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J. Jonas Anderson^{*} and Peter S. Menell^{**}

ABSTRACT

Patent claims define the scope of the patent right and hence are central to the operation of the patent system. Patent prosecutors devote substantial effort to crafting patent claims so as to maximize the scope of their right without “reading on” prior art (and thereby defeating novelty). Businesses seeking to enter a technology marketplace must be careful to avoid encroaching patent claims. Thus, when patentees enforce their rights, the interpretation of claim boundaries guides both validity and infringement analysis.

Following the Supreme Court’s decision in *Markman v. Westview Instruments* (517 U.S. 370 (1996)), holding that “the construction of a patent, including terms of art within its claim, is exclusively within the province of the court,” district judges began the practice of construing patent claims in advance of trial following so-called “Markman” hearings. These constructions became subject to appellate review after the trial or summary judgment ruling.

The *Markman* decision thus opened a valuable window into an important facet of patent law and the litigation process. This has led to a wide range of empirical studies examining: (1) reversal rates; (2) the sources and methodologies that judges employ in construing patent claims; and (3) appellate behavior generally. This chapter examines the hypotheses underlying these studies, the data used, the empirical methods deployed, and the principal results. It also suggests directions for further research.

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Empirical Studies of Claim Construction

J. Jonas Anderson^{*} and Peter S. Menell^{**}

Patent claims define the scope of the patent right and hence are central to the operation of the patent system. Patent prosecutors devote substantial effort to crafting patent claims so as to maximize the scope of their right without “reading on” prior art (and thereby defeating novelty). Businesses seeking to enter a technology marketplace must be careful to avoid encroaching patent claims. Thus, when patentees enforce their rights, the interpretation of claim boundaries guides both validity and infringement analysis.

With the steep rise in the use of jury trials in patent cases in the 1970s, the construction of patent claims receded from view as judges delegated claim construction to juries with general instructions. Following the Supreme Court’s decision in *Markman v. Westview Instruments* (517 U.S. 370 (1996)), holding that “the construction of a patent, including terms of art within its claim, is exclusively within the province of the court,” district judges began the practice of construing patent claims in advance of trial following so-called “Markman” hearings. These constructions became subject to appellate review after the trial or summary judgment ruling.

The *Markman* decision thus opened a valuable window into an important facet of patent law and the litigation process. Beginning with the work of then-Professor Kimberly Moore (2001), scholars have collected data on claim construction as a means for evaluating a variety of hypotheses about the functioning of the patent system and judicial behavior more generally.

This chapter surveys this evolving literature. Part I summarizes the economic, legal, and institutional background of this research. Part II describes the hypotheses, research design, data, empirical methods, principal results, and limitations of these studies. Part III explores the jurisprudential and policy ramifications of these studies. Part IV suggests areas for future research.

I. Economic, Legal, and Institutional Background

The patent system relies upon the delineation of boundaries to establish rights to intangible resources – processes, machines, articles of manufacture, and compositions of matter. The Patent Act of 1870 formalized use of patent claims by requiring applicants to “particularly point out and distinctly *claim* the part, improvement, or combination which he claims as his invention or discovery.” (ch. 230, § 26, 16 Stat. 198, 201 (emphasis added)). Such claims provide the basis to examine applications (eligible subject matter, novelty, non-obviousness, and

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disclosure), inform the public of the scope of rights, and enable to courts adjudicate patent validity and infringement. Clarity of patent claims and transparency of patent institutions play a critical role in the efficacy of patent law and institutions. (Menell & Meurer (2013)).

Under current law, patent applicants must conclude their specification (written description of the invention and the manner and process of making and using the invention) “with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor . . . regards as the invention.” (35 U.S.C. § 112(b)). A typical patent contains multiple claims relating to the invention.

U.S. patent claims typically follow a “peripheral” claim format whereby the drafter delineates the outer boundaries of the claimed invention. As an example, U.S. Patent No. 5,205,473 claims an insulated recyclable beverage container sleeve as:

A recyclable, insulating beverage container holder comprising a corrugated tubular member comprising cellulosic material and at least a first opening therein for receiving and retaining a beverage container, said corrugated tubular member comprising fluting means for containing insulating air; said fluting means comprising fluting adhesively attached to a liner with a recyclable adhesive.

Like other peripheral claims, this claim begins with a preamble (“A recyclable, insulating beverage container holder”) followed by a transitional phrase (“comprising”) and the claim body setting forth the claim restrictions (or elements). The open transitional phrase “comprising” signifies that the patentee claims all structures containing the claim restrictions and anything else. By contrast, the closed transitional phrase “consisting of” limits the claim to structures containing the claim restrictions and nothing else.

