and innovative endeavours, allowing reverse-engineering for research purposes readily appears desirable, particularly so in the software industry, a complex technology where knowledge in the inventive and innovative processes is tacit.

Reproducing computer programs' particular functions without access to their source code can be complicated. Whereas the technical skills and ideas behind the invention are easily identifiable by running the application, reproducing them can be difficult and costly. If the software function of interest is patented, the low level of patent disclosure required for computer programs makes it unlikely to be

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329 *The Oxford English Dictionary, sub verso* "reverse engineering", online: Oxford Dictionaries <http://oxforddictionaries.com/definition/english/reverse%2Bengineering>.

330 See *Vault Corp v Quaid Software, Ltd*, 847 F 2d 255 (5th Cir 1988) at para 48; see also Cohen & Lemley, *supra* note 161 at n 52.

useful for industry actors trying to reproduce it for research.[331] By giving access to source code, reverse-engineering can alleviate this problem. This logic resonates even more for patented software functions as the bargain theory pre-supposes that the invention shall be publicly disclosed.[332] Patentees might complain rightly that a wide use of research engineering could give a blow to their inventions' commercial exploitation, thus impinging on the incentive to invent and innovate. To lessen these effects, reverse-engineering could be limited to research and study purposes as these practices are likely to maximise technical knowledge, and thence inventive and innovative activities, while not conflicting with the patent exclusivity. Reverse-engineering is one way available to articulate, through codification, this tacit knowledge and to have industry actors invent around or build on it.

The complex nature of software technology also makes reverse-engineering particularly desirable. In complex technologies, a myriad of new inventions and innovations can be obtained by combining elements of existing input. Compatibility between the different elements of input, in this regard, is primordial. When reverse-engineering is permitted, competitors are in a better position to invent and innovate technically compatible products.[333] In addition to lowering consumers' costs when they change products,[334] this increased compatibility enhances competition. It makes it harder for a single firm or group of firms to appropriate a whole market segment by having an exclusive invention become a market standard. Chances are high that SII are more stimulated when reverse-engineering for research is a legally accepted and legitimately recognised industrial practice than when it is not.

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331 Cohen & Lemley, *ibid* at 18-19.
332 *Ibid* at 24.
333 *Ibid* at 21-22.
334 The concept in question is *network externalities*; see *ibid*. But see Kenneth W Dam, "Some Economic Considerations in the Intellectual Property Protection of Software" (1995) 24 J Legal Stud 321 at 342-52.

Even though a single instance of reverse-engineering for research can interfere with almost all forms of IP protection guaranteed by TRIPS, this superstructure does not impede Members in allowing it if they wish to.

First, Article 10.1 of TRIPS guarantees that computer programs, both in source and object code, are protected by copyright. When decompiling or disassembling a computer program, the copyrighted work is necessarily reproduced, which at first glance violates the exclusive right granted by copyright.[335] Yet exceptions to this exclusive right are permitted if "reproduction does not conflict with a normal exploitation of the work and does not unreasonably prejudice the legitimate interests of the author."[336] In Canada, these exceptions are categorised under the term "fair dealing", which lists *research* as a purpose of a dealing that does not infringe copyright.[337] Dealing's fairness is to be determined on a case-by-case basis, taking a certain number of factors into consideration.[338]

Transposing the application from *Canada—Patent Protection of Pharmaceutical Products*, a normal exploitation of a copyright would imply retaining the economic return from market exclusivity.[339] Likewise copyright-

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335 Article 10.1 of TRIPS, *supra* note 11, makes computer programs protected as literary works under the *Berne Convention* (1971). Paragraph 9(1) of the *Berne Convention for the Protection of Literary and Artistic Works*, 9 September 1886, 828 UNTS 221, as last revised at Paris on 24 July 1971, WIPO [*Berne Convention*], which WTO Members have to comply with following TRIPS' Article 9.1, grants the exclusive right of authorising reproductions of literary works to their authors.

336 *Berne Convention*, *ibid* at para 9(2). See TRIPS, *ibid* at art 13 to the same effect. Compare with the text of Article 30 elaborated in Subsection 3.1.2 above.

337 *Copyright Act*, RSC 1985, c C-42 s 29. *Research* has been conceptualised broadly enough to comprise industrial and commercial research; see *Society of Composers, Authors and Music Publishers of Canada v Bell Canada*, 2012 SCC 36 at para 27, Abella J. In the United States, it is called "fair use"; see 17 USC §107. The fair dealing and fair use regimes are very similar, but there are differences in their exact applications.

338 In Canada, see *CCH Canadian Ltd v Law Society of Upper Canada*, [2004] 1 SCR 339 at paras 48-60 [*CCH*]. In the United States, the factors are listed in the legislation; see 17 USC §107. Fair use must also be assessed on a case-by-case basis; see Cohen & Lemley, *supra* note 161 at 18.

339 See Subsection 3.1.2 above. For the present discussion, the conceptual disagreement highlighted above with the Panel's decision is ignored. For a review of the three-step

holders' legitimate interests include those that can be expected from the copyright regime's utilitarian rationale, in Canada, "a balance between promoting the public interest in the encouragement and dissemination of works of the arts and intellect and obtaining a just reward for the creator".[340] Though not all reverse-engineering practices are fair dealing, reproduction originating from reverse-engineering that merely purports to research a program's source code is not likely to conflict with a normal exploitation of the work and goes hand in hand with the rationale's purpose of disseminating works.[341] Therefore, Members could allow reverse-engineering for purposes of research in full respect of the copyright provisions of the international law superstructure.

