Reconstructing the Complete Patent Bargain: The Doctrine of Equivalents

Dr Apostolos Chronopoulos*

N.B. This is the draft version of the paper. Please do not cite. For the complete version of this paper please check the published article [2020] IPQ Issue 2 (forthcoming).

Abstract:

This paper provides a theoretical justification for the doctrine of equivalents in patent law that is based on the contractarian view of the patent grant.

Introduction

In *Actavis v Eli Lilly*,[1] the Supreme Court introduced the concept of infringement by equivalents in UK patent law. Lord Neuberger justified his decision by arguing that "adopting a normal approach to [the] interpretation [of patent claims] would risk depriving patentees of a proper measure of protection […]."[2] At a theoretical level, the doctrine of equivalents could be justified as a corollary of the patent bargain theory. Inventors are invited to incur the kind of investments in research and development that are eventually rewarded by the patent system. Hence, the inventors' investments are relationship-specific. After outlining some practical problems associated with the determination of patent scope, this paper will highlight the nature of the patent bargain as a relational contract. Someone engaging in relationship-specific investments is exposed to the risk of opportunistic behaviour at an *ex post* stage because such investments lose their value outside the context of the existing relationship. When third parties find a way to design around the patent claims in order to utilise the incentive concept encapsulated therein, the patent loses its market value since the patentee has no outside option to exploit his inventive efforts. Opportunism is examined as a lay, legal and economic term with a view to specifying the type of conduct that qualifies as opportunistic for the purposes of patent law.

British patent law has long adhered to the purposive approach which aligns claim construction with the interpretation of contracts. Compared to the textualist interpretative method, contextualism features the advantage of being more suitable for considering the interest position of the party that has incurred relationship-specific investments. Courts have been particularly effective in combating some very specific forms of blatant opportunism when administering the "pith and marrow" doctrine or assessing patent infringement through the lens of the more advanced concept of purposive claim construction, which marked the evolutionary pinnacle of the traditional British approach to the determination of patent scope.

The main drawback of those infringement theories has been that they readily assumed a virtually perfect ability of applicants to design optimally inclusive claims. In practice, however, this is often

* Senior Lecturer in Intellectual Property Law, Centre for Commercial Law Studies, Queen Mary University of London.

[1] *Actavis UK Ltd v Eli Lilly and Co* [2017] *RPC* 957 SC.

[2] *Actavis v Eli Lilly* [2017] *RPC* 957 at 985, per Lord Neuberger.

impossible or comes at a very high cost of drafting, thereby leaving room for opportunism to emerge as third parties have a chance to exploit a patented inventive concept by skilfully evading the contextual meaning of the claims' wording. This not only reduces the incentives of inventors to innovate but, equally crucial, it decelerates the process of technical disclosure. Optimal drafting might be time-consuming or require the applicant to try out some things first. Such a situation is comparable to a state of contractual incompleteness attributable to high transaction costs which is bound to give rise to a hold-up problem. In a fashion that is quite similar to that of default rules in contract law, the doctrine of equivalents essentially reconstructs the complete patent bargain to rectify the impossibility or the potential inefficiencies associated with an attempt to draft optimally inclusive patent claims, the paper argues. To illustrate all of these points, this paper reviews some of the most important cases on the interpretation of patent claims in the UK.

The legal dimension of a practical problem

Patent law has to strike a balance between the patentee's interest in internalizing the full market value of his inventive idea, whose protection secures incentives to innovate, and the value of legal certainty about the scope of IP (intellectual property) rights, which are vital to market entry and competition. Patent claims serve the paramount function of notice as they inform other economic operators about the boundaries of the property upon which they are not supposed to trespass and, most importantly, the types of activity in which they are allowed to engage without infringing earlier rights. In practice, however, the patent claims often fail to capture the inventive idea in its entirety and are taken to refer to subject matter that simply constitutes an expression thereof. That being the case, it would be possible in many instances for third parties to design around the claims' wording and yet be able to compete with the patentee by offering a highly substitutable product implementing the same inventive concept. Let's reconsider the following well-celebrated examples from case law.

The *Catnic*[3] litigation concerned an inventor who came up with a new type of lintel. Such load-bearing beams have been placed on top of wall openings ever since to absorb the weight of brickwork that doors or windows, for instance, cannot sustain. Up to that point, the most advanced lintels were made of reinforced concrete or steel girders. The patentee's inventive idea was to use a hollow steel box instead, which had been configured to optimally increase its load bearing capacity. In the patent claims, the product was described as comprising two horizontal plates that were "substantially parallel"[4] to each other and two supporting members one of which was "extending vertically from or from near the rear edge of the first horizontal plate or part to join with the second plate or part adjacent its rear edge."[5] Patent infringement proceedings were brought against competitors who marketed a similar lintel whose weight bearing power was reduced by 0.6 percent due to its rear support member having been made at an angle of 84 rather than 90 degrees.

In *Improver v Remington*,[6] the infringement action rested on the UK patent protecting the Epilady, the first hair epilating device. A curved spring rotated rapidly by an electric motor would trap and pull out hair by the roots as half of its windings opened out while the rest closed at the same time. The claims made reference to a "helical spring".[7] Remington's "Smooth and Silky" epilator substituted that element of the earlier invention for a slotted rubber rod.

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[3] *Catnic Components Ltd v Hill & Smith Ltd* [1982] *RPC* 183.
[4] *Catnic* [1982] *RPC* 183 at 240.
[5] *Catnic* [1982] *RPC* 183 at 240.
[6] *Improver Corp. v Remington Consumer Products Ltd* [1990] *FSR* 181.
[7] *Improver* [1990] *FSR* 181 at 187.

The plaintiff in *Kirin-Amgen*[8] had obtained a process patent for the production of erythropoietin (EPO) after isolating and sequencing the gene capable of expressing that protein. According to the patent's teachings, the relevant DNA sequence had to be inserted into a host cell for cultivation. Thanks to that invention, it became possible to artificially produce large quantities of EPO, which has been used, among other functions, in the treatment of anaemia. A dispute arose as to whether an alternative process based on gene activation technology could be subsumed under the claims of that patent. Instead of introducing a DNA sequence into a host cell, the defendant's method operated by inserting a gene activator (a promoter sequence of DNA) into the organism. Promoters would be placed at the appropriate places before dormant DNA sequences within cells that would not have otherwise expressed erythropoietin to activate them. In essence, the defendant's way of dealing with the technical problem was to switch on the EPO gene in cells where this was supposed to remain inactive because those cells were initially dedicated to the production of other proteins. In contrast, the patent in suit claimed a process that was reliant upon an "exogenous" DNA sequence.

The Supreme Court was called upon to rule on issues of law pertaining to patent infringement in the landmark case of *Actavis v Eli Lilly*,[9] which elaborated upon a long line of precedents attending to the same complex problem. The earlier invention taught the manufacture of a drug based on pemetrexed acid, which was already known as a potent anti-cancer agent. In the pharmaceutical industry, it is common to combine acids featuring potential therapeutic applications with an appropriate base in order to produce a salt. Somewhat oversimplified, bases are substances that lack hydrogens whereas acids possess a surplus of such atoms. Combining these two would normally give rise to a neutralization reaction that reduces the toxicity of the acid while retaining its desirable attributes. Soap, for instance, is often the product of a reaction between a fatty acid obtained from some poor fleshy animal and a base like sodium or potassium. Hence, getting to an effective drug is often a matter of obtaining the salt form of an acid. A single acid may react with many different bases to form a wide range of salts. Apart from their acid-neutralization function, salts may themselves contribute to the effectiveness of the drug depending on their composition. A salt may even constitute an improved modification of its parent acid in terms of therapeutic efficacy. Since the various salts tracing back to the same acid may have different properties, inventors in the pharmaceutical sector should identify the optimal salt(s) to determine the most suitable form(s) of a drug. When the suggested treatment involves intravenous chemotherapy, the salt's degree of solubility is obviously of crucial importance.

By replacing two acidic hydrogen units with sodium counterparts, Eli Lilly was able to obtain an acid salt called pemetrexed disodium in solid form. This is a neutrally charged ionic compound because it contains an equal number of positively charged ions (cations) and negatively charged ions (anions). Once the salt is thrown into water the positively charged sodium cations will flee, separating themselves from the pemetrexed anions. Those anions constitute the therapeutic ingredients of pemetrexed disodium. Despite the neutralization reaction, some of the toxic side effects of pemetrexed persisted. Meanwhile, Eli Lilly discovered that a combination therapy that would include the administration of vitamin B12 would drastically reduce those side effects. Claim 1 of the patent granted reads: "Use of pemetrexed in the manufacture of a medicament for use in combination therapy for inhibiting tumour growth in mammals wherein said medicament is to be administered in combination with vitamin B12 or a pharmaceutical derivative thereof."

[8] *Kirin-Amgen Inc v Hoechst Marion Roussel Ltd* [2005] *RPC* 169.
[9] *Actavis v Eli Lilly* [2017] *RPC* 957 at 989.

Actavis sought to capitalise upon Eli Lilly's discovery of the combined effect produced by the simultaneous administration of pemetrexed and vitamin B12 while avoiding infringing the earlier patent. To achieve that aim, it marketed products that either combined the free acid form pemetrexed with vitamin B12 or relied on an alternative salt such as pemetrexed dipotassium.

All the aforementioned examples raise issues of patent scope. The relevant legal rule is s. 125(1) Patents Act 1977, which corresponds to Article 69 of the EPC 2000 (ex Article 69 of the EPC 1973). Pursuant to this provision, the extent to which an invention is protected through the patent instrument shall be "taken to be that specified in a claim of the specification of the application or patent, as the case may be, as interpreted by the description and any drawings contained in that specification." As s. 125(3) PA 1977 further stipulates, the interpretation of s. 125(1) PA 1977 must be in accordance with the guidelines set out in the Protocol on the Interpretation of Article 69 of the EPC.

The Protocol excludes extreme interpretations that would give excessive prominence to the value of legal certainty over the interest of protecting inventions to induce innovation and vice versa. It rejects out of hand the notion of a strict literal interpretation whereby the description and the drawings would only be consulted for the purpose of resolving any ambiguity found in the claims. Equally, the opposite extreme must be avoided. Patent scope may not be exclusively determined through an extrapolation of the patentee's inventive concept as it could be deducted from a conjunctive reading of all information contained in the specification document as a whole in an attempt to appreciate what the patentee had in fact contemplated. The Protocol itself describes the proper approach to the interpretation of patent claims in Article 1 as a balancing exercise in search of a position between two extremes "which combines a fair protection for the patentee with a reasonable degree of certainty for third parties." Article 2 of the Protocol provides that courts assessing the scope of patents should take due account of "any element which is equivalent to an element specified in the claims."

The patent bargain as a relational contract

From the perspective of the patent bargain theory, the patent grant is perceived as the result of a contract between the inventor and the state.[10] The state grants a temporally limited right of exclusivity in exchange for the efficient disclosure of an invention that is new, non-obvious and useful. Just as social contract theory has been relied upon to justify the authority of the state over the individual,[11] the bargain theory of patents dissociated the foundations of the patent system from the notion of a monarchical monopoly grant and offered a justification centred around the public's consent.[12] It may also explain the nature and the function of patentability requirements such as novelty and non-obviousness,[13] which determine whether the consideration offered by the applicant

[10] *Kirin-Amgen* [2005] *RPC* 169 at 196 per Lord Hoffmann.

[11] See generally R. Reiner, "Justice" in J. Penner, D. Schiff, and R. Nobles (eds), *Jurisprudence and Legal Theory: Commentary and Materials* (Oxford: Oxford University Press, 2002) p 721-22.

[12] *Cartwright v Eamer*, reported and confirmed in *Harmer v Plane* (1807) 33 *E.R*. 470 at 471-72, per Lord Eldon: "[the patent grant should not be perceived "in the light of a monopoly, as it had been before been put by the judges, but as a bargain with the public."]. See also W. Carpmael, *The Law of Patents for Inventions, Familiarly Explained, for the Use of Inventors and Patentees* s (London: G. Wightman, 1832) p.1: "[Crown grants of patents] must be restricted within the bounds of the common law."