The Patent Act authorizes applicants to prepare claims in various formats, including dependent form (which incorporates by reference limitations of a prior or multiple prior claims) and means-plus-function form. The Patent Act provides a specific rule for interpreting claims using the means-plus-function format:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

(35 U.S.C. § 112(f)). Thus, the claim restriction “said corrugated tubular member comprising fluting means for containing insulating air” from the ‘473 patent would be limited to the “corresponding structure, material, or acts described in the specification and equivalents thereof.”

As a noted patent jurist remarked, “*the name of the game is the claim.*” (Rich (1990) at 499). The incentives of those claiming intellectual property can diverge from the social interest. (Menell & Meurer (2013)). Inventors can sometimes benefit from obfuscating the scope of rights and keeping others in the dark about their intellectual property. (See, e.g., Sheldon (2005) at 6–114 (including a section entitled “Include Ambiguous Claims,” which offers numerous “strategies” for “intentionally writ[ing] ambiguous claims”); Fish (2007) at 7-35 (advising drafters to “[a]void . . . like the plague” claim language that clearly identifies the “gist of the invention” or the “factor” that makes it “unique”)). The Supreme Court has recently sought

to tighten claim drafting standards to better promote the claim clarity required by the Patent Act. (*Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120 (2014)).

Courts have developed specialized doctrines governing claim construction. (Menell, Powers, & Carlson (2010)). As a starting point, courts interpret claim terms based on their ordinary and accustomed meaning to those having ordinary skill in the art (scientific or engineering field of the invention) as of the filing date of the invention. Since few judges have scientific or technical training, this standard places district judges in a challenging situation.

Various other rules and doctrines can come into play depending upon the circumstances. The court must place principal reliance on intrinsic evidence (the patent specification and the prosecution history), but may consider extrinsic evidence (such as dictionaries, treatises, and expert testimony) so long as it does not contradict the intrinsic evidence. Patent claims are generally not limited to the preferred embodiments set forth in the specification except with respect to means-plus-function claim elements, which are limited to the “corresponding structure, material, or acts described in the specification and equivalents thereof.”

Moreover, patentees can serve as their own lexicographers. Thus, courts generally follow the definitions of claim terms set forth in the specification. The doctrine of claim differentiation provides that each claim in a patent is presumptively different in scope. Therefore, independent claims are generally interpreted more broadly than dependent claims that incorporate the independent claim and add a limitation. Courts will also read disclaimers reflected in the prosecution history (the correspondence between the applicant and the Patent Office) into the claim terms where the disclaimers clearly and unmistakably disavow claim scope.

Following the rise in the use of jury trials for patent cases in the 1970s, (Anderson & Menell (2014) at 20 (over 70% of patent cases were tried to juries by the early 1990s)), the interpretation of patent claims became subsumed in the jury’s verdict. This left the trial judge and appellate court with very limited basis for ascertaining the correctness of any underlying claim constructions. The Court of Appeals for the Federal Circuit, which has exclusive jurisdiction over patent appeals, came to see the lack of transparency as an impediment to the predictability and reviewability of patent adjudication. (Michel (1994) at 1238-39 (observing that “[w]hen the court delegates both construction and infringement to the jury’s discretion, the jury is free to do almost anything it wishes”)).

The Federal Circuit addressed this problem in *Markman v. Westview Instruments* (52 F.3d 967 (Fed. Cir. 1995) (en banc) (“*Markman I*”)). Some of the Federal Circuit judges assumed that if claim construction involved factual issues, then the Seventh Amendment right stood in the way of trial judges in cases in which a party requested a jury trial from construing patent claim terms. The majority opinion worked around the Seventh Amendment impediment by holding that the construction of a patent claim is a pure question of law, and hence outside of the jury’s purview, based on the “fundamental principle of American law that ‘the construction of a written evidence is exclusively with the court.’” (Id. at 978 (quoting *Levy v. Gadsby*, 7 U.S. (3 Cranch) 180, 186 (1805))). Under this principle, the responsibility to construe patent claims fell, in the first instance, to the district judge. It also meant that district judges’ construction of patent claim terms was subject to de novo review. The decision finessed the question of how district judges, lacking scientific and technical training, could step into the shoes of skilled artisans. The court masked the factual nature of disputes about how terms would be understood by skilled artisans by reasoning that although the trial judge could use extrinsic evidence in

construing claims, “the court is not crediting certain evidence over other evidence or making factual evidentiary findings. Rather, the court is looking to the extrinsic evidence to assist in its construction of the written document, a task it is required to perform.” (Id. at 991).