Second, reverse-engineering a computer program that contains patented software functions might infringe the exclusive patent rights conferred in Article 28 of TRIPS. Article 30's exception can be relied on to allow it, provided its three conditions are respected. The last two conditions being the same as for the copyright exception, the same analysis applies *mutatis mutandis*. The remaining condition is to ensure that the exception is limited, narrow in scope. Inasmuch as the patented function cannot be reproduced commercially without the patentee's consent, a reverse-engineering exception for research, even when resulting in commercially exploited alter-inventions, appears sufficiently narrow. This analysis should also apply on a case-by-case basis.[342] However, to comply with the non-discrimination proviso of TRIPS' Article 27.1, exceptions to patent rights

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interpretation of TRIPS' Article 13 on copyright exceptions, very similar to Article 30's three-step test for patent exceptions, see *United States—Section 110(5) of the US Copyright Act (Complaint by the European Communities)* (2000), WTO Doc WT/DS160/R (Panel Report), online: WTO <http://doconline.wto.org> [*US—Section 110(5)*].

340 *Théberge*, *supra* note 35 at para 30, reaffirmed in *CCH*, *supra* note 338 at para 23. Unlike Article 30 of TRIPS, legitimate interests of *third parties* are not mentioned in Article 13. Still, the *legitimate* interests of the copyright holder are those set forth by the copyright regime's rationale. At para 6.224, the Panel in *US—Section 110(5)*, *ibid*, recognised this aspect within the term *legitimate*. It is worth noting that copyright regimes might be predicated on different rationales in different jurisdictions.

341 Canadian and U.S. courts have taken the right path in assessing fair dealing/use on a case-by-case basis.

342 See *Canada—Patent Protection of Pharmaceutical Products*, *supra* note 293 at para 7.92: "[T]he effects of each exception must be found to be 'limited' when measured against each affected patent." See also Gervais, *supra* note 58 at para 2.398.

by reverse-engineering for the purpose of research should not discriminate with respect to technological fields; if a Member permits reverse-engineering in software, it should also permit it for other technologies, and vice-versa.

Third, reverse-engineering could infringe trade secrets contained in source code. Here again, allowing reverse-engineering is not incompatible with TRIPS. Trade secret protection under TRIPS' Article 39.2 is required to be enforceable only in cases of dishonest commercial practices. Other than the illustrative practices specified in note 10 of TRIPS, which are irrelevant in most scenarios of reverse-engineering in the software industry, TRIPS' Article 1.1 leaves it to Members to implement this provision in their legal system and practice. Fully consistent with TRIPS, Members could qualify reverse-engineering for research purposes as an honest commercial practice.[343]

Fourth, computer applications are often distributed with license contracts that prohibit licensees to reverse-engineer the licensed product, conditions accepted by some courts.[344] Still, no TRIPS provisions prevent Members from introducing legislation or practice that refuse to enforce these contractual terms. In fact, as reverse-engineering improves competition by facilitating compatibility with competitors' products, contractual licensing terms that disallow it are likely to have "an adverse effect on competition in [a] relevant market."[345] In this respect, if a Member finds these licensing terms abusive, Article 40.2 of TRIPS specifies that Members are not prevented from adopting TRIPS-consistent measures to prevent or control them.[346] Having already observed that this hypothetical exception does comply with TRIPS' copyright, patent and trade secret provisions, TRIPS consistency is not an issue. Following TRIPS' Article 1.1, licensing terms

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[343] See also Cohen & Lemley, *supra* note 161 at 17.
[344] In the United States, see *Bowers v Baystate Technologies, Inc*, 320 F 3d 1317 (Fed Cir, 2003) at 1525; see also Phillips, *supra* note 15 at 33.
[345] TRIPS, *supra* note 11 at art 40.2.
[346] See Subsection 3.1.5 above.

that bar reverse-engineering could be deemed abusive, especially under circumstances where they conflict with users' rights granted by copyright.[347]

Consequently, a reverse-engineering exception for research is both pragmatically feasible with respect to TRIPS' superstructure and consequentially desirable as a result of its articulating effects in software technology and by facilitating compatibility between different computer applications. Whereas broad reverse-engineering exceptions are likely to conflict with TRIPS' provisions and impinge on the patent system's incentive benefits, an equivalent exception that is too narrow might not reap the full benefits in SII that can be obtained from reverse-engineering. Therefore, policy makers adopting reverse-engineer exceptions to spur SII should aim at a balanced, heedful implementation that is likely to focus on research.

3.2.2. Venturing Into Silicon Valley

Albeit this thesis argues for heedful and well thought-out tools to fuel SII, possibly the most stimulating environment so far for software technology stemmed from historical accident: Silicon Valley.[348] *Silicon Valley* is a tag to designate the San Francisco Bay area in California, where a large number of computer and software firms are based, notably Adobe, Apple, Cisco Systems, Facebook, Google, Hewlett-Packard, Intel, Oracle and Yahoo, but also countless startups. Silicon Valley, whose name refers to the semiconductor chip technology—made of silicon—that characterised its early growth,[349] is an epitome of the industrial cluster, a "spatial concentration of firms in the same or a related

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[347] In Canada, uses permitted under the fair dealing exception are categorised as "users' rights": see *CCH*, *supra* note 338 at para 48. An equivalent reasoning can be held in U.S. law, notably with 17 USC §117.