[13] *Actavis Group PTC EHF v ICOS Corporation* [2019] Bus. L.R. 1318 SC at 1333-1334, per Lord Hodge; cf *Pennock et al. v. Dialogue* 27 US 1, 23 (1829) per Justice Story: "If the public were already in possession and common use of an invention fairly and without fraud, there might be sound reason for presuming, that the legislature did not intend to grant an exclusive right to any one to monopolize that which was already common. There would be no quid pro quo—no price for the exclusive right or monopoly conferred upon the

is adequate.[14] A key feature of the bargain theory is that it had historically provided crucial support for the patent system at times when incentive theories were not very persuasive and debaters argued that the lure of an exclusive right is not really necessary to induce innovation.[15] Patents may not be indispensable, according to that argument, for spurring innovation but are nonetheless necessary as they do provide incentives for disclosure of inventions that would have otherwise remained secret.[16] Although the invention-inducement theory and the disclosure theory are conceptually independent of one another,[17] both rationales underpinning patent protection constitute complementary justifications[18] for the patent system and may well be accommodated under a holistic contract theory of patents.[19]

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inventor [...].”; *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.* 489 US 141, 161 (1989) (noting that the federal patent statute has conditioned the grant of a patent on “the *quid pro quo* of substantial creative effort”). cf W.M. Hindmarch, *A Treatise on the Law Relative to Patent Privileges for the Sole Use of Inventors and Patentees* (Harrisburg, PA: I.G. M'Kinley and J.M.G. Lescure, printers, 1847) p.71.

[14] Courts are not supposed to assess the adequacy of consideration as they normally are in no better position to assess the reasonableness of contractual terms than the parties themselves. Any asymmetry between the value of a promise and the consideration rendered by the other party would potentially be relevant as circumstantial evidence for the existence of some legitimate ground to set aside the underlying contract, R. Posner, *Economic Analysis of Law* (New York: Wolters Kluwer Law & Business, 9th edn, 2014) pp 102-05 (exploring the various economic functions of the consideration requirement). From a law and economics perspective, however, the magnitude of consideration correlates with the efficiency of resource allocation, C. Veljanovski, *Economic Principles of Law* (New York: Cambridge University Press, 2007) p 137. Unless the state’s promise to grant and enforce exclusive rights in inventions is supported by adequate consideration, patents would give rise to socially undesirable monopolies. Courts often accentuate the principle that the scope of a patent should be commensurate to the patentee’s inventive contribution. See for instance, *Actavis Group* [2019] UKSC 15 at [57] per Lord Hodge: “The general principle that the extent of the patent monopoly should correspond to and be justified by the actual technical contribution to the art is thus part of the jurisprudence of both the EPO and the UK courts and, as Lord Sumption observed in *Generics v Warner-Lambert* […] “the principal conditions of validity, novelty, inventive step, industrial application and sufficiency are all, in one way or another, directed to satisfying the principle thus expressed”. There is therefore a balance or symmetry in patent law […].” Thus, the doctrine of consideration serves the key function of guaranteeing that patents are justifiably granted. Importantly, it also bars, as a matter of contemporary positive law, the emergence of an enforceable promise of the state to arbitrarily award monopolies through the issuance of prerogative patents like monarchs used to do back in the old days. See E.A. Posner, “Economic analysis of contract law after three decades: success or failure?” (2003) 112 *Yale LJ* 829 at 850 (noting that one of the main functions of the consideration doctrine “is now to deny enforcement of promises to give gifts.”). cf W.M. Hindmarch, *A Treatise on the Law Relative to Patent Privileges* (1847) p.64. See also D. Vaver, “Intellectual property: still a "bargain"?” (2012) 34 *EIPR* 579 (accepting that the “bargain metaphor” is helpful in ensuring that there is a proper balance between individual and collective interests but arguing that the IP system favours rights holders).

[15] M. Fisher, *Fundamentals of Patent Law: Interpretation and Scope of Protection* (Oxford: Hart Publishing, 2007) pp 81-85.

[16] It is perhaps for this reason that the bargain theory is quite often juxtaposed to reward and incentive theories as showing just cause for the patent system on the grounds of technical disclosure. See for instance, Vincenzo V. Denicolò and L.A. Franzoni, “The contract theory of patents” (2004) 23 *IRLE* 365 (developing an insightful economic model and suggesting that the information function of patents constitutes a self-contained and sufficient justification for the grant of patent protection).

[17] F. Machlup, “An economic review of the patent system” Study of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, U.S. Senate, study no. 15 (Washington: United States Government Printing Office, 1958) p 24.

[18] *Asahi Kasei Kogyo KK's Application* [1991] *RPC* 485 at 523, per Lord Oliver: “The underlying purpose of the patent system is the encouragement of improvements and innovation. In return for making known his improvement to the public the inventor receives the benefit of a period of monopoly during which he becomes entitled to prevent others from performing his invention except by his licence.” cf *Kewanee Oil Co. v. Bicron Corp.* 416 US 470, 480 (1974), per Chief Justice Burger: “The patent laws promote [the] progress [of science

This analysis will further illustrate that point by drawing upon the specific incentive structures created by contracts inducing the parties to act in reliance of an enforceable promise. In particular, credible commitments to enforce contractual promises generate incentives for individuals to engage in relationship-specific investments.[20] Think of an automobile manufacturer, for instance, who wishes to outsource the production of some car part to a third party. Let's assume further that this mechanical part has to be tailored to its needs and therefore it would only optimally interact with its own engine system. On the other hand, the parts manufacturer would have to specialize on a given type of machinery foregoing other contractual opportunities or even perhaps losing some of its current customers. Such investments lose their value, partially or completely, outside the context of a commercial relationship. No third party would match the price the automobile manufacturer is willing to pay for the customized car part. Normally, the parts manufacturer would require a long-term contact guaranteeing certain output levels at a profitable price to consider incurring relationship-specific investments.[21]

Several features of the patent system militate in favour of the proposition that the patent bargain should be viewed as a relational contract. Inventors have an incentive to promptly disclose their innovations to the Intellectual Property Office rather than keeping them secret as in the latter case they would not be able to enjoin the use of their inventive ideas by those who will at some point become able to develop them independently.[22] Rules excluding particular categories of subject matter from patent protection are designed to induce some abstractly prescribed human intervention with the state of things by means of a technical contribution to the art.[23] No patent will be granted for discovering a naturally occurring substance, for instance, since discoveries themselves

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and useful arts] by offering a right of exclusion for a limited period as an incentive to inventors to risk the often enormous costs in terms of time, research, and development. The productive effort thereby fostered will have a positive effect on society through the introduction of new products and processes of manufacture into the economy, and the emanations by way of increased employment and better lives for our citizens. In return for the right of exclusion -this "reward for inventions" […]- the patent laws impose upon the inventor a requirement of disclosure."

[19] cf *Actavis Group* [2019] Bus. L.R. 1318 SC at 1333, per Lord Hodge: "[T]he purpose of a grant of a patent has been to encourage innovation. The monopoly granted by the patent rewards the inventor by enabling him or her to charge a higher price than would have been possible if there had been competition. The "patent bargain" is this: the inventor obtains a monopoly in return for disclosing the invention and dedicating it to the public for use after the monopoly has expired."; *Teva Canada Ltd v Pfizer Canada Inc* [2013] 4 *LRC* 218 at 227: "The patent system is based on a 'bargain', or quid pro quo: the inventor is granted exclusive rights in a new and useful invention for a limited period in exchange for disclosure of the invention so that society can benefit from this knowledge. This is the basic policy rationale underlying the Act. The *patent bargain encourages innovation and advances science and technology*." (emphasis added). cf M. Coulter, *Property in Ideas – The Patent Question in Mid-Victorian Britain* (Kirksville, Missouri: Thomas Jefferson University Press, 1991) p.94 (noting how the proponents of patent protection had relied on the bargain theory to corroborate arguments pertaining to incentives to invent and disclose).

[20] R. Craswell, "Two economic theories of enforcing promises" in P. Benson (ed.), *The Theory of Contract Law: New Essays* (New York: Cambridge University Press, 2001) pp.28-30.

[21] I.R. Macneil, "Contracts: Adjustment of long-term economic relations under classical, neoclassical, and relational contract law" (1977-1978) 72 *Nw. U. L. Rev.* 854, 886 et seq.

[22] The bargain between the inventor and the state does not coerce but rather encourages disclosure. cf *Kewanee Oil* 416 US 470, 484 (1974), per Chief Justice Burger: "The more difficult objective of the patent law to reconcile with trade secret law is that of disclosure, the quid pro quo of the right to exclude." (ruling eventually that federal patent law does not pre-empt state trade secret law).

[23] *Aerotel Ltd v Telco Holdings; Re Macrossan's Application* [2007] R.P.C. 117 CA (Civ Div) at 134–135; *Symbian Ltd v Comptroller-General of Patents* [2009] R.P.C. 1 CA (Civ Div) at 7–9; T-208/84 *Computer-related invention/VIACOM* [1987] *OJ EPO* 14 at 16.

do not constitute protectable subject matter.[24] Those, however, who have been able to isolate a natural substance from its surroundings may patent that substance as well as its isolation method provided that other requirements for patentability are met.[25] This is a strong incentive for inventors to make available inputs that are essential to medicinal or other industrial productions. By excluding only some types of inventions patent law manages to steer innovative efforts within a broader field of activity envisaging an optimal trade-off between the social costs and the social benefits associated with the grant of an exclusive right. Medical methods are not patentable, for instance, but substances intended for use in such methods are. Occasionally, the invention of a new pharmaceutical compound may coincide with an innovative treatment method, which could then be practised freely.[26]

Inventions are patentable as long as they are new, involve an inventive step, and are capable of industrial application. The novelty requirement can be quite harsh. If there has been a single opportunity for the invention to be inspected by a person skilled in the art who could appreciate the details of the invention while not being under any obligation of confidentiality, the novelty of the respective patent application is destroyed.[27] Ultimately, the patent system strives to induce the expeditious disclosure of inventive ideas through patent applications. Grave emphasis is placed on the celerity of the patent disclosure, which is crucial not only for the efficient dissemination and commercialization of technology but also for the progress of science.[28] Moreover, the requirement of absolute novelty highlights that no patent incentive is provided for simply importing technology from abroad.[29] Regardless of where in the world it has been made available, already existing information about the invention would anticipate the inventor's application.[30]

With regard to the requirement of an inventive step, it is a manifestation of the principle that the patent instrument is not there to induce the disclosure of inventions that are somehow supposed to have emerged anyway as a result of the efforts undertaken by a person ordinarily skilled in the art who would combine pieces of relevant prior knowledge to solve a given technical problem.[31] Instead, the prospect of patent rights functions as an incentive to bring forward inventions that may indeed occur in the natural course of events but at a much later stage. Assessing whether an invention entails an inventive step is a complex question which requires the consideration of various

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[24] PA 1977, s.1(2)(a); EPC, art.52(2)(a).

[25] Directive 98/44/EC of the European Parliament and of the Council of 6 July 1998 on the legal protection of biotechnological inventions OJ 1998 L213/13 pp.13–21, [hereinafter Biotech Directive], Art 5(2); PA 1977, Sch.A2, para.2; *Howard Florey/Relaxin* [1995] *EPOR* 541.

[26] cf *Kirin-Amgen* [2005] *RPC* 169 at 196, per Lord Hoffmann: "An invention is a practical product or process, not information about the natural world. That seems to me to accord with the social contract between the state and the inventor which underlies patent law. The state gives the inventor a monopoly in return for an immediate disclosure of all the information necessary to enable performance of the invention. That disclosure is not only to enable other people to perform the invention after the patent has expired. If that were all, the inventor might as well be allowed to keep it secret during the life of the patent. It is also to enable anyone to make immediate use of the information for any purpose which does not infringe the claims."

[27] *Lux Traffic Controls Ltd v. Pike Signals Ltd and Faronwise Ltd* [1993] *RPC* 107 at 133, per Aldous J.

[28] *Kirin-Amgen* [2005] *RPC* 169 at 196, per Lord Hoffmann.

[29] Notably, the nature of the consideration may change over time. Consider *Edward Darcy Esquire v Thomas Allin of London Haberdasher* (1599) Noy 173, 74 *E.R.* 1131 at 1139. See also *Singer Mfg. Co. v. June Mfg. Co.* 163 U.S. 169 (1896).

[30] PA 1977, s.2(2); EPC, art.54(2).