The Supreme Court affirmed the Federal Circuit’s conclusion that the Seventh Amendment did not require claim construction to be allocated to juries, but through different reasoning. (*Markman v. Westview Instruments*, 517 U.S. 370 (1996) (“*Markman II*”). The Court held that the district judge should be responsible for claim construction based on judges’ “training in exegesis [of written instruments],” notwithstanding what it characterized as the “mongrel [or mixed fact/law] practice” of patent claim construction. In contrast to the Federal Circuit’s analysis, the Supreme Court did not deem patent claim construction purely a question of law. Rather, consistent with its characterization of claim construction as a “mongrel practice,” the Court noted merely that claim construction was a matter “exclusively within the province of the court.”

The distinction between characterizing claim construction as a mixed question of fact and law as opposed to a pure question of law has important ramifications for appellate review. If claim construction is a mixed question, then the Federal Circuit would have to accord deference to trial judges’ factual determinations underlying their claim construction rulings. (Fed. R. Civ. P. 52(a)(6) (appellate courts must “give due regard to the trial court’s opportunity to judge the witnesses’ credibility” and defer to the trial court’s factual determinations unless “clearly erroneous”)). If claim construction is a pure question of law, then the Federal Circuit would review claim construction rulings de novo, i.e., without any deference to the district court’s factual findings.

The Federal Circuit ultimately adhered to the view expressed in its original *Markman* opinion that claim construction is a pure question of law (*Cybor Corp. v. FAS Technologies, Inc.*, 138 F.3d 1448 (Fed. Cir. 1998) (en banc)), although with vigorous disagreement (id. at 1465–66 (Mayer, C.J., joined by Newman, J., concurring in the judgment)). The Federal Circuit continued to tinker with presumptions and the hierarchy of sources in an effort to make claim construction more predictable. In *Texas Digital Systems, Inc. v. Telegenix, Inc.* (308 F.3d 1193 (Fed. Cir. 2002)), a panel sought to further clarify the claim construction framework by recognizing dictionaries, encyclopedias, and treatises as “particularly useful resources to assist the court in determining the ordinary and customary meanings of claim terms” due to their public availability and objectivity. (Id. at 1202). The court noted that, unlike expert testimony, these reference sources are not “colored by the motives of the parties” or “inspired by litigation.” (Id. at 1203). “Indeed, these materials may be the most meaningful sources of information to aid judges in better understanding both the technology and the terminology used by those skilled in the art to describe the technology.” (Id.).

Elevating dictionaries may well have exacerbated the unpredictability of claim construction, eventually leading the Federal Circuit to grant en banc review to another case to reconsider many aspects of claim construction methodology including the standard of review. (*Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc)). The *Phillips* majority emphasized the role of intrinsic evidence. While authorizing trial courts to consider extrinsic evidence, the Federal Circuit deemed such evidence “less significant” and “less reliable” in determining the scope of claim terms. While continuing to recognize the objectivity of dictionaries, the majority nonetheless backed away from *Texas Digital*’s presumption that a dictionary meaning would apply unless the term in question was explicitly defined in the

specification or where the intrinsic evidence disavowed or disclaimed such meaning. The majority declined to revisit the scope of appellate review of claim construction rulings, thereby leaving *Cybor*'s de novo standard in place. Nonetheless, lingering division among the members of the court remained. While adhering to the view that claim construction is a question of law subject to de novo review, Judge Lourie, joined by Judge Newman, wrote separately to urge his colleagues "to lean toward affirmance of a claim construction in the absence of a strong conviction of error." (Id. at 1330). In dissent, Judge Mayer, joined by Judge Newman, reiterated their continued frustration with "the futility, indeed the absurdity, of this court's persistence in adhering to the falsehood that claim construction is a matter of law devoid of any factual component." (Id.).

Division over the standard of review continued to surface after the *Phillips* decision. (*Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 469 F.3d 1039, 1040 (Fed. Cir. 2006) (Moore, C.J., joined by Rader, J., dissenting from denial of rehearing en banc); *Medegen MMS, Inc. v. ICU Med., Inc.*, 317 F. App'x 982, 988–91 (Fed. Cir. 2008) (Walker, Chief District Judge (N.D. Cal.), dissenting) (urging greater deference); *Trading Techs. Int'l, Inc. v. eSpeed, Inc.*, 595 F.3d 1340, 1363-64 (Fed. Cir. 2010) (Clark, District Judge (E.D. Tex.), concurring and writing separately to "suggest that the current de novo standard of review for claim construction may result in the unintended consequences of discouraging settlement, encouraging appeals, and, in some cases, multiplying the proceedings"); *Retractable Techs., Inc. v. Becton, Dickinson & Co.*, 659 F.3d at 1373 (Fed. Cir. 2011) (Moore, J., joined by Rader, C.J., dissenting from denial of rehearing en banc); *Lighting Ballast Control LLC v. Philips Elecs. N. Am. Corp.*, 744 F.3d 1272, 1297 (Fed. Cir. 2014) (en banc) ((O'Malley, J., joined by Rader, C.J., Reyna, J., and Wallach, J. dissenting) (castigating the majority for "misapprehend[ing] the Supreme Court's guidance, contraven[ing] the Federal Rules of Civil Procedure, and add[ing] considerable uncertainty and expense to patent litigation").