[348] Gilson, *supra* note 245 at 619.

[349] Martin Kenney & Urs von Burg, "Technology, Entrepreneurship and Path Dependence: Industrial Clustering in Silicon Valley and Route 128" (1999) 8:1 Industrial and Corporate Change 67 at 78; Saxenian, *supra* note 245 at 25.

industry".[350] The traditional theoretical benefits from this spatial concentration are manifold: for example, the concentration of firms in the same field guarantees employment to workers in that field, which in turn attracts these workers to the area. Firms can then, following economic laws of supply and demand, hire better skilled workers at lower costs.

Acknowledging the regional benefits of clusters, policy makers try to implant favourable conditions for their blooming, sometimes successfully, other times not.[351] A certain number of authors have pondered on the successes characterising Silicon Valley in comparison with other regions. In her book, AnnaLee Saxenian suggested that what distinguishes Silicon Valley as an industrial cluster is the casual, laid-back business culture of California, where entrepreneurship is highly valued and social networks vast and rich.[352] While this explanation was a first and important step in identifying the distinctive traits of Silicon Valley, it asks for unwrapping another layer: what factors facilitated this unique business culture? Two relevant explanations have been brought forward: path dependency and covenants not to compete.

Path Dependency

In technological theory, path dependency means that "once a given innovation is achieved, technological trajectories will tend to follow the path marked by this innovation."[353] This process, by analogy, also applies to non-technological economics: new entrants into a given industry or market tend to follow the patterns left by their most successful predecessors, for better or worse.

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350 Gilson, *supra* note 245 at 576.
351 Gilson, *ibid*; Saxenian, *supra* note 245 at 1.
352 Saxenian, *ibid* at 2-3.
353 Manuel Castells, *The Internet Galaxy: Reflections on the Internet, Business, and Society* (New York: Oxford University Press, 2001) at 100.

This model of business patterns has been observed in the development of Silicon Valley.

In the 1960s, semiconductor technology was a specialised field with few skilled workers. As a result, workers were on the high hand in negotiating employment conditions, and many obtained to be partly paid in equity.[354] This way, their remuneration was linked to the firm's success. Meanwhile, to take part in this new field, many startups were established, some of which were divisions of incumbent computing firms, others launched by new entrepreneurs. To back these startups, venture capital businesses, a then inchoate financing model, played a crucial role by providing financial resources to this risky business.[355] As firms working in this technological field grew at high and fast rates, a large number of startup founders, investors and skilled workers quickly became very wealthy.[356]

Path dependency followed in two ways. First, these successes became "an example and an incentive for others to follow and establish their own firms."[357] Second, this first wave of prosperous entrepreneurs and engineers had vast resources to back up new entrants financially, in other words, to become venture capital investors themselves.[358] Even more, these successful entrepreneurs had built strong network connections with financial institutions and investors, connections they could share with their protégés. A virtuous circle resulted from this process: "the broad availability of venture capital reinforced the firm-creation process, which, in turn, spurred the accumulation of venture capital."[359] Studies since then have recognised the positive relationship between venture-capital backing and innovative output in the economy.[360] The crucial role of venture capital in the software industry originates from the high amount of time required

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354 Kenney & von Burg, *supra* note 349 at 82-83.
355 *Ibid* at 84.
356 *Ibid* at 83.
357 *Ibid*.
358 *Ibid* at 84; Saxenian, *supra* note 245 at 39.
359 Kenney & von Burg, *ibid* at 85.
360 Graham et al, *supra* note 187 at 1270.

to develop a marketable software product; until the program is completed and can be demonstrated, no gains can be expected from these lengthy, intensive efforts.[361] Financial backing until profits can be reaped from the product is primordial.

In addition, when successful entrepreneurs become venture capital investors, financial backing and their networks are not the only resources they share; their knowledge of the industry and technology are also precious.[362] The importance of this mentoring relationship can be observed in the birth and fast growth of a Taiwanese entrepreneurial spirit in Silicon Valley. First-generation Taiwanese engineers based in Silicon Valley were few to climb the ladder of success, but when put in contact with the next generation through network organisations, numerous young Taiwanese entrepreneurs obtained a lot of success.[363] Networks created this way fostered master-apprentice transfers of knowledge that articulated tacit industrial and technological information.

Path dependency is a helpful process that can contribute at kindling SII. Efficient industry patterns and network mechanisms that encourage and incentivise successful entrepreneurs to share their experience, knowledge and resources with the younger generation of entrepreneurs are likely to lead their startups to invent and innovate prosperously. Because of the structure of software entrepreneurship where profitability is not attained readily, this pattern is peculiarly important in this industry. Though it does not formally respect the letter of the communal ideal as conceptualised by Merton, part of its spirit can be observed when successful entrepreneurs share their intra-industry knowledge and experience disinterestedly to new entrepreneurs in order to help them. They

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361 Mann, *supra* note 16 at 974.
362 Saxenian, *supra* note 245 at 32, 39.
363 AnnaLee Saxenian & Jinn-Yuh Hsu, "The Silicon-Valley-Hsinchu Connection: Technical Communities and Industrial Upgrading" (2001) 10:4 Industrial and Corporate Change 893 at 903-04, 907.

recognise that their success partly stems from the support they received, and so they choose to share their own successes.