[31] *Windsurfing International Inc. v. Tabur Marine (G.B.) Ltd* [1985] *RPC* 59 at 77, per Oliver LJ: "No doubt, the philosophy behind [obviousness must take into account] that it would be wrong to prevent a man from doing something which is merely an obvious extension of what he has been doing or of what was known in the art before the priority date of the patent granted."

factors without yielding to some rigid formula.[32] Research and development efforts based on promising research avenues with a reasonable expectation of success are rather unlikely to culminate in the procurement of a patent, for instance.[33]

Patent protection is only available for inventions that are capable of industrial application.[34] Courts and competent authorities have interpreted this requirement broadly to include anything that could possibly be made or used in industry.[35] A patentable invention must offer to the public some "concrete benefit."[36] Claims directed at a DNA-sequence expressing a novel protein, for instance, would not be patentable unless there is an indication in the application about the therapeutic virtues of the claimed invention.[37] Notably, the law refrains from dictating the types of socially desirable innovations. In a system where there is no state compensation for rewarding inventive activity but innovation is spurred by patent rights ensuring that patentees will capture the full market value of their inventions, it is for the inventors to figure out themselves what sort of utilitarian value may be demanded by the public. In that regard, it could be argued that the patent bargain features a certain degree of strategic incompleteness.[38] Furthermore, the utilitarian benefit associated with the invention does not need to be positively proven. It would suffice to plausibly establish that the novel protein just discovered could be put to some therapeutic use by highlighting, for instance, its structural analogies to other proteins known for their pharmaceutical applications.[39] Inventors are thereby incentivized to disclose their inventive ideas at the very moment they reach a sufficient stage of maturity so that they could be characterized as mere speculations without being required to adduce empirical data based on some *in vitro* or *in vivo* study. It ensues therefrom that the general policy favouring the unhesitating disclosure of inventions underlies the administration of the industrial applicability requirement as well.[40]

The efficiency of the patent disclosure depends not only on its promptness but also on its quality. Hence, requirements such as those of sufficiency[41] as well as claim clarity, support and confinement to a single invention/inventive concept[42] essentially specify the consideration applicants are required to render.[43] Under a contractarian view of the patent system, the contract between the inventor and the state is meant to induce reliance investments by individuals through abstract provisions that are capable of channeling inventive efforts towards the achievement of socially desirable innovations.[44]

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[32] *Generics (UK) Ltd v Daiichi Pharmaceutical Co Ltd* [2009] RPC 828 at 837, per Jacob LJ.

[33] *Conor Medsystems Inc v Angiotech Pharmaceuticals Inc* [2008] *RPC* 716 at 730, per Lord Hoffmann.

[34] PA 1977, ss.1(1)(c) and 4(1); EPC, arts.52(1) and 57.

[35] *Chiron Corporation v Murex Diagnostics Ltd and Organon Teknika Ltd* [1996] *RPC* 535 at 607, per Morritt LJ.

[36] T 0898/05 *Hematopoietic receptor/ZYMOGENETICS* [2007] *EPOR* 2 at [r 2]-[r 6].

[37] Biotech Directive, Art 5(3); Patents Act 1977, Sch.A2, para 6.

[38] On this point see J. Tirole, "Incomplete Contracts: Where Do We Stand?" (1999) 67 *ECMA* 741 at 742.

[39] *Eli Lilly and Co v Human Genome Sciences Inc* [2012] 1 *All ER* 1154 SC at 1181-84, per Lord Neuberger (reviewing the principles established by the EPO Technical Boards of Appeal).

[40] *Eli Lilly and Co*, [2012] 1 *All ER* 1154 at 1187-88, per Lord Neuberger.

[41] PA 1977, ss.14(3) and 72(1)(c); EPC, art.83.

[42] PA 1977, s.14(5)(c); EPC, art.84.

[43] See generally M. Fisher, "Extracting the price of a patent: enablement and written description" [2012] *IPQ* 262; *Warner-Lambert Co LLC v Generics (UK) Ltd (t/a Mylan)* [2019] 3 All ER 95 SC at 105-106, per Lord Sumption; cf *Universal Oil Products Co. v. Globe Oil & Refining Co.* 322 US 471, 484 (1944), per Justice Reed: "But the quid pro quo is disclosure of a process or device in sufficient detail to enable one skilled in the art to practice the invention once the period of the monopoly has expired […]."

[44] *cf Brenner v. Manson* 383 US 519, 534-35 (1966), per Justice Fortas: "The basic quid pro quo contemplated by the Constitution and the Congress for granting a patent monopoly is the benefit derived by the public from an invention with substantial utility. Unless and until a process is refined and developed to this point—where

The problem of opportunism

Where the parties have entered a contract but were not able to stipulate provisions for all possible future contingencies, the party that has incurred relation-specific investments might find itself in a vulnerable position at some renegotiation stage, particularly if specialization has reduced or eradicated its outside options. Contractual incompleteness is associated with the problem of underinvestment. The prospect of opportunistic behaviour during the renegotiation stage reduces incentives to invest.

There are basically two suggested solutions to this problem. The first solution, which is derived from the insights of transaction cost economics, seeks to promote the conclusion of complete contracts. Parties are expected to provide for revelation mechanisms that cover all possible contingencies including the mutual exchange or the surrendering of economic "hostages", such as posting a bond, to quell their anxieties about entering into an agreement and living in dread of being exposed to opportunism.[45] Contract law seeks to remedy "incompleteness errors" through recourse to default rules in order to reconstruct the complete contract.[46] The second solution relies on property rights to avoid the problem of underinvestment.[47] A typical example is the R&D game. Normally, courts cannot verify whether the agent has complied with its obligation under the contract to use its best efforts to create some new technology. In the case of "observable but non-verifiable" contractual variables, the agent is exposed to the opportunistic behaviour of the principal who might seek to renegotiate the price arguing that the research and development efforts were lax. There is also the possibility of a court or a jury mistakenly assuming that the agent did not observe the "best efforts" clause. Allocating the patent rights to the agent reduces the reservations of R&D firms to enter into such contracts.[48] In contrast to the transaction cost theory, the property rights approach is based on the premise that complete contracting is unattainable. Although they are based on different assumptions, both approaches share the notion that contractual safeguards are necessary for dealing with the problem of opportunism.[49]

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specific benefit exists in currently available form—there is insufficient justification for permitting an applicant to engross what may prove to be a broad field." *J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred Intern., Inc.* 534 U.S. 124, 142 (2001), per Justice Thomas: "The disclosure *required by the Patent Act* is the *quid pro quo* of the right to exclude." (emphasis added).

[45] O.E. Williamson, *The Mechanisms of Governance* (New York: Oxford University Press, 1996) pp 120 et seq. Integration would be another option for two transacting parties wishing to eradicate the prospect of falling victim to opportunism apart from achieving other efficiencies such as the reduction of transaction costs. See also O.E. Williamson, *Markets and Hierarchies: Analysis and Antitrust Implications* (New York: The Free Press, 1975) pp 29-40 and 253-58 (summarizing his theory).

[46] Veljanovski, *Economic Principles of Law* (2007) pp 121-25; C.J. Goetz and R.E. Scott, "The limits of expanded choice: An analysis of the interactions between express and implied contract terms" (1985) 73 *Calif. L. Rev.* 261, 270-71.

[47] S.J. Grossmann and O.D. Hart, "The costs and benefits of ownership: A theory of vertical and lateral integration" (1986) 94 *J Pol Econ* 691; O. Hart and J. Moore, "Property rights and the nature of the firm" (1990) 98 *J Pol Econ* 1119. For a concise introduction see O. Hart, *Firms, Contracts and Financial Structure* (New York: Oxford University Press, 1995) pp.1-12 and 29-33.

[48] See generally, Tirole, "Incomplete Contracts" (1999) 67 ECMA 741.

[49] For a juxtaposition of those theories, a critical appraisal of their core assumptions and further bibliographical references see E. Brousseau and J-M. Glachant, "The economics of contracts and the renewal of economics" in E. Brousseau and J-M. Glachant (eds), *The Economics of Contracts: Theories and Applications* (New York: Cambridge University Press, 2002) pp 3-30. Importantly, these observations apply to public-state partnerships where residual rights of control might be reserved for the state, Hart, O "Incomplete contracts and public ownership: Remarks, and an application to public-private partnerships" (2003) 113 *EJ* p C69. Hence, the contractarian view of the patent grant may indeed explain review proceedings of administrative nature. cf

But without a workable definition of opportunism, those principles cannot be fructified. At a very abstract level, opportunism could be defined as an attempt to promote self-interest in a manner that is socially undesirable.[50] Such an over-inclusive definition could only be avoided if the circumstances actually warranting legal intervention are more clearly defined. In a contractual setting, opportunism could be perceived as conduct that falls short of violating any literal terms but which evidently contradicts the reasonable expectations of the other party under the contract.[51] Refining the definition further, an opportunist seeks to obtain a benefit which contractual stipulations seem to have left free for acquisition when the reason for that benefit not having been contracted away in the first place lies in the impossibility to cost-efficiently define and deter opportunistic behaviour *ex ante* through appropriate contract terms.[52] Importantly, this definition is capable of capturing instances where opportunism may easily take on the guise of perfectly legitimate conduct ("subtle opportunism").[53] Legal safeguards operate *ex post* through the administration of rules or standards that rely on proxies associated with opportunism. Patentees face an analogous problem when the state fails to protect them against the appropriation of their inventive concepts by parties that are capable of circumventing the wording of the claims.

Contract interpretation: Textualism v contextualism

Textualism reflects the notion that complete contracting is both feasible and desirable.[54] A strict literal approach to interpretation would foster better contracting by motivating the parties to correctly perceive the meaning of words and use them accurately for determining the content of complete contracts. Accordingly, textualism neither favours inquiries upon whether there are terms that should be deemed as implied nor tends to excessively rely on default rules. Textualist approaches to interpretation or recognition of implied terms would only work, however, when it is indeed cost-efficient for the parties to make provision for all possible contingencies. If transaction costs are high and/or the ability of the parties to design complete contracts is limited, textualism will inevitably allow opportunism to flourish.

Under the contextual approach, on the other hand, courts are not only required to ascertain the objective meaning of the language used by the parties to express their agreement but they are also expected to look at the contract as a whole and consider elements arising from the wider contractual context to achieve that aim.[55] Contextualism is rooted in the idea that contracts would

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Ghosh, S "Patents and the regulatory state: Rethinking the patent bargain metaphor after *Eldred*" (2004) 19 *Berkeley Tech LJ* 1315 (rejecting the normative value of the theory and criticising it, among others, for not being able to explain the administrative law dimension of patent law).

[50] See e.g. O.E. Williamson, *The Economic Institutions of Capitalism* (New York: The Free Press, 1987) p.47 (defining opportunism as "self-interest seeking with guile").

[51] G.M. Cohen, "The negligence-opportunism trade-off in contract law" (1992) 20 *Hofstra L. Rev.* 941 at 957; cf V.P. Goldberg, "Relational exchange: Economics and complex contracts" (1980) 23 *Am. Behav. Sci.* 337 at 339 and Posner, *Economic Analysis of Law* (2014) p 97 (both associating opportunism with the exploitation of the other party's vulnerabilities).

[52] H.E. Smith, "Equity as second-order law: The problem of opportunism" (2015) *Harvard Public Law Working Paper No. 15-13* available at https://ssrn.com/abstract=2617413 at 14. Opportunistic behaviour tends to redistribute "portions of an already allocated contractual pie", C.J. Goetz and R.E. Scott, "Principles of relational contracts" (1981) 67 *Va. L. Rev.* 1089 at 1139.

[53] On the concept of "subtle opportunism" see T.J. Muris "Opportunistic behaviour and the law of contracts" (1981) 65 *Minn L Rev* 521 at 525.

[54] G.K. Hadfiled, "Judicial competence and the interpretation of incomplete contracts" (1994) 23 *J. Legal Stud.* 159 at 161.

[55] *Investors Compensation Scheme Ltd v West Bromwich Building Society* [1998] 1 *WLR* 896 at 912 per Lord Hoffmann ("Interpretation is the ascertainment of the meaning which the document would convey to a

often be incomplete not only because of the parties' failure to provide for a given contingency but also due to the vagueness of their express terms. Still, the point of departure remains the natural and ordinary meaning of the contested clause which within the framework an iterative process of interpretation might give way to some alternative interpretation emerging from the content of the contract or the surrounding circumstances.[56]

In practice, courts eventually end up balancing indications derived from both textual and contextual argumentations.[57] Textual analysis would normally dominate the interpretative inquiry in the case of complex and sophisticated agreements which are usually negotiated and drafted with the assistance of skilled professionals.[58] On the other side of the spectrum, greater emphasis would be placed on the factual background when less formal agreements are being interpreted.[59] Recourse to the factual matrix[60] would be imperative to the interpretation of complex formal agreements that are vitiated by vagueness. Inconsistency between the several terms assorted in a single agreement is likely to arise when the final text adopted reflects a compromise between parties that have conflicting aims.[61] Various other factors such as the parties' adherence to different drafting practices, communication failures between them and pressing deadlines to reach an agreement, may be instrumental in the eventual failure to adopt an unambiguous text.[62]

The contextual approach to contractual interpretation requires a significant degree of inquisition. Courts should be mindful, for instance, that it would have been impossible for the parties to *ex ante* design more precise contractual terms. Business common sense could inform the assessment by highlighting the commercial consequences of rival interpretations.[63] To live up to the challenge of interpreting vague terms the courts might look at the meaning the parties themselves have ascribed to specific terms in their prior dealings or consider how similar provisions in contracts of the same type are perceived within the relevant business sector.[64]

At any rate, the language used by the parties may not be disregarded. The purpose of contractual interpretation is to ascertain what the parties have agreed upon from the perspective of a

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reasonable person having all the background knowledge which would reasonably have been available to the parties in the situation in which they were at the time of the contract.").