Covenants Not to Compete

Another important aspect explaining the distinctive business culture of Silicon Valley is that the State of California does not enforce covenants not to compete in employment contracts.[364] When such a covenant is enforced, a departing employee is barred from starting his own competing firm or from working for a competitor in the same geographical area for a reasonable time period, generally one year or two.[365] Ronald J. Gilson explains that the effects of these covenants in the software industry can be overreaching:

> Given the speed of innovation and the corresponding telescoping of product life cycles, knowledge more than a year or two old likely no longer has significant value. The hiatus imposed by a covenant not to compete thus assures that a departing employee will bring to a new employer only her general and industry-specific human capital. The value of proprietary tacit knowledge embedded in the employee's human capital, or the value of inchoate inventions the employee has strategically chosen not to bring to conception during her employment, will have dissipated over the covenant's term.[366]

When an employee leaving Firm X for Y is not limited by a covenant not to compete, the tacit knowledge that he acquired with X can be transferred and articulated to Y. Likewise, when X hires new employees, they bring to the firm and articulate the tacit knowledge they acquired in their previous employments. This process, in turn, facilitates the transfer and articulation of tacit information that can be crucial to spurring SII. This type of information being difficult and

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364 Gilson, *supra* note 245.
365 *Ibid* at 602-03.
366 *Ibid* at 603; Saxenian, *supra* note 245 at 37.

costly to transfer and articulate, organisational forms of industry that facilitate that can be very beneficial.

The fast-moving rate of employees also has a peculiarly beneficial impact in complex industries: the simple combination of tacit information input from Firms X and Y can foster new inventions or spark new creative ideas.[367] Reminiscent of Usher's combination/accumulation model, Gilson explained that inventive ideas are often generated in an employee's mind in the course of his employment. If benefits for sharing the idea to his employer are insufficient, and he cannot compete for a certain time following his departure, the idea might become worthless before its inventor can realise, commercialise or innovate it. The common pool of general technical knowledge suffers from the non-implementation of these ideas.

Pragmatically, not enforcing covenants not to compete could conflict with trade secret protection. TRIPS' Article 39.2 sets out that holders of undisclosed information can prevent it from being acquired, disclosed or used through dishonest commercial practices, which practices must include breach of contract or knowing that a breach of contract is involved.[368] Legislation or practice that allow breaching a covenant not to compete or using information knowing such a covenant was breached in its procurement appear to violate TRIPS. The legislation of the State of California, however, wisely—and coincidentally, based on the history of its code that has nothing to do with a desire to foster industrial clusters[369]—finds a way to avoid this pragmatic problem. The relevant section provides that "every contract by which anyone is restrained from engaging in a lawful profession, trade, or business of any kind is to that extent void."[370] By legislatively voiding covenants not to compete, these clauses are no longer part of

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367 *Ibid* at 629.
368 See Subsection 3.1.4 above.
369 See Gilson, *supra* note 245 at 613-19.
370 7 Cal BPC Code §16600 (West 1997).

the contracts. No breach of contract follows from not abiding by them. Therefore, legislation and practices that do not enforce covenants not to compete are not likely to be successfully disputable through a WTO complaint.[371]

However, despite such a measure being consequentially beneficial in Silicon Valley, reproducing it is not a sure promise of success to fuel inventive and innovative endeavours in other clusters or industries. Adverse costs include a "reciprocal reduction in the incentive for intellectual property investment that results from the dilution of employers' property rights."[372] In the software industry, the Silicon Valley experience shows that the inventive and innovative benefits are likely to exceed the adverse costs, though a case-by-case analysis is desirable. As labour law can hardly be applied distinctively based on the applicable industrial sector, however, such a non-enforcement proviso would apply indistinctively to all sectors, including those for which inventive and innovative activities might be harmed by this measure. In addition, as discussed next, the industrial model of network enterprise, which is less and less geographically defined, reduces the benefits that can be reaped from not enforcing covenants not to compete as tacit knowledge finds new ways to be transferred, and industrial clusters' advantages slowly evaporate. Policy makers should therefore measure these concerns if they wish to adopt this instrument.

3.2.3. Endogenous New Inventive Opportunities

For digital products like software, communication, transaction and design costs incurred in the inventive and innovative processes have dramatically

[371] This conclusion would be different if non-violation and situation complaints could be heard in the dispute settlement process of the WTO; see note 318 above.