[56] *Arnold v Britton* [2015] *AC* 1619 SC at 1627, per Lord Neuberger (noting that the disputed clause had to be assessed in light of (i) [its] natural and ordinary meaning, (ii) any other relevant provisions of the contract, (iii) [its] overall purpose [as well as the broader purpose of the contract]" (iv) the facts and circumstances known or assumed by the parties at the time that the document was executed, and (v) commercial common sense, but (vi) disregarding subjective evidence of any party's intentions."). See also Lord Grabiner, "The iterative process of contractual interpretation" [2012] 128 *LQR* 41.

[57] *Wood v Capita Insurance Services Ltd* [2017] *AC* SC 1173 at 1180, per Lord Hodge. In that case, the Supreme Court effectively summarized and expanded upon the principles established through its earlier decisions on contact interpretation.

[58] *Wood* [2017] *AC* 1173 at 1180, per Lord Hodge.

[59] *Wood* [2017] *AC* 1173 at 1180, per Lord Hodge.

[60] The term was coined in *Prenn v Simmonds* [1971] 1 *WLR* 1381 at 1384, per Lord Wilberforce. The factual background comprises all information that could have affected the way the document would have been understood by a reasonable person, *Investors Compensation Scheme*, [1998] 1 *WLR* 896 at 921 per Lord Hoffmann. There is no conceptual limit as to what may be included in the factual background, *Bank of Credit and Commerce International SA v Ali* [2002] 1 *AC* 251 at 269 per Lord Hoffmann.

[61] *Wood* [2017] *AC* 1173 at 1180, per Lord Hodge.

[62] *Wood* [2017] *AC* 1173 at 1180, per Lord Hodge.

[63] *Rainy Sky S. A. v Kookmin Bank* [2011] 1 *WLR* 2900 SC at 2908, per Lord Clarke.

[64] *Wood* [2017] *AC* 1173 at 1180,. See also C. Staughton, "How do the courts interpret commercial contracts?" [1999] 58 *CLJ* 303 at 311-12. For some examples derived from case law see K. Lewison, *The Interpretation of Contracts* (London: Sweet & Maxwell, 6th edn, 2015) at 5.09.

reasonable business person and not to re-write contracts in light of business common sense with a view to coming to the aid of someone who has slipped into a bad deal.[65] Evidence might nevertheless suggest that the parties had used words of common vocabulary in an unconventional sense creating their own "private dictionary."[66] Apart from its primary meaning, the word elephant, for instance, may mean a hand-carved object in the shape of an elephant or it may even mean "horse" if there is an understanding or a common assumption between the parties that it actually does so.[67] Importantly, it is not necessary to establish that the crucial term is ambiguous before ascertaining its contextual meaning.[68]

While a broad evidentiary basis is necessary for ascertaining the parties' intention, limits must be drawn as to the admissible background otherwise contractual interpretation might turn out to be overly costly.[69] Hence, the law excludes the parties' previous negotiations and declarations of subjective intent from the pool of information that forms the factual matrix in light of which contracts are to be interpreted.[70]

Contextualism provides incentives for better contracting since it induces the parties to familiarize themselves with the language usage as well as with the customary practices pervading the conclusion of bargains in the field of their economic activity.[71] By doing so, negotiating parties would also economize on transaction costs. Over and above that, the contextual approach is more permissive towards the implication of contractual terms by courts seeking to ascertain the contents of contracts exactly because it calls for a thorough consideration of the factual matrix. Another advantage of contextualism is that it provides the courts with an analytical tool enabling them to ensure that no intention is attributed to the parties which they could not possibly have had due to some unfortunate contractual stipulation.[72]

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[65] *Arnold v Britton* [2015] *AC* 1619 SC at 1628-2169 per Lord Neuberger; *Chartbrook Ltd v Persimmon Homes Ltd* [2009] *AC* 1101 SC at 1114, per Lord Hoffmann ("All that is required is that it should be clear that something has gone wrong with the language and that it should be clear what a reasonable person would have understood the parties to have meant."). *Investors Compensation Scheme* [1998] 1 *WLR* 896 at 913, per Lord Hoffmann; N. Andrews, "Interpretation of contracts and "commercial common sense": Do not overplay this useful criterion" [2017] 76 *CLJ* 36.

[66] *Chartbrook* [2009] *AC* 1101 HL at 1122, per Lord Hoffmann; *Charter Reinsurance Co Ltd v Fagan* [1997] A.C. 313 at 391-92, per Lord Hoffmann (highlighting the various possible contextual meanings of the word "pay"). For additional illustrative examples from case law see K. Lewison, *The Interpretation of Contracts* (2015) at 5.10.

[67] D. McLauchlan, "Some fallacies concerning the law of contract interpretation" [2017] LMCLQ 506, 518. On the contextual dependency of interpretation see generally Lord Hoffmann, 'The intolerable wrestle with words and meanings' [1997] 114 SALJ 656 and D. Nicholls, "My kingdom for a horse: The meaning of words" [2005] 121 *LQR* 577.

[68] *Regina (Westminster City Council) v National Asylum Support Service* [2002] 1 WLR 2956 at 2959, per Lord Steyn. See also E. McKendrick, "The interpretation of contracts: Lord Hoffmann's Re-Statement" in S. Worthington (ed), *Commercial Law and Commercial Practice* (Oregon: Hart Publishing, 2003) p 138 at 157-58; R. Buxton, "'Construction' and rectification after Chartbrook" [2010] 69 *CLJ* 253 at 256.

[69] The exercise of the judiciary's case management powers ensures that adjudication costs will not go out of proportion, G. McMeel, *McMeel on the Construction of Contracts: Interpretation, Implication, Rectification* (New York: Oxford University Press, 3rd edn, 2017) at 5.47.

[70] *Investors Compensation Scheme* [1998] 1 *WLR* 896 at 913 per Lord Hoffmann; *Chartbrook*, [2009] *AC* 1101 at 1120-21, per Lord Hoffmann.

[71] See, for instance, *British Sugar plc v NEI Power Projects Ltd* (1997) 87 *BLW* CA (Civ Div) 45 at 50 per Lord Justice Waller (holding that "a reasonable businessman must more naturally be taken to be having the intention that the phrase should bear the same meaning as [in earlier analogous cases]. It would again take very clear words to allow a court to construe the phrase differently").

[72] *Antaios Compania Naviera SA v Salen Rederierna AB (The Antaios)* [1985] *AC* 191 HL at 201, per Lord Diplock.

The contextual approach is better suited for protecting parties "whose investments are vulnerable to changes in contractual interpretation."[73] Therefore, contextualism is a preferable method for interpreting patent claims.

Default rules

Default rules seek to remedy the defects of contractual incompleteness by filling gaps in contracts. One of their functions is to determine the efficient terms, those that the parties would have contracted for in the absence of transaction costs with a view to maximizing their joint utility.[74] Gap-filling is normally justified when drafting is very expensive due to high transaction costs, the inability of the parties to foresee future contingencies and/or any inevitable limitation of language.[75]

In other instances, it would make sense to choose default rules that are most likely to be eventually contracted around in order to force parties to avoid incompleteness either by explicitly providing for a given contingency or by revealing information.[76] A default rule setting the quantity of goods to be delivered at zero, for instance, would induce the parties to a sales contract to specify the amount of the contracted goods. Buyers facing large losses in the event of non-performance, to refer to another example, would be motivated by a default remedy for breach of contract providing for only a small payment to negotiate an explicit contractual term that would cover all of their potential losses revealing thereby the potential magnitude of their consequential damages.

Purposive interpretation: the traditional British approach to patent claim construction[77]

From early on, British courts have always sought to shield patentees against the opportunistic attempts of third parties to highjack the inventive concept revealed in letters patent by marketing products or practising processes that fall outside the conventional meaning of the wording used to describe the patented invention. Findings of patent infringement were not confined to the straightforward case where one reproduces verbatim or punctiliously practises the claimed subject matter. Reiterating earlier case law, the House of Lords noted in *Clark v Adie*, that patent property may well be trespassed upon by someone, for instance, who has offered for sale a product resembling a patented machine only in some respects but which nonetheless implemented and

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[73] A.W. Katz, "The economics of form and substance in contract interpretation" (2004) 104 *Colum L Rev* 496, 530.

[74] R.A. Posner, "The law and economics of contract interpretation" (2005) 83 *Tex. L. Rev.* 1581, 1588 (noting that gap-filling rules driven by efficiency considerations would tend to mirror the terms the parties would have wanted if they were able to conclude a complete a contract).

[75] A. Schwartz, "Relational contracts in the courts: An analysis of incomplete agreements and judicial strategies" (1992) 21 *J. Legal Stud.* 271, 281-83.

[76] I. Ayres and R. Gertner, "Filling gaps in incomplete contracts: An economic theory of default rules" (1989) 99 *Yale LJ* 87 (elaborating upon *Hadley v Baxendale* 9 Ex. 341, 156 Eng Rep 145 (1854) and introducing the concept of "penalty defaults" while also highlighting the complexity of ascertaining whether a contractual gap exists in the first place).

[77] According to the mainstream view adopted by the House of Lords in *Kirin-Amgen* [2005] *RPC* 169 at 188 per Lord Hoffmann, the development of the principles governing claim construction may be narrated as a story of how case law left an initial stage of strict acontextual literalism behind. Others have argued that this has never been the case and that claims had always been construed in context. See, R. Jacob, "Interpretation of claims and infringement" in M. Vitoria (ed.), *The Patents Act 1977 – Queen Mary College Patent Conference Papers* (London: Sweet & Maxwell, 1978) p 67; H. Laddie, "Kirin Amgen – The end of equivalents in England?" (2009) 40 IIC 3, 8-12. For the purposes of this article, we refer to the law as it had developed and stood until the Supreme Court rendered its decision in *Actavis v Eli Lilly* as the "traditional British approach."

utilised the essence, the "pith and marrow", of the same inventive concept.[78] Under the doctrine of "pith and marrow", which had already been established before claims became mandatory under the Patents, Designs and Trade Marks Act 1883, the courts would practically examine whether any dissimilarities between the two products concealed a disguised attempt to evade liability for patent infringement. Accordingly, the presence of variations pertaining to inessential elements of the claimed invention was treated as a proxy for opportunism. In practice, the application of the doctrine leaned towards literalism as it was presumed that the use of narrow language was meant to exclude variants not covered by the unambiguous meaning of the terms used in the claims. In *Van der Lely v Bamfords*,[79] the plaintiff sought to enforce a patent on a hay-raking machine that was convertible to a swathe turner. The claims taught an arrangement whereby the "hindmost" wheels could be moved parallel to the original wheel row to become adjacent to the "foremost" wheels of the rake. A machine operating under the same principle was deemed as non-infringing because it achieved the same practical utility through an analogous adjustment, which required its front wheel-set to be repositioned.[80] Just a few years later, the House of Lords ruled in another case that substituting the U-shaped connectors of a patented expandable bracelet for C-shaped links did not amount to infringement after applying the same principles. At this early stage, UK patent law was therefore characterised by a strong adherence to the literal meaning of the claims. The doctrine of "pith and marrow" served as a safety valve against a specific form of blatant opportunism wherein a third party would introduce insubstantial variations to a product embodying the teachings of an earlier patent in an attempt to escape liability for patent infringement.[81]

To avoid the undesired consequences of strict literalism courts endorsed the principle of purposive construction. As per its very purpose, the patent specification is not meant to address everyone but only those who are skilled in the relevant art to teach them how the invention claimed therein could be practised. Drafting costs would have undermined the efficiency of the patent disclosure if the

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[78] *William Clark v Patrick Adie* (1877) 2 *App. Cas.* 315 at 320, per Lord Cairns (noting also that the same principle would be applicable to the case where a third party would appropriate a part of a complex product or a step of a patented process which was inventive in itself).

[79] *C. Van Der Lely N.V. v Bamfords Ltd.* [1963] *RPC* 61 HL.

[80] *Van Der Lely* [1963] *RPC* 61 at 77-78, per Viscount Radcliffe.