[372] Gilson, *supra* note 245 at 627.

diminished with the help of computer and internet technologies.[373] In other words, software technology endogenously transforms its own inventive and innovative opportunities. The growth of the network enterprise model, which shifts the industry focus from the firm to the inventive or innovative project itself, renders opportunities for inter-firm partnerships and cooperation more viable and profitable.[374] For instance, even though geographical clusters maintain substantial industrial benefits arising from firm concentration, an increasing number of transnational relationships between Silicon Valley firms and foreign partners are put at contribution to develop new software products.[375]

To explain this phenomenon, Carliss Baldwin and Eric von Hippel set down three basic models for firms to innovate: single user innovation, producer innovation and open collaborative innovation. The first two models represent the traditional innovation processes, respectively, innovating internally or acquiring innovation from an external firm. Open collaborative innovation, on the other hand, is a model in which contributors "share the work of generating a design and also reveal the outputs from their individual and collective design efforts openly for anyone to use."[376] Firms select an innovative model by considering different factors—primarily costs and benefits. Prior to digital technology the window of opportunity for open collaborative innovation was highly constrained because of significant communication, transaction and design costs. By reducing these costs, digital technology widens open collaborative innovation's window of viability over the other two traditional models.[377] Microsoft itself, a firm widely recognised

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373 Baldwin & von Hippel, *supra* note 232 at 21-23. Earlier, citing Baldwin and von Hippel, *ibid*, *transaction costs* was defined as "the cost of establishing property rights and engaging in compensated exchanges of property."

374 Castells, *supra* note 353 at 67.

375 Saxenian & Hsu, *supra* note 363 at 916.

376 Baldwin & von Hippel, *supra* note 232 at 9. See Robert C Allen, "Collective invention" (1983) 4 Journal of Economic Behavior and Organization 1 and Alessandro Nuvolari, "Collective invention during the British industrial revolution: the case of the Cornish pumping engine" (2004) 28 Cambridge Journal of Economics 347 for examples of pre-internet open collaborative efforts.

377 Baldwin & von Hippel, *ibid* at 25.

in the 1990s and early 2000s for its fortress mentality, shifted its practice in the last ten years from a go it alone approach to embracing open collaboration.[378]

Industry actors have a lot to gain from adapting their management decisions to these changing conditions of viability for inventive and innovative models. In addition to open collaboration increasingly becoming less costly and more profitable than traditional models of invention and innovation, these changes have the benefit of decreasing the negative effects of the ZMC conundrum by sometimes significantly decreasing the initial investment required from the firm. For the same reason, inventive and innovative activities that were previously non-profitable for a firm under the traditional inventive and innovative models may become profitable with open collaboration. Overall, these new opportunities increase the amount and variety of SII that is produced. Moreover, they bring inventive and innovative models closer to the communal imperative by intrinsically sharing the results of their inventive and innovative endeavours. It might explain how Microsoft succeeded in achieving what was then inconceivable in everyone's mind—concluding a technology cooperation agreement with Novell, a leading open source software distributor.[379]

3.2.4. Checking Unstable Ground

The increasing number of partnerships and alliances stemming from the new inventive and innovative opportunities made possible by the network enterprise partly explain the increasing licensing practices between patentees described earlier.[380] Another motivation behind these industrial changes is the recognition of hazards presented by patent thickets, particularly in the software industry.

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[378] Marshall Phelps & David Kline, *Burning the Ships: Intellectual Property and the Transformation of Microsoft* (Hoboken, NJ: John Wiley & Sons, 2009) at 6-9. Phelps was hired exactly to navigate this transition in the intellectual property department.

[379] *Ibid* at 110-129.

[380] See Section 2.4 above.

Processes that usually lead to firms cross-licensing all or part of their IP portfolio or licensing their technology to respectively ensure mutual freedom to operate and obtain royalties were discussed earlier. Two other often overlapping types of arrangements can be observed: patent pooling and standard setting.

Patent pools are established when firms owning complementary patent rights decide to license them in a one-stop shop. *Complementary* refers to Antoine-Augustin Cournot's theory: two or more components of input are complementary if they are all essential to make or commercialise a product.[381] When each component is protected by rights that ascertain their holders to be single sellers, or *monopolists* in Cournot's terms, each "monopolist" is likely to commercialise its component at the highest competitive price possible. However, as the components are complementary for the market output, these conditions generate what is called *double marginalisation*: if two "monopolists" or more commercialise with a view to maximise their marginal profits, the market price for the combined product becomes so high that sales for each component are minimal.[382] This deleterious scenario for both consumers and producers can be resolved by pooling the components in a single "monopoly", a one-stop shop for anyone interested in obtaining all required components. This process also minimises litigation risks between "monopolists" and consumers' transaction costs.[383] *Patent pooling* thus refers to this type of arrangement when the complementary components are patents, a likely situation in the software industry as a result of patent thickets.

Some patent pools also act as standard setting organisations ("SSOs"), though not all SSOs are pools. In addition to potentially serving as a one-stop shop, SSOs share the objective of solving problems that can arise from patent thickets, but

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[381] Shapiro, *supra* note 227 at 123. These components can be anything, so long as they are essential for the output—in other words, no substitutes are available. May be essential input material parts, hardware, software, distribution lines, IP rights, state-protected monopolies and anything else one can think of that can be appropriated.

[382] Gilbert, *supra* note 256 at 335.

[383] Crane, *supra* note 256 at 375.

they do so with the view of creating a technological standard.[384] Remember, for instance, the discussion above on products' compatibility, which can be necessary and beneficial to invent and innovate, especially for complex technologies that combine a multitude of input. To do so, interested parties must, first, determine which components would be part of the technological standard; second, pick IP rights, if any, that would satisfy these components; and, third, enter into an agreement with the holders of these IP rights.