[81] *Van Der Lely* [1963] *RPC* 61 at 78, per Viscount Radcliffe: '[t]he application of this principle is from first to last directed to the prevention of *abuse of patent rights by colourable evasion* : it is not a special or "benevolent" method of construing an uncertain claim : and I think that he is right to remind us that the basic duty of the patentee to state clearly what is the invention for which he seeks protection and the modem practice of building up patent claims by a meticulous accumulation of separate or combined elements has left a good deal less room for a patentee to complain of abuse, where there is no textual infringement, than may have been allowed to him at some periods in the past." (Emphasis added). An illustrative example of a failed attempt to impermissibly ensnare the inventive concept disclosed in an earlier patent can be found in *Marconi v British Radio Telegraph & Telephone Co* [1911] *RPC* 181. Marconi's improved wireless telegraphy system consisted of two separate devices, the transmitter and the receiver. In that new system, he substituted the single circuit featured in both the transmitter and the receiver for a pair of circuits. At the transmission station, one circuit would persistently generate electrical oscillations and function as a conserver of energy allowing those oscillations to build up inside it while remaining closed. Once the oscillating circuit was open, the second circuit would readily absorb and radiate. The circuits at the receiving end would respectively absorb and accumulate oscillations in a similarly efficient fashion. Marconi's improvements increased the transmission range through the achievement of stronger signals and more effective reception. Circuits were connected by means of another unit called the transformer, which is used to transfer energy between circuits. There are different types of transformers. The patent specification made reference to a two-coiled transformer. A competitor marketed a wireless telegraph drawing upon the same inventive idea but using an auto-transformer to pair circuits instead. In the end, the patent was held infringed because the variation introduced by the defendant was deemed as pertaining to an inessential feature of the claimed invention.

applicant were under an obligation to describe the invention to the technically unlearned. Thus, it is the perspective of the skilled addressee that matters. Such a person has no propensity for ascribing to patent claims the dictionary or conventional meaning of their wording.

First and foremost, the notion of the skilled addressee is a legal fiction.[82] By imputing specific attributes to that hypothetical person, patent law seeks to induce applicants and third parties to act in accordance with standards of reasonableness. Applicants must determine the subject matter of protection with sufficient clarity and precision identifying the *sine qua non* elements of their inventions. Third parties, on the other hand, are expected to inquire upon the patentee's intention as this manifests itself in the patent claims to take due consideration of his legitimate interests. For reasons of legal certainty, however, there must be a certain point where users would be entitled to plan their course of action rightfully assuming that they have accurately ascertained the scope of the earlier patent.

It is taken for granted that the skilled person reads patent specifications being aware that the purpose of the claims is to define the scope of the patent monopoly. He would contemplate whether the use of a very specific term has been intended by the patentee to exclude minor variants known to exist at the date of publication which could have no material effect on the way the invention works. When confronted with narrow claim language, the notional addressee would cogitate on the reasons explaining why the patentee did not choose a wording that includes equivalents known at the relevant date. In other words, the skilled person may not light-heartedly assume that the omitted variant falls outside the exclusionary scope of the patent unless there is some concrete indication that the patentee had reasons to exclude it.[83] Although the hypothetical person is familiar with the function of the claims, he is untutored in patent law.[84] Hence, there will be no rumination about whether any limitations present in the claims might have emerged during the stage of patent prosecution to steer clear of an examiner's objection as to the patentability of the invention claimed. However, when it comes to variants that are unknown to both to the patentee and the skilled addressee at the publication date, third parties are entitled to assume without further ado that they lie outside the scope of the patent.

All those personality traits of the man skilled in the relevant art had been engineered and assembled together by the courts over a long line of precedents culminating in *Catnic*, the case that firmly established the principle of purposive interpretation in UK patent law.[85]

Given that the angulated variant used by the defendant did not materially alter the load bearing capacity of its lintel, there was no way the person skilled in the art would conclude that the rear

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[82] *Halliburton Energy Services, Inc. v Smith International (North Sea) Ltd* [2006] *RPC* 25 (Pat) at 47, per Pumphrey J.

[83] This applies also to the case where the patentee has only disclosed one specific embodiment of his invention *Virgin Atlantic Airways Ltd v Premium Aircraft Interiors Group* [2010] *RPC* 192 CA (Civ DIv) at 208, per Lord Justice Jacob.

[84] For the purposes of patent law his knowledge is therefore partial and to some extent derived from expert advice. Hence, it is reasonable to assume that the notional reader knows enough about the law so as to be familiar with the function of the claims and the specification. Patentees are deemed, for instance, to be acquainted with some patent claim drafting conventions such as the concept of divisional applications. See *Virgin Atlantic Airways*, [2010] *RPC* 192 at 200, per Lord Justice Jacob. See also *Terrell on the Law of Patents* (London: Sweet and Maxwell, 18th ed. 2016, at 8-48).

[85] *Catnic* [1982] *RPC* 183 at 243, per Lord Diplock. The judge was adamant that purposive interpretation had in fact been the controlling principle even behind decisions rendered under the "pith and marrow" doctrine as the courts had been essentially focusing on finding out what the parties have meant in light of a given context. See also T.A. Blanco White, *Patents for Inventions* (London: Stevens & Sons, 4th ed. 1974) pp.89-90.

support member described in the claims had to be vertical in a strict literal sense because the patentee had intended this to be an essential element of the invention.[86] It would have been absurd for an applicant to make it so easy for imitators to exploit his inventive idea without running the risk of being held liable for patent infringement.[87] Circumstances where a third party works towards exploiting a patented inventive concept through embodiments featuring minor or insignificant variations in respect to the claimed subject matter have been apparently perceived by the court as a straightforward proxy for opportunism.[88]

Alternatively, the defendant's product in *Catnic* was deemed to fall under the wording of the patent's claims were their contextual meaning to be taken into account as it was perceived by the skilled addressee who was not a geometer. A builder familiar with the building operation would understand the reference to a vertical support member to mean a support member that is 'positioned near enough to the exact "geometrical vertical" to enable it in actual use to perform satisfactorily all the functions that it could perform if it were precisely vertical.'[89]

Following *Catnic*, British courts had to assess the legality of less straightforward attempts to snatch the inventive concept anchored in the claims of an earlier patent. Instead of making insubstantial differences to essential elements of claimed subject matter, competitors would design around the patent in a manner that involved the use of variants that were significantly different than their counterparts in the patent specification. In that scenario, the changes and substitutions made in the original patent are important and substantial. Such conduct is not as closely associated with opportunism as the activity of colourful imitation but still the attempt to design around the claims of a patent may in some instances disguise an opportunistic appropriation of another's inventive concept. The *Improver* case[90] raised exactly that legal problem.

Reiterating the law at the Patents Court, Mr Justice Hoffmann, as he then was, confirmed that the principle of purposive construction established in *Catnic* was controlling.[91] Moreover, he developed a structured legal test to facilitate its application, which was formulated as a series of questions:[92]

> 1. Does the variant have a material effect upon the way the invention works? If yes, the variant is outside the claim. If no -
>
> 2. Would this (ie that the variant had no material effect) have been obvious at the date of publication of the patent to a reader skilled in the art? If no, the variant is outside the claim. If yes –
>
> 3. Would the reader skilled in the art nevertheless have understood from the language of the claim that the patentee intended that strict compliance with the primary meaning was an essential requirement of the invention? If yes, the variant is outside the claim.

The evidence suggested that the variant used by the defendant was known at the relevant date and had no material effect upon the way the invention works. Hence, the first question was answered in the negative and the second in the affirmative.[93] In answering the third question, which raises the

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[86] *Catnic* [1982] *RPC* 183 at 244, per Lord Diplock.
[87] *Catnic* [1982] *RPC* 183 at 244, per Lord Diplock.
[88] cf. *Minnesota Mining and Manufacturing Co v Beiersdorf (Australia) Ltd* [1980] F.S.R. 449 HCA at 476.
[89] *Catnic* [1982] *RPC* 183 at 244, per Lord Diplock.
[90] *Improver* [1990] *FSR* 181, per Hoffmann J.
[91] *Improver* [1990] *FSR* 181 at 188-89, per Hoffmann J.
[92] *Improver* [1990] *FSR* 181 at 189, per Hoffmann J.
[93] *Improver* [1990] *FSR* 181 at 191-93, per Hoffmann J.

essential question of purposive construction, the judge argued that the adoption of language not covering a known equivalent is most likely to be perceived by the skilled addressee as concealing an intent to exclude that variant for some clearly identifiable reason unless the broader context suggests that the wording of the claims had not been used in accordance with its ordinary meaning.[94]

The trailhead of that approach had been the assumption that patentees normally do envisage functional equivalents to be included into the scope of the claimed monopoly.[95] That was particularly applicable to the case of minor variants.[96] At any rate, there was no interpretative presumption *stricto sensu* operating in patentee's favor.[97] In fact, courts would only consider the possibility of the patentee having departed from the use of conventional language if there was some "rational basis" for the skilled addressee to assume that this could have been the case indeed.[98] Where claim limitations remain unexplained, it is reasonable to answer the third question in favour of the defendant. The skilled addressee has no way of reaching a credible conclusion as to the whether the patentee had intended to cover the allegedly infringing variant.[99] These observations illustrate the adjudication costs associated with contextualism.

In *Improver*, it was found that at the crucial date the use of rubber had been associated with overwhelming problems of hysteresis and that the plaintiff's inventors had done no work on rubber rods.[100] Besides, a rubber rod could not be assembled into the invention's preferred embodiment, which was configured to comprise an arcuate-formed member for plucking hair.[101] In the view of the court, all this explained the narrow language of the claims and suggested that the patentee had intentionally excluded the said variant.[102] Hence, there could be no infringement.

The judge then went on to examine whether the patentee had envisaged the term "helical spring" to have a figurative rather than a literal meaning in the sense of a synecdoche or metonymy. Specifically, he inquired as to whether the term "helical spring" could, on the basis of a contextual interpretation, be interpreted to mean "a class of bendy, slitty rods of which a close-coiled helical spring in its primary sense is a striking and elegant example but which includes the defendant's rubber rod."[103] Nothing suggested that the term could be reasonably given a generic construction. The helical spring had always been known as a distinct mechanical device and there was no further indication that the patentee had intended to claim a broader range of equivalents that were not associated with such a concrete engineering concept.[104] An "equivalents clause" was included as part of the description in the patent specification, which clarified that the claimed invention was not limited to the details of the illustrative embodiments represented through the drawings but encompassed "all variations which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein."[105] It became apparent from that stipulation,

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[94] *Improver* [1990] *FSR* 181 at 190, per Hoffmann J.
[95] L.H. Hoffmann, "Patent construction" (2006) 108 *GRUR* 720, 723.
[96] *Wheatley (Davina) v Drillsafe Ltd* [2001] *RPC* 133 at 142, per Lord Justice Aldous.
[97] *Assidoman Multipack Limited v The Mead Corporation* [1995] *RPC* 321 (Pat) at 332, per Aldous J.
[98] *Kirin-Amgen* [2005] *RPC* 169 at 187, per Lord Hoffmann.
[99] *Telsonic AG's Patent* [2004] *RPC* 744 (Pat) at 760, per Laddie J. See generally, *Terell on the Law of Patents* (2016) paras. 9-97 – 9-100.
[100] *Improver* [1990] *FSR* 181 at 197, per Hoffmann J.
[101] *Improver* [1990] *FSR* 181 at 197, per Hoffmann J.
[102] *Improver* [1990] *FSR* 181 at 197, per Hoffmann J.
[103] *Improver* [1990] *FSR* 181 at 190, per Hoffmann J.
[104] *Improver* [1990] *FSR* 181 at 194-97, per Hoffmann J.
[105] *Improver* [1990] *FSR* 181 at 196, per Hoffmann J.

according to the judge, that the patentee had itself confined the scope of the patent to those variants that fall within the meaning of the claims' wording.[106]

Mr Justice Hoffmann, as he then was, ruled that the outer boundaries of the patent monopoly should be determined by the wording of the claims stressing that the ultimate question underlying the process of purposive construction "is always whether the alleged infringement is covered by the language of the claim."[107] On top of that, he suggested that this proposition finds support in *Catnic* and, and particularly, in Lord Diplock's contextual interpretation of the term "vertical."[108]

The prevalence of contextual literal interpretation was ultimately confirmed by the House of Lords in *Kirin-Amgen*.[109] Not surprisingly, the Court held that the plaintiff's patent claimed no more than a method to produce genetically engineered EPO within a host cell outside the human body. There was nothing in the context suggesting that the wording of the claims gave rise to a different contextual meaning, which was broader than the meaning conveyed by the conventional use of the respective words.[110] Speaking in terms of contract theory, the traditional approach in the UK mirrors the adoption of a contextualist linguistic default whereby each party may fall back on a broad base of extrinsic evidence[111] to argue that the contract has been written in "private language", apparently assuming that the benefits of concluding a more efficient contract outweigh the costs of adjudicating disputes about the meaning of agreed stipulations.[112]

As a structured legal test, the *Improver* questions facilitate the administration of purposive claim construction and reduce the possibility of error in the assessment. Nonetheless, Improver's three-prong test falls short of being a universal method for conducting the evaluation dictated by the adoption of a purposive approach to claim interpretation. In some instances, it is rather prone to distort the results of the assessment. Question two does not work well in cases like *Kirin-Amgen* when the variant used by the defendant rests on a technology that was unknown at the relevant date.[113] Kirin-Amgen's process relied on recombinant DNA technology whereas the allegedly infringing method to produce EPO deployed gene activation technology.

It would be unreasonable to make the scope of the right dependent on a presumed ability of the patentee to not only foresee future technological developments but also to appreciate how variants based on alternative technologies would actually work. On the other hand, it may reasonably be expected of the patentee to frame the wording of the claims at a level of generality capable of accommodating equivalents driven by technological considerations that are not obvious in the patent sense at the crucial date. Hence, in some cases it would better serve the aims of purposive interpretation to skip the second question and simply ask whether the patent claims as they stand would be understood by the skilled person as encompassing the new variant or not.[114] The scope of

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[106] *Improver* [1990] *FSR* 181 at 196-97, per Hoffmann J.
[107] *Improver* [1990] *FSR* 181 at 189, per Hoffmann J.
[108] *Improver* [1990] *FSR* 181 at 190, per Hoffmann J.
[109] *Kirin-Amgen* [2005] *RPC* 169.
[110] *Kirin-Amgen* [2005] *RPC* 169 at 196-97, per Lord Hoffmann.
[111] *Kirin-Amgen* [2005] *RPC* 169 at 186-87, per Lord Hoffmann.
[112] A. Schwartz and R.E. Scott, "Contract theory and the limits of contract law" (2003) 113 *Yale LJ* 541, 584-90 (exploring the advantages and disadvantages of different approaches to eventually argue that the efficient interpretation regime for business contracts should heavily rely on majoritarian linguistic defaults and narrow evidentiary bases to allow the more sophisticated parties involved therein to economize both on transaction and litigation costs). For a reformulation of their thesis and a thorough engagement with their critics see A. Schwartz and R.E. Scott, "Contract interpretation redux" (2010) 119 *Yale LJ* 926.
[113] *Kirin-Amgen* [2005] *RPC* 169 at 197, per Lord Hoffmann.
[114] *Kirin-Amgen* [2005] *RPC* 169 at 197, per Lord Hoffmann.

the patent will even capture inventive variants as long as these can be subsumed under the claims' language. Setting apart the second question did not benefit the plaintiff in *Kirin-Amgen* since the defendant's process lay outside of the patent claims' wording.[115]

By accepting the inadequacy of the *Improver* questions to carry out a purposive claim construction, the court recognized essentially that the patentee's ability to envisage future contractual contingencies is rather limited. Therefore, the court placed a less onerous burden on the patentee by requiring him to formulate the claims at a level that is abstract enough to cover variants that are likely to be developed through the advancements of new technologies even though he might not be able to teach how these would work in practice. To conclude, determining the scope of patent rights by virtue of purposive claim construction alone rests on the assumption that the patentee should bear the risk of contractual incompleteness because he is the least cost avoider.[116] As the creator of the inventive concept, he is supposed to be in the best position to make predictions about future equivalents in light of emerging technologies and draft inclusive claims.

With regard to the problem of opportunism, those principles provide some protection to the patentee against attempts to capitalize upon the inventive idea through the proliferation of inventive equivalents that were not obvious at the publication date. However, purposive claim construction, as conceived in *Improver*, does not shield the patentee against more subtle forms of opportunism such as when a third party skilfully designs around the wording of the patent claims or takes advantage of some sort of loophole in their drafting to appropriate the inventive idea.[117]

According to Lord Diplock's pronouncement in *Catnic*, there is no independent principle of "colourful evasion" operating to extend the scope of the patent beyond the contextual meaning of the claims' wording.[118] Some cases seem to suggest, however, that there has always been some form of second-order principle pursuant to which courts would be able to quash any given overt instance of opportunism.

A good example is *Henriksen v Tallon*.[119] Henriksen had invented a ballpoint pen comprising a moveable plug, which, according to the claims, "prevents air from contacting the surface of the ink." Air could not flow into the pen's reservoir and cause the ink stored therein to deteriorate. While the ink reservoir of Tallon's pen was not airtight, the defendant's product was able to offer a comparable utilitarian advantage through a similar plug that reduced the flow of air by 60 per cent. The defendant argued that that there was no patent infringement because the plug used by Tallon did allow some air to pass through. Acknowledging that the language of the claims was ambiguous, the House of Lords ruled in favour of the plaintiff noting that the term "prevents" should be read as meaning "prevents for all practical purposes." Hence, the patent would be infringed by any ballpoint

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[115] *Kirin-Amgen* [2005] *RPC* 169 at 197, per Lord Hoffmann.

[116] Cohen, "The negligence-opportunism trade-off in contract law" (1992) 20 *Hofstra L Rev* 941 at 951-52 and 983-90 (noting that the cheapest cost-avoider principle requires the party in the best position to draft clear terms to actually do so but arguing that it does not account for the problem of opportunism which can only be addressed through *ex post* precautions taken by the other party to the contract. Given that the costs of avoiding opportunistic behaviour are normally low, and provided that the administrative costs of tackling opportunism are not disproportionally high, there could be no general principle granting priority to the encouragement of *ex ante* precautions in complete contracting). On the concept of the least cost avoider see G. Calabresi, *The Costs of Accidents: A Legal and Economic Analysis* (New Haven and London: Yale University Press, 1970) pp 135 et seq.

[117] cf *Actavis v Eli Lilly* [2017] *RPC* 957 at 984-85, per Lord Neuberger.

[118] *Catnic* [1982] *RPC* 183 at 242, per Lord Diplock.

[119] *Henriksen v Tallon Ltd* [1965] *RPC* 434. cf H. Norman, "Determining the scope of the patentee's monopoly: Purposive construction revisited" (1998) 27 *Anglo-Am L Rev* 221 at 227-28.

pen utilising a similar mechanism that does not fully block the airflow into the ink reservoir but is nonetheless tolerably effective in preserving the ink's condition by reducing its contact with air. The court justified its opinion by invoking a general principle applicable to the construction of documents pursuant to which a meaning leading to absurd results should be rejected where there is a choice between two possible interpretations.[120] A ruling in favour of the defendant would encourage third parties to appropriate opportunistically the inventive concept claimed in earlier patents while marketing less efficient embodiments of the same idea to keep at arm's length from infringement liability.[121]

The plaintiff in *Beecham Group v Bristol Laboratories*[122] owned product and process patents with respect to a type of semisynthetic penicillin called ampicillin. Those patents were held infringed by the defendant company through the importation of hetacillin, a similar but nevertheless not identical substance that would eventually turn into ampicillin when absorbed into the bloodstream or after reacting with some other substance prior to administration. In fact, hetacillin was a derivative of ampicillin and served as its carrier much like a capsule containing some compound. There was no difference in pharmaceutical efficacy between the two. Borrowing the words of the Court of Appeal, the House of Lords noted that defendant's acts were tantamount to "reproduction of the substance ampicillin, albeit temporarily masked."[123] Despite the absence of literal infringement, the court ruled for the plaintiff stressing that the "pith and marrow" doctrine is directed against the colourable evasion of a patent.[124] Its application would therefore strike out any disguised attempt to pirate a patented invention. This case suggests that, despite Lord Diplock's subsequent pre-emption of the "pith and marrow" doctrine, a finding of infringement would indeed be possible as a matter of precedent in the event of blatant opportunism even when the defendant's product evaded the wording of the claims.[125]

The core concern of the traditional approach to patent claim construction in the UK has been to robustly promote the value of legal certainty through a focus on a contextual literal interpretation while seeking to combat blatant forms of opportunism. Applicants are presumed to be capable of drafting optimally inclusive claims. One has the option of infusing a figurative meaning into words of common vocabulary or even established technical terms either implicitly through the teachings contained in the specification or explicitly through statements clarifying the use of language in the claims. What is more, it would also be perfectly possible for them to draft patent claims at such an abstract level of generality so as to cover equivalents which are not known to work at the publication date. It was perhaps this conviction about the inventor's ability to draft optimally inclusive claims, be it on his own or with the help of expert consultants, which led Lord Hoffmann to rule against the patentee in *Improver*. Not only did the applicant fail in embedding a broader and more inclusive contextual meaning into the crucial term transcending its conventional usage but also lost the opportunity to secure a wider scope for the patent through the "equivalents clause", which was essentially a blank cartridge the way it was drafted. What Lord Hoffmann probably saw was an

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[120] *Henriksen* [1965] *RPC* 434 at 443, per Lord Reid.
[121] *Henriksen* [1965] *RPC* 434 at 445, per Lord Reid.
[122] *Beecham Group Ltd v Bristol Laboratories Ltd* [1978] *RPC* 153.
[123] *Beecham* [1978] *RPC* 153 at 202, per Lord Diplock.
[124] *Beecham* [1978] *RPC* 153 at 200, per Lord Diplock.
[125] cf J.D.C. Turner, "Purposive construction - seven reasons why Catnic is wrong" (1999) 28 *CIPAJ* 700; J.L. Beton and K.J. Heimbach, "Claim drafting and significance – An Anglo-German industrial view" in J.A. Kemp (ed.), *Patent Claim Drafting and Interpretation* (London: Oyez Longman, 1983) p 42; P.G. Cole, "Patent Infringement "Pith and Marrow" – A review of United Kingdom Practice" (1980) 2 *EIPR* 289 at 298-99; B. Reid, "The Catnic Decision – The Construction of Patent Claims" (1981) 3 *EIPR* 56 at 58-59.

economic operator that had floundered in effectively securing its own proprietary interests, not a party in need of protection.[126] By the same token, he was satisfied in *Kirin-Amgen* that the principle of purposive interpretation offers adequate drafting possibilities for inventors to ward off the prospect of their inventive concept being appropriated by someone who will be able to implement through means that were technically incomprehensible at the crucial date. Both *Improver* and *Kirin-Amgen* masterfully clarified the law elaborating upon Lord Diplock's opinion in *Catnic* without subscribing to any of the two extreme positions disapproved by the Protocol.[127] Nonetheless, the main drawback of the traditional British approach has been that it does not provide for a safety valve to protect against opportunism.[128] No matter how inclusive the claims might be there will always be room for opportunistic manoeuvring around the claims which may not be predictable *ex ante*.[129]

Actavis v Eli Lilly and beyond: Infringement by equivalents

Lord Neuberger apparently suggested that the assessment of patent infringement could not be reduced to a matter of claim interpretation because this would inevitably expose the patentee to opportunism. He further referred to the outcome of the *Improver* litigation as an illustrative example corroborating this proposition.[130] Were the width and breadth of the terms used in the claims to conclusively determine the scope of patent rights, the patent system would as a matter of course run aground. When assessing infringement claims, the courts should not, according to the ruling of the Supreme Court, confine themselves to claim construction but also consider in light of the facts and expert evidence which variants should be captured by the exclusionary scope of the patent because they achieve substantially the same result in substantially the same the way as the patented invention. Thus, patent infringement cases involve two distinct issues. An issue of interpretation, which entails a process of claim construction, and an issue of patent scope, which requires an analysis of equivalents.[131] The second issue is concerned with the appropriation of the patentee's inventive concept.[132] After clarifying the law, the Supreme Court held that the products of Actavis would infringe Eli Lilly's patents under the newly introduced doctrine of equivalents.[133]

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[126] See also H. Dunlop, "Court of Appeal gets to grips with the Protocol" (2003) 25 *EIPR* 342 at 344 (explaining how this notion has been an overriding consideration in other cases).

[127] On the conformity of Lord Diplock's reiteration of the purposive approach with the guidelines of the Protocol see *Assidoman* [1995] *RPC* 321 at 332-37, per Aldous J.

[128] cf N. Hölder, "Exogenous equals endogenous? Claim construction after the Amgen decision" (2006) 37 *IIC* 662 at 669 (arguing that the complex issues related to patent scope cannot be simultaneously addressed within the framework of the "ultimate" third question).

[129] In his insightfully critical review of the law as it then stood, Fisher, *Interpretation and Scope of Protection* (2007) pp 389-91 had suggested a two-stage analysis of patent scope. Accordingly, the purposive interpretation of patent claims would be supplemented by consideration of equivalents that may lie outside the wording of the patent claims but are in any event obvious at the infringement date.

[130] *Actavis v Eli Lilly* [2017] *RPC* 957 at 982-85 and 988-89 per Lord Neuberger. Dissatisfaction with the traditional approach and particularly with the outcome in *Improver* had been vehemently expressed in the meantime by some scholars. See Turner, "Purposive construction" (1999) 28 *CIPAJ* 700; P. Torremans, *Holyoak & Torremans Intellectual Property Law* (Oxford: Oxford University Press, 8th ed. 2016) pp 162-63.