Pragmatically, nothing in TRIPS prevents patentees from entering into patent pooling or standard setting arrangements. Consequentially, these tools are promising. In addition to offering a viable option to minimise the harmful effects of patent thickets, technological pre-emption is likely to be minimal because patent pools and SSOs benefit from a wider adoption of the technologies they offer. These benefits are particularly significant in complex sectors like software, where patentees limiting the use of their patented input block a myriad of possible SII output. Improved access to patented functions also increases the elements that inventors have at their disposal under the Usherian combination/accumulation model.

However, these arrangements are subject to abusive practices detrimental to SII. Legitimated communications between competitors facilitate cartel practices where patentees collusively inflate their prices to supra-competitive rates—prices superior to what they could have obtained in competitive market conditions.[385] Likewise, in SSOs, the step of selecting technologies to serve in the standard is vulnerable to gerrymandering: interested patentees can negotiate, horse-trade and use their industry positions to ensure that their technologies are included in the standard even though they are not essential or that technically superior technologies are available.[386] Another detrimental effect of these arrangements is

[384] *Ibid* at 372.
[385] *Ibid* at 372, 381.
[386] *Ibid* at 376-77.

the disincentive for competitors to alter-invent: if a technological input is part of a market standard and has no independent market profitability,[387] market opportunities for alter-inventing this input are trivial, thus disincentivising its alter-invention. To palliate these risks, antitrust authorities are a pertinent tool.

Antitrust authorities are a crucial tool to stimulate SII, and examining when their checks and controls are consequentially warranted is particularly pertinent for this endeavour, but this task is too incommensurable to be undertaken here. It suffices to say that, as for other tools discussed herein, an appropriate balance should be sought between the benefits to SII that can be obtained from patent pooling and SSO arrangements and those fostered by antitrust authorities' checks and controls of these arrangements. For instance, grantback clauses, conditions by which licensees automatically grant to licensors a license to use inventions developed while using the licensor's technology, are often susceptible to raise antitrust concerns.[388] Yet, when empirically looking at cooperative technology agreements—a subclass of technology license agreements where the knowledge transferred is highly intense and intricate[389]—the high frequency of often

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387 Standards can arise from governmental regulations or SSOs, but they can also stem from *de facto* market conditions, particularly in the context of patent pools. Imagine a product P made of two technologies, X and Y, pooled through patents X1 and Y1. If one alter-invents around Y1 to create Y2, purchasers of P are not likely to be interested in Y2 as they would have to independently acquire X1. This would replicate the double marginalisation scenario. For consumers, licensing-in P with the pool persists as the most viable market option. Therefore, unless there is independent demand for Y2, one probably has no market incentive to invent it except if one can create an alternate pool with X1's patent-holder or if another firm created X2.

The reader may have noticed the weak link in this example, hence in the whole reasoning. If one has invented around Y1, Y1 is no longer essential, and thus should no longer be part of the patent pool. Essentiality is not a permanent quality. In practice, however, things are more intricate. For instance, Gilbert, *supra* note 256 at 339-46 shows that the presence of non-essential patents in a patent pool is not economically damaging for consumers as long as there is at least one essential patent in the pool. Note that, as this footnote explains, this observation applies to consumers, not to other inventors or innovators, the subject of this undertaking.

388 *Ibid* at 326. See also TRIPS, *supra* note 11 at art 40.2, where grantback conditions are illustratively listed as licensing practices and conditions that may be specified to constitute an abuse of IP rights.

389 Eric Brousseau, Natalia Lyarskaya & Carlos Muniz, "Complementarities Among Governance Mechanisms: An Empirical and Theoretical Assessment of Cooperative Technology Agreements" in Rochelle C Dreyfuss, Harry First and Diane L Zimmerman, eds, *Working*

reciprocal grantback conditions in these agreements signals an "idea of 'amicable' usage of grant-back provision aimed at encouraging partners to innovate and share innovation."[390] Antitrust practices that are too sweeping might disallow this type of contractual terms that may encourage SII. This is but one example to show that antitrust authorities, even though highly desirable to promote SII and competition in general, should be heedful in their application in order not to disallow practices that stimulate invention and innovation while preserving their other missions; in a nutshell, to focus on effects on the end, not on the means.

Pragmatically, TRIPS' Article 40.2 allows antitrust authorities to control anti-competitive practices in contractual licenses inasmuch as they comply with other TRIPS provisions. This limitation includes the exclusive rights that Article 28 of TRIPS confers to patentees. For antitrust law to authorise uses that contravene to these rights, the conditions of Articles 30's or 31's exceptions should be respected. In the context of antitrust practices, however, Article 30 is unlikely to be relied on because appropriate remedies are unlikely to be limited, narrow in scope. With respect to TRIPS' Article 31, considering that paragraph (k) lifts some of the conditions in the context of anticompetitive practices, remedies consisting of non-voluntary licenses should, among others, be (a) considered on their individual merits, (c) limited in their scope and duration, (d) non-exclusive, (h) subject to adequate remuneration—that can take into account the anticompetitive context—and (i) subject to judicial review. When remedying to anticompetitive practices by revoking patent rights, the different elements discussed earlier should be taken into consideration.[391]

Within the Boundaries of Intellectual Property: Innovation Policy for the Knowledge Society (New York: Oxford University Press, 2010) 229 at 238.

390 *Ibid* at 245.