[131] *Actavis v Eli Lilly* [2017] *RPC* 957 at 985 per Lord Neuberger.

[132] *Technetix BV & Ors v Teleste Ltd* [2019] EWHC 126 (IPEC) at [113], per Hacon J: ("The starting point for an argument of equivalence is the identification of the inventive concept or core."); *Regen Lab SA v Estas Medical Ltd* [2019] R.P.C. 121 (Pat) at 166–170. The patent in suit claimed a method for producing platelet rich plasma (PPT). The invention relied on the use of thixotropic gel, which is capable of changing phase from solid to semi-liquid when centrifuged. After blood and gel are centrifuged together, the gel would return to a state of solidity assuming a position so as to separate the red cells at the bottom of the tube from the "buffy layer"

The distinction between the issue of interpretation and the issue of patent scope reflects a distinction between contingencies that are contractible because they can be reasonably predicted by the applicant and junctures which are either unpredictable or not easy to envisage at the time where the patent claims were drafted. As it makes provision for non-contractible contingencies and applies if the parties have not contracted to the contrary, the doctrine of equivalents possesses all the characteristics of a default rule. Furthermore, the doctrine of equivalents harnesses the unruly principle of fairness, which is normatively binding as a result of the Protocol's mandate for fair protection of the patentee, by specifying the particular circumstances under which protection against opportunism is warranted. The approach adopted by the Supreme Court avoids the administration of a broad interpretative principle in order to apply a default rule which is designed to protect the party incurring relationship-specific investments. In essence, the formulation of the equivalents doctrine transpired with a view to circumventing problems that are analogous to those associated with the inefficiency of broad notions of good faith in performing a gap-filling function for incomplete contracts.[134]

A closer look at the facts of *Actavis v Eli Lilly* reveals how the doctrine of equivalents effectively balances out the patentee's inability to precisely identify all variants that are capable of implementing the inventive concept and draft the wording of the claims in a manner that is optimally inclusive. Patent claims may be under-inclusive for various reasons. It may be practically impossible to predict every variant that may promote the utilitarian purpose of the invention as another surrogate means for achieving the desired technical result. Identifying and specifying all those variants may involve prohibitive costs of drafting.[135] Such costs may be unreasonable even if the drafting of optimally inclusive claims is possible when they are sufficiently high to slow down the inventor's disclosure. In all those instances, the doctrine of equivalents operates as a default rule filling gaps in contracts that are attributed to high transaction costs. This point emerges illustratively from *Actavis v Lilly* if one considers the common general knowledge and the innovation efforts taking place in the relevant technical field.[136]

Pemetrexed belongs to the acid group of antifolates, which are commonly used in cancer chemotherapy despite their severe toxicity because their antimetabolic effect is apt to inhibit tumour growth. Research and development efforts have been engrossed in dissipating their toxic side effects to the utmost feasible extent. Prior to Eli Lilly's invention it was recognized as a matter of common general knowledge that pemetrexed disodium was the only form of the acid that had been

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containing the platelets and the plasma. For the trick to work, the gel had to be of a given molarity. Hacon J ruled that by using a gel of a different chemical structure and slightly different molarity but which reacted in the same way when centrifuged in order to produce PPT, the defendants had utilised the same inventive idea. See also *E Mishan & Sons, Inc v Hozelock Ltd* [2019] EWHC 991 (Pat) at [94], per Nugee J; *Marflow Engineering Ltd v Cassellie Ltd* [2019] EWHC 410 (IPEC), per Hacon J at [68].

[133] *Actavis v Eli Lilly* [2017] *RPC* 957 at 991.

[134] S. Baker and K.D. Krawiec, "Incomplete contracts in a complete contract world" (2006) 33 *Fla St U L Rev* 725 at 744-47.

[135] Cf. Beton and Heimbach, "Claim drafting and significance" in J.A. Kemp (ed.), *Patent Claim Drafting and Interpretation* (London: Oyez Longman, 1983) p.38 (referring to drafting difficulties as justifying protection outside the contextual meaning of the claims). See also W.M. Landes and R.A. Posner, *The Economic Structure of Intellectual Property Law* (Cambridge, Massachusetts: Cambridge University Press, 2003) p.323 (drawing an analogy to boilerplate clauses)."

[136] *Actavis v Eli Lilly* [2017] *RPC* 957 at 975-77 per Lord Neuberger (reiterating the findings of Arnold J, as he then was, in Actavis UK Ltd v Eli Lilly & Co [2015] *RPC* 73. In the view of the judge, the case he had in front of him was clearly one of a patentee seeking to avoid the consequences of a decision taken during the course of the prosecution of the patent application, *Actavis v Eli Lilly*, [2015] *RPC* 73 at 120-21 per Arnold J, as he then was).

shown to be fairly effective and reasonably safe. Getting to a novel salt form of an acid is anything but easy. Clues encountered on the way are often polysemous and therefore prone to mislead the inquiry. It is not a rare phenomenon to watch a research avenue going to a stalemate. Neither the properties nor the production of the new salt itself may be anticipated with a satisfactory degree of certainty. Sodium salts are generally associated with relatively lower toxicity and decent solubility. A drug's efficacy is largely a factor of its solubility, which conditions the absorption efficiency of the active ingredient by the human organism. Whether alternative salts created through reactions with potassium or tromethamine would work in the same way was uncertain.

Obviously, at the moment it is found that the administration of vitamin B12 in combination with pemetrexed disodium is a new and inventive compound which can be used to treat cancer, the most efficient route to disclosure goes through the reliance on the inclusion of the base which is already known to produce a good folate salt. Requiring the patentee to further inquire upon the functionality of other variants and describe them with precision in the specification would delay the disclosure of the invention. In fact, the doctrine of equivalents makes it possible for an obligationally complete contract to arise at the point in time where it is optimal for the disclosure of the invention to take place. The costs of drafting increase even further when the inventor has to consider avoiding elements that would destroy the novelty of his invention, render it obvious or vitiate the sufficiency of the patent disclosure. In that regard, the patent system encourages inventors to draft their claims while taking into account that some future contingencies, for which no provision could be made at the drafting stage, will be eventually addressed by the default rule of equivalence. Every applicant knows in advance that what he will get amounts to the variant(s) claimed plus equivalents that are patentable. Patentees could therefore use narrower language to avoid patentability problems and rest assured that they will enjoy the maximum possible protection under the doctrine of equivalents. Thus, the new legal framework encourages something akin to incomplete contracting through reliance on default rules.[137]

Under the equivalence theories, the scope of the patent normally encompasses all variants that achieve substantially the same outcome in a substantially similar way except for those whose equivalence in terms of effect on the way the invention works was not obvious at the priority date.[138] Only if the non-obvious, in the aforementioned sense, variants are excluded could it be ensured that the breadth of the patent monopoly would be commensurate to the patentee's disclosure. The non-obviousness of the variant's equivalent function provides a considerable degree of certainty with regard to the scope of the property right and, at the same time, constitutes a good proxy for the lack of opportunism on behalf of the alleged infringer. On the other hand, it is fair -in the sense that the Protocol uses this term- to internalize all equivalent variants that were obvious at the priority date to the benefit of the patentee by virtue of his exclusive right.

Considering the difficulties in producing an acidic salt for therapeutic purposes, however, this principle is likely to do injustice to the patentee's legitimate interests. He may envisage loads of variants that may come into play as alternatives but due to the unpredictability of the chemical reactions it would be uncertain to him how many and which of those would turn out to be workable in the end. For this reason, most of the variants contemplated by the patentee would be deemed non-obvious, in the aforementioned sense, as it may not have been possible at the priority date to tell with certainty that the invention would work if practiced by using one of the variants that could potentially be relied upon. To deal with this problem, the Supreme Court ruled that the assessment

[137] This is also important in view of the fact that patent law has not embraced the principle of validating construction *Warner-Lambert v Generics* [2019] 3 *All ER* 95 at 134-136. per Lord Briggs.
[138] *Actavis v Eli Lilly* [2017] *RPC* 957 at 987, per Lord Neuberger.

of patent infringement should proceed on the assumption that at the priority date the skilled addressee is privy to the way a known variant works. Obviousness will be assessed in light of such knowledge.[139] Had this default rule not been in place, the patentee would have had to try out different variants ensuring that they work before drafting the claims. Again, by reducing the transaction costs that must be incurred to achieve an obligationally complete patent bargain it is envisaged that optimal patent disclosure will be achieved. Notably, the doctrine of equivalents would internalize to the benefit of the patentee variants that would have been inventive at the crucial date. This is corollary to the notion of protecting an inventive concept.[140]

Getting back to the contract theories addressing the problem of hold up, UK law seems to strongly adhere to the property rights theory as it creates a strong property right in an inventive concept which is defined broadly and protected at a rather high level of abstraction.[141] Of course, that right is not absolute. Variants that are non-obvious at the crucial date will not be protected, for instance, and the patentee will eventually not be able to rely on equivalents to ensnare prior art.[142] Given that a finding of infringement by equivalents requires the administration of a standard-like rule, theories of equivalence could be perceived as contractual arrangements in the form of default rules that are designed to give rise to a complete contact.

While the primary concern of the equivalence theory established by the Supreme Court in *Actavis* is to secure a profit-maximizing opportunity to the patentee by effectively protecting the inventive

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[139] *Actavis v Eli Lilly* [2017] *RPC* 957 at 987-88 per Lord Neuberger; *Actavis UK Ltd v Eli Lilly and Co* [2016] *RPC* 38 at 66-67 per Lord Justice Floyd.

[140] C. Jamieson, "In defence of a UK doctrine of equivalents" [2019] 41 *EIPR* 147 at 153; The decision is primarily driven by the need to secure fair protection for the patentee, P. Johnson, "The (re-)emergence of the doctrine of equivalents" (2017) 12 *JIPLP* 817 at 819.

[141] Icescape Ltd v Ice-World International BV [2019] F.S.R. 108 CA (Civ Div) at 134-135, per Kitchin LJ." Ice-World's patent claimed a system for cooling mobile ice rinks. A typical ice rink works like this: coolant material stored in a refrigeration unit is pumped with the help of a feed manifold into a long u-shaped pipe where it evaporates to release cold before it reaches a discharge manifold at the other end of the pipe in gas form. The gas eventually reaches a collection unit and is then forwarded to the refrigeration unit for the whole process to start all over again. Ice rinks are comprised of a long array of such pipes. The invention breaks the typical ice rink structure down to further independent units operating under the same principle which can be assembled and disassembled in a cost- and time-efficient manner. Accordingly, the feed and discharge manifolds "extend in the extension of one another in the transverse direction" and they are "provided with a coupling member to make fluid-tight connection between the respective feed and discharge manifolds." Furthermore, each u-shaped pipe is made up of sections fluid-tightly connected to each other via an appropriate joint member. On the other hand, Icescape's mobile ice rink system comprised the same type of independent units albeit with two major differences. Its manifold pairs were neither adjacent to each other nor directly connected to the pumping unit. The feed manifold of each individual unit communicates with a central manifold feed which is connected to the refrigeration unit. In turn, the discharge manifold of each individual unit communicates with a central discharge manifold. Coolant material would therefore reach the pipes of each individual unit through the individual feed manifold of such a unit. For the rest, the defendant's system equally relied on joint members to render its u-shaped pipes foldable. LJ Kitchin, as he then was, found infringement by equivalents. While Icescape's product could not be subsumed under the claims' wording which referred to a specific kind of connection between the manifolds, it was evident that the nature of that connection was inessential to the inventive concept. To do justice to the patentee, the determination of the inventive concept was not somehow constrained by the breadth of the claims but was rather conducted in light of the underlying problem, which consisted in the design of an ice rink that could be disassembled to form different surface areas depending on the purpose of the individual use. See also *Regen Lab* [2019] R.P.C. 121 at 169–170, per Hacon J.