391 See Subsection 3.1.3 above.

3.2.5. Competition between Exclusivity and Sharing

The thrust of antitrust authorities as a tool to promote SII suggests the importance of competition. Benefits from competition can be seen in the distinct models of the software industry, F/OSS and exclusion. One major concern with F/OSS, recognised by its own proponents, is usability.[392] Programmers in the F/OSS community usually work on projects that correspond to their needs and fulfill their "itches", leading them to program software that is developer-oriented and little user-oriented.[393] This feature can constitute a tall hurdle to software *innovation*.[394] On the other hand, F/OSS programs, being the result of multiple minds of different backgrounds collaborating together, are often more technically advanced. They are more likely to incorporate creative features that might be absent from software produced under the exclusionary scheme because both approaches respond to different stimuli.

Software developers spurred by the promise of obtaining an exclusive space for commercialisation, what is here called the *exclusionary scheme*, are guided by market, not technical objectives: only if their software can be widely adopted by its user market will profits be maximised. In this scenario, patents are useful to operate freely in developing and commercialising products, hence a probable stimulation instrument for SII. This way, patents are proven efficient to solve the ZMC conundrum as temporary exclusivity allows marketing beyond the marginal cost, therefore recouping initial costs. F/OSS is also a relevant approach to answer to the ZMC conundrum. As profits are not the driving motive behind F/OSS, the movement intrinsically nullifies for itself some of the harmful effects that the ZMC conundrum poses to SII.

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[392] Eric S Raymond, "The Revenge of the Hackers" in Chris DiBona, Sam Ockman & Mark Stone, eds, *Open Sources: Voices from the Open Source Revolution* (Sebastopol, CA: O'Reilly and Associates, 1999) at 218-19.

[393] Phillips, *supra* note 15 at 156-57.

[394] See *supra* note 10.

In many cases, software produced within F/OSS and the exclusionary scheme are mutually exclusive because of their distinctive appropriation and licensing practices; whereas free software is only licensed under the condition that other software produced while using it would also be licensed as free software, computer applications produced under the exclusionary scheme are usually licensed under proprietary licenses that exclude others from using it without the proprietor's consent.[395] Yet, the dividing line is not as clearly defined; for instance, nothing restricts firms from developing both F/OSS and exclusionary technologies, each following their best profitability model.[396] Moreover, assuming that alter-invention is a beneficial inventive activity and that first-mover advantage and technological superiority lead to competitive benefits, an industrial structure that combines and leaves space for both the F/OSS and exclusionary approaches to thrive is likely to spur SII as each pushes the other to improve.[397] Predicated on these assumptions, maintaining conditions that permit both schemes to grow and to compete technologically with one another is a helpful tool to stimulate SII. Leaving the last word to Microsoft CEO Steve Ballmer, "[o]pen source is not going away. Why should it?"[398]

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395 Phillips, *supra* note 15.
396 Plotkin, *supra* note 176 at 156.
397 *Ibid* at 189.
398 Phelps & Kline, *supra* note 378 at 104.

Conclusion

From glassmaking in medieval Venice to nowadays' computer programming, the purpose of the patent system and the scope of the rights they confer have fluctuated in accordance with political objectives. In modern times, the utilitarian rationale according to which patents purport to stimulate inventive and innovative activities is pervasive. Despite this mostly common rationale, some jurisdictions do not allow patenting computer programs while others do. As identifying and assessing measures that can spur SII is the purpose of this undertaking, to do so, it appeared preferable to straddle the fence of computer programs' patentability in order to focus on the end of stimulating SII instead of restricting this thesis to the patent system, a means. Still, patents are not detached from it: they are the way through which are brought to light fundamental elements to consider when one wishes to stimulate inventive and innovative activities in the software industry. Moreover, pragmatic considerations are constantly kept in mind to focus on feasible measures and factors that are likely to act as effective impetus to SII.

As a result of this methodology, this thesis started by taking a look at the international law superstructure through its main representative for IP, TRIPS, in order to determine how this agreement affects Members of the WTO in deciding to include or exclude computer programs within conditions for patentability. As TRIPS' Article 1.1 allows Members to rely on their practices to implement the agreement's undefined terms, it appears that Members' practices of patent-eligibility, through national definitions of *invention* among others, can exclude computer programs from the scope of patentability in full compliance with TRIPS' provisions. Among Members that permit patents for computer programs, policy makers and judges are often toiling to appropriately delineate the varieties of computer programs that can be patented. This situation has been illustrated by

reviewing Canadian case law, where the *Amazon.com* case shows the complications arising from a puzzling definition of *art* found in the Supreme Court's *Shell Oil* decision. While *Amazon.com* re-affirms the *Schlumberger* reasoning three decades later, it includes as well a wish for polishing Canadian patent rules to determine computer programs' patent-eligibility. It was later found that the *Schlumberger* standard for computer programs' patent-eligibility is more likely to consequentially foster SII than *Shell Oil*'s wide approach.

Chapter 2 opened with an outline of how U.S. Supreme Court decisions relating to the exclusion of abstract subject matter from patent-eligibility, a crucial aspect to determine computer programs' patentability, bestow substantial importance to patent rationale considerations. By discussing the rationale behind this exclusion, these interpretative efforts in jurisdictions that permit patents for computer programs underscore a concern for rules that stimulate SII rather than stifle them. From these decisions, four elements were gleaned that cohere with the rationale for the exclusion of abstract subject matter, which all deserved an in-depth analysis in the context of software technology: pre-emption, the building-block structure of inventive activities, patent thickets and disembodiment.

By reviewing them, different software-specific elements that ought to be considered in assessing measures that aim at stimulating SII were observed. First, the algorithmic nature of software technology renders software particularly vulnerable to pre-emption, and pre-emption's potential impact is likewise increased when taking into account the complex, building-block nature of software technology. Moreover, there exists in the software community a strong sense, though not unanimous, of a communal ethos according to which software, as part of scientific activities, belongs to the community. On another note, the knowledge needed to create software is usually tacit—best transmitted in a master-apprentice relationship and difficult to articulate. The software industry has a special language to articulate this tacit information, source code, but it is not always readily available, notably in patent specifications. As for patents

themselves, practices that purport to mitigate their negative thicket effects in the software industry, such as cross-licensing, patent pools and standard setting, potentially threaten to pre-empt software development by appropriating market segments, and so antitrust authorities have an important role to play to mediate these concerns. Another noteworthy aspect is the disembodied nature of software. The easy and technically free copying of software products yields the zero-marginal-cost conundrum, a potential disincentive to SII.

From there, a non-exhaustive list of measures that can fuel SII are discussed in Chapter 3 using two criteria to assess them: pragmatically, by evaluating their feasibility under the TRIPS superstructure, and consequentially, by determining their interactions with the different elements outlined in Chapter 2. Attention was devoted to a reverse-engineering exception to patent rights for research, path dependency in the software industry, restrictions to covenants not to compete in work contracts, industries' adaptation to the effects of digital technology on innovative approaches, contractual means to reduce patent thickets' effects and appropriate checks and controls of these contractual practices when abusively undertaken and competition between the F/OSS and exclusionary schemes of technological appropriation. All of these measures can pragmatically be implemented and are likely to stimulate SII, although a heedful, case-by-case consideration of each measure is warranted before implementing them as they are not mere templates that can easily be reproduced, but intricate mechanisms with multifaceted ramifications.

When looking globally at these six measures, it is instructive to see that all of them can be categorised in either or both of two boxes: factors that relate to the tacit nature of knowledge involved in software technology and others that concern industry structure. Albeit keeping in mind the caveat that these software-specific instruments are not exhaustive, this observation indicates that the structure of the software industry and the tacit nature of the knowledge involved in it are possibly

the two elements most pertinent to bear in mind when intending to kindle SII. After all, these measures were not selected randomly; they became more and more striking as we were moving forward in the methodology of straddling the fence of computer programs' patentability. They were picked principally because they are most likely to affect SII beneficially, even though their pragmatic feasibility and their being significantly discussed in the academic literature also contributed to their selection.

Indeed, the pragmatic step of this review has shown that these elements can be implemented. However, the pragmatic superstructure is not limited to TRIPS nor is it fixed. This thesis focused on TRIPS because it is the only part of the IP superstructure at the moment that can be effectively enforced and because it represents, for most countries in the world, the basic, common superstructure. However, most Members of the WTO are also tied to plurilateral or bilateral agreements, some of which introduce rules for their signatories that can additionally or differently constrain Members' flexibilities in adopting and implementing measures to stimulate SII. For instance, a plurilateral or bilateral agreement could require its signatories to make computer programs patent-eligible or restrain exceptions to patent rights further than TRIPS does. Combined with the MFN rule of TRIPS' Article 4, bilateral or plurilateral commitments that grant a more favourable treatment to nationals of another country have to be extended to nationals of all WTO Members. Therefore, these bilateral and plurilateral commitments produce wider pragmatic limitations than they first appear to, and the pragmatic feasibility explored in this thesis is likely to differ from the actual pragmatic opportunities available to some Members.[399]

Likewise, the pragmatic picture drawn from the TRIPS superstructure is not fixed. The GATT/WTO framework is constantly evolving through the results of

[399] Pires de Carvalho, *supra* note 8 at paras 39.357-39.375, discusses this effect of the MFN principle with respect to bilateral and multilateral agreements in the context of governmental protection of test data.

rounds of negotiations. Reaching an agreement to the current round, the DDA, is more laborious than expected, but this short-term, and possibly middle-term, stall in the negotiations is unlikely to be permanent. The upcoming results of these negotiations and of subsequent rounds are likely to modify the international law superstructure, and with it the pragmatic flexibilities of Members to adopt measures stimulating SII.

In the light of the measures fueling SII identified in this thesis and of the intricate elements that distinguish software technology, governments would be well-advised to try maintaining a certain level of flexibility in the context of multilateral negotiations at the WTO and of bilateral/plurilateral trade agreements. Shrinking this pragmatic space of flexibility may undermine the patent rationale's utilitarian objective of maximising inventive and innovative activities in the long run. Of course, these negotiations are conducted on multiple fronts in international trade, and a Member could concede flexibility in a sector of minor importance to its interest for leverage in a sector to which it ascribes a greater importance. Still, just as maximising inventive and innovative activities within the patent system is considered in the long term, trade negotiators in IP areas, to be coherent, should also adhere to this long-term perspective, especially with respect to a blooming technological sector like software. There is another, but much more intricate, way to coherently do otherwise: by attributing another purpose to the patent rationale. Patent history shows that it is possible; but would it be desirable?

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