[142] Fisher, *Interpretation and Scope of Protection* (2007) pp.389-91; L. Bently, B. Sherman, D. Gangjee, and P. Johnson, *Intellectual Property Law* (Oxford: Oxford University Press, 5th ed. 2018) p.666.

concept emerging from the patent specification, it does not neglect to appropriately consider the need to guarantee a reasonable degree of certainty for third parties as required by the Protocol. Compared to the previous legal framework, though, which rested solely on the principle of purposive construction, the current approach makes significant concessions to the degree of certainty as to the scope of the patent monopoly that third parties may reach after reading the specification. The use of very narrow claim language could not anymore be taken as a strong indication of the patentee's intention to denounce the strict compliance with the wording of the patent claims as an essential element of his invention.[143] What is more, variants are protected even if it is overtly clear that they could not possibly be subsumed under the claims' wording. There is no way of arguing, for instance, that the literal meaning of the term pemetrexed disodium could be stretched to include pemetrexed dipotassium. Moreover, contextual arguments revolving around the contrast between the extensively broad teachings of the specification and the conspicuously narrow language of the claims would not generally let the defendants off the hook. Eli Lilly's patent made general references to the use of antifolates in cancer treatments which were followed by a claim pinned down to one single pemetrexed salt. It seemed as if the reason why pemetrexed salts were not referred to as class in the patent specification was because the fact that there could be many salt forms of the same acid was commonly known in the relevant field. Hence, the very specific reference to a single cation could not be irrefutably perceived as a manifestation of the patentee's intention to confine the scope of the claimed right to pemetrexed disodium alone. Assuming that there was no reference to antifolates whatsoever in the specification, the argument for such a narrow patent scope would have been, in Lord Neuberger's view, stronger but still not conclusive.

In short, unless the patentee himself confines the scope of the claimed right to some specifically mentioned variant(s) through the use of unequivocal language to that effect, he would not be deprived of the enhanced protection granted under the doctrine of equivalents. From the perspective of contract theory, the approach taken by the Supreme Court reflects the notion that default rules aimed at primarily protecting one of the parties to the contract –in our case the party that makes relationship-specific investments[144]– could only be abrogated with the consent of that party. To ensure that default rules serve their purpose, their abrogation is often hinged on the observation of a formality.[145] In similar fashion, the Supreme Court chose to place less emphasis on the language of the claims to secure the internalization of equivalent variants to the benefit of the patentee as a default rule of the patent bargain.[146]

As it was necessary for structuring the administration of the test for patent infringement and the avoidance of error costs, the court reformulated the *Improver* questions. Lower courts must now

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[143] See also *Icescape v Ice-World* [2019] F.S.R. 108 at 135, per Kitchin LJ.

[144] On this point see generally R.E. Scott "A relational theory of default rules for commercial contracts" (1990) 19 *J Legal Stud* 597; Baker and Krawiec, "Incomplete contracts in a complete contract world" (2006) 33 *Fla St U L Rev* 725 passim.

[145] Ayres and Gertner, "An economic theory of default rules" (1989) 99 *Yale LJ* 87 at 123-25 (elaborating upon the work of L. Fuller, "Consideration and Form" (1941) 41 *Colum L Rev* 799).

[146] See also *Regen Lab* [2019] R.P.C. 121 at 170, per Hacon J. This was a case where the value indicated by a numerical claim was inessential to the underlying inventive concept. Hacon J stated that there had to be some "sufficiently clear indication" to allow a conclusion that strict compliance with the respective figure was intended. Had the patent been valid, it would also have been infringed. In his critical appraisal of the *Actavis v Eli Lilly* case during the Twenty Sixth Annual Fordham Law School Conference on International Intellectual Property on the 6th of April 2018, Lord Hoffmann wondered whether applicants who have opted for a narrow wording should also include the phrase "I mean it!" to indicate by drafting that strict compliance with the literal meaning of the claims constitutes an essential requirement of the invention, P. Johnson, A. Roughton, and T. Cook, *The Modern Law of Patents* (LEXISNEXIS UK, 4th ed. 2018) at 6.39.

make the following inquiries when assessing the infringement of patents under the doctrine of equivalents:[147]

> i) Notwithstanding that it is not within the literal meaning of the relevant claim(s) of the patent,[148] does the variant achieve substantially the same result in substantially the same way as the invention, ie the inventive concept revealed by the patent?
>
> ii) Would it be obvious to the person skilled in the art, reading the patent at the priority date, but knowing that the variant achieves substantially the same result as the invention, that it does so in substantially the same way as the invention?
>
> iii) Would such a reader of the patent have concluded that the patentee nonetheless intended that strict compliance with the literal meaning of the relevant claim(s) of the patent was an essential requirement of the invention?

Default contractual arrangements may take the form of rigid rules or rather flexible standards. The latter option is appropriate where, due to the complexity of the issue that needs to be addressed, a case-by-case balancing exercise has to take place so that all interests involved are squarely considered. Structured legal tests also tend to reduce the probability of errors in the application of the law by lower courts as indicated above. Assessing patent infringement by equivalents requires the courts to enmesh in the administration of a standard-like default rule.

In *Actavis*, the Supreme Court jettisoned the notion that the patentee, as the least cost avoider, has to bear the burden of drafting optimally inclusive claims. Under the new approach, third parties wishing to appreciate the scope of a relevant patent in order to plan their course of action are expected to inquire upon equivalent variants to a reasonable extent.[149]

In the patent bargain context, the contractual value reaches its maximization point when protection against infringement by equivalents is provided. The patentee gets an opportunity to internalize the full market value of the inventive concept claimed and the state secures the strongest incentives for innovation. It is in the interest of both parties to the contract to act towards maintaining the contractual value. Instead of placing an insurmountable burden on the patentee to draft optimally inclusive claims that provide absolute certainty as to the scope of the patent, the doctrine of equivalents requires both the inventor and third parties to exercise care so as to avoid the reduction of the contract's value. For the sake of granting protection that allows the patentee to reap the full market value of the invention claimed, the law induces third parties through the threat of liability for patent infringement to exercise due care by exerting their own individual efforts to ascertain the scope of monopoly. That is to say that the doctrine of equivalents establishes a system whereby all parties to the contract have to exercise care towards the maintenance of the contractual value. A similar structure exists in tort law to induce both injurers and victims to exercise due care in order to

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[147] *Actavis v Eli Lilly* [2017] *RPC* 957 at 989 per Lord Neuberger.

[148] Thus, before proceeding with an analysis of infringement by equivalents courts must engage in a purposive construction of the patent claims first. *Generics (UK) Ltd (t/a Mylan) & Anor v Yeda Research And Development Company Ltd* [2017] EWHC 2629 (Pat) at [134]-[139] per Arnold J; *Illumina, Inc v Premaitha Health Plc* [2017] EWHC 2930 (Pat) at [201] – [202] per Carr J. See also J. Strath and J. Reuben, "Skating on thin ice: the Court of Appeal expands on the circumstances when an immaterial variant may amount to patent infringement" [2019] 41 *EIPR* 115, 118.

[149] E. Armitage, "Interpretation of European Patents (Art. 69 EPC and the Protocol on the Interpretation)" (1983) 14 *IIC* 811, 815 (arguing that the Protocol's requirement of a reasonable degree of certainty for third parties "suggests that any stretching of the claim to cover an infringement should be reasonably predictable by a third party").

reduce the total costs of accidents through appropriate standards of liability.[150] Hence, instead of arguing that the new law generates uncertainty, it would be fair to say that it simply requires third parties to be more diligent in calculating the risk of infringing earlier rights.

Conclusion

As emphasized by Lord Justice Floyd, it is now undisputed that Article 69(1) EPC does not mandate a purely interpretative approach by stipulating that the extent of protection conferred by a European patent shall be determined by the claims.[151] Still, the patent claims retain their notice function. The scope of the patent would after all encompass variants that are equivalent to the subject matter covered by the contextual meaning of the claims.

Securing robust legal protection for an inventive concept rather than for some specific embodiments of it that fall within the wording of the claims, the doctrine of equivalents represents a strong adherence to the incentive theory of patents. The decision of the UK Supreme Court in *Actavis v Eli Lilly* is indeed driven by sound economic reasoning. This paper suggests that a more formal and doctrinal justification for the doctrine of equivalents emerges from the contractarian view of the patent grant. Inventors are accordingly perceived as parties induced to make relationship-specific investments through an enforceable promise that they will be able to fully internalize the market value of their inventive ideas. Equivalence theories feature economic functions usually fulfilled by default rules in the context of incomplete contracts. They seek to remedy the problem of high transaction costs arising from the applicant's inability to foresee all future contingencies and design optimally inclusive patent claims. In addition, such decreases in the cost of drafting (transaction costs) tend to accelerate patent disclosure. Incentives to innovate are secured against a form of "subtle opportunism" whereby a third party skillfully evades the wording of the claims to effectively utilize the inventive concept disclosed by the patentee.

While primarily concerned with maintaining proper incentive structures for individual patentees, the Supreme Court did not lose sight of the broader implications of patent scope for the innovative activity of other inventors and the effectiveness of the competitive process in general. The tradeoffs underlying the assessment of infringement by equivalents under the Protocol are particularly complex. As Lord Neuberger observed, "there is an unavoidable tension between the appropriateness of giving an inventor a monopoly and the public interest in maximising competition."[152] In that regard, competition concerns would be particularly severe when the breadth of patent scope threatens to stifle cumulative innovation.[153] Lord Neuberger's opinion seems to suggest that such considerations form part of the standard lower courts would have to administrate in order to decide patent infringement cases in the future.[154]

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[150] R. Cooter, "Unity in tort, contract, and property: The model of precaution" (1986) 73 *Cal L Rev* 1 (explaining how a "model of precaution" seeking to encourage the exercise of care against injuries through the allocation of their cost pervades the structures of private law).

[151] *Icescape Ltd v Ice-World International BV* [2019] F.S.R. 108 at 138-139, per Floyd LJ; For an insightful historical argument see C. Wadlow, "Requiem for a noun: the "terms of the claims" (1953-2007)" [2011] 33 *EIPR* 146.

[152] *Actavis v Eli Lilly* [2017] *RPC* 957 at 978, per Lord Neuberger.

[153] These concerns, along with other unclarified issues, are highlighted by P. Johnson, A. Roughton, and T. Cook, *The Modern Law of Patents* (2018) at 6.35-6.36.

[154] The part of the standard addressing those concerns shall be of immutable nature. Immutable terms are used when the interests of third parties or the public in general are at stake, Ayres and Gertner, "An economic theory of default rules" (1989) 99 Yale LJ 87, 88.

The decision of the UK Supreme Court in *Actavis v Eli Lilly* gives the impression of a retreat from the traditional position of interpreting claims in a manner that mirrors the construction of other legal documents including commercial contracts. Nevertheless, for the reasons outlined above, the doctrine of equivalents fully comports with the contractarian view of the patent grant. The patent bargain may be perceived as a point of logical departure, a topos, wherefrom one could examine the accuracy of a statement through deductive reasoning.[155] In that regard, the patent bargain theory has already been proven instrumental to the firm establishment of the requirement to submit a written specification.[156] If the patent grant is based on consent granted in the prospect of societal utility gains, the argument goes, there must be a written specification teaching how the patented article can be manufactured.[157] It has been astutely observed that the rationale behind the requirements of sufficiency and enablement is "the consummation of the patentee's bargain with the State."[158] The same applies to the doctrine of equivalents. The conceptualization of patents as relational contracts elucidates and offers an additional justification for a very specific and complex rule of patent law such as the doctrine of equivalents. When dealing with interpretative problems or addressing issues of contractual incompleteness pertaining to relational contracts one needs to have recourse to the nature of the underlying relationship. In the patent law context, this further requires consideration of the trade-offs immanent to the incentives-access paradigm. Hence, contract theory may facilitate the derivation of *de lege lata* arguments based on legal reasoning. Therein lies the great normative value and the analytical strength of the patent bargain theory.

[155] cf H.I. Dutton, *The Patent System and Inventive Activity During the Industrial Revolution* (Manchester: Manchester University Press, 1984) pp.17-29 (referring to the "exchange-for-secrets thesis" as one of the complementary arguments raised against the patent abolitionists); C. MacLeod, *Inventing the Industrial Revolution – The English Patent System, 1660-1800* (Cambridge: Cambridge University Press, 1988) pp.183 and 196-200 (referring to the "quid pro quo" argument as one of the various complementary justifications for patent rights).

[156] Fisher, *Interpretation and Scope of Protection* (2007) pp 81-85 (with further bibliographical references); S. Bottomley, *The British Patent System during the Industrial Revolution 1700-1852* (Cambridge: Cambridge University Press, 2014) pp 85 et seq.; MacLeod, *Inventing the Industrial Revolution* (1988) p.49. See also P. Johnson, *Privatised Law Reform: A History of Patent Law Through Private Legislation, 1620-1907* (Oxford/New York: Routledge, 2018) pp.103-119 (highlighting the role of private legislation); cf A. Mossoff, "Rethinking the development of patents: An intellectual history, 1550–1800" (2001) 52 *Hastings LJ* 1255 at 1289 onward. (arguing natural rights philosophy had exercised some influence on the development of the law in this field).

[157] Fisher, "Extracting the price of a patent" [2012] *IPQ* 262, 269.

[158] Fisher, "Extracting the price of a patent" [2012] *IPQ* 262, 264.