Anecdotal evidence indicated that the *Cybor* rule steered district judges away from using extrinsic evidence and fully explaining the basis for their constructions, produced a notable claim construction reversal rate, and demoralized district judges. (Anderson & Menell (2014) at 45, 68-69); Mazumdar (2005) at 537 (quoting one district judge stating that in view of the high reversal rate, "you might as well throw darts"); O'Malley et al.(2004), at 682); *Merck & Co. v. Teva Pharm. USA, Inc.*, 395 F.3d 1364, 1381 (Fed. Cir. 2005) (Rader J., dissenting) (noting that the Federal Circuit "often hears criticism from district court judges that its reversal rate on claim construction issues far exceeds that of other circuit courts"))).

II. Hypotheses and Research Design

The controversy over the *Cybor* rule and its effects on reversal rates motivated the first empirical studies of claim construction. The second group of studies explores the sources and methodologies that judges employ in construing patent claims. A third group of studies looks at claim construction as a proxy for appellate behavior more generally. This section examines the hypotheses underlying these studies, the data used, the empirical methods deployed, and the principal results.

A. Reversal Rate Studies

Moore (2001) presents the first systematic evaluation of appeals of district court claim

constructions. This paper measures the reversal rate as a basis for assessing the capacity of district judges to adjudicate complex technical patent issues. In that latter respect, her project built upon her work assessing the role of juries in patent cases. (Moore 2000).

Moore (2001) collected a database of all claim construction appeals to the Federal Circuit from 1996 to 2000. It includes every Federal Circuit case, whether published, unpublished, or summarily affirmed (Fed. Cir. Rule 36), in which claim construction issues were appealed. She identified potential cases using a Boolean search for “patent & claim/s interp! or constru!” on Westlaw. (Moore (2001) at 8, n.36). Her initial queries retrieved 515 cases. After eliminating false positives, she identified 323 cases reviewing construction of 496 separate claim terms. Since the Rule 36 summary affirmances did not result in opinions, she reviewed the briefing in each of these (161) cases to determine whether claim constructions had been appealed.

As Moore ((2001), at 9-10)) notes, her database could not directly assess the appellate “correctness” of *all* district court claim construction decisions because not all claim constructions were appealed. Some cases settled prior to appeal. And even for those cases that were appealed, not all claim construction rulings were appealed. The critical question is whether her sample is random or reflects selection bias. She notes two possible influences: (1) observed reversal rate could understate the appellate correctness of district court claim constructions because parties are less likely to appeal correctly decided cases and/or issues; and (2) reflecting the transaction costs of appellate review, (Priest & Klein (1984) (predicting that litigated outcomes should tend toward even division under various assumptions); Kobayashi (1996); Kessler, et al. (1996)), the cases that are appealed are most likely close cases.

Moore found that the Federal Circuit reversed district court judges on at least one claim construction issue in 33% of all the appealed patent cases between 1996 and 2000. The Federal Circuit reversed 33% of means-plus-function constructions. On 15% of these constructions, the district court and the Federal Circuit disagreed over whether the claim term was properly categorized within the § 112(f) category. Of those that the Federal Circuit held to fall properly within that category, the Federal Circuit reversed the district courts on 30% of the constructions. Where the Federal Circuit found an error in claim construction, it reversed or vacated the trial court decision in 81% of the cases, resulting in an overall case reversal/vacate rate of 27% attributable to claim construction errors. The 33% claim construction error rate exceeded the error rate for appeals of other patent issues by a significant level.

Moore surmised that the higher reversal rate for claim construction determinations was most likely attributable to the lack of deference under the *Cybor* rule, but could also reflect district judges’ limited experience with claim construction. Since the reversal rate trended upward during the period of study, she surmised that the Federal Circuit’s muddled claim construction jurisprudence contributed to the problem.

Moore also tested whether the reversal rate was affected by variation among the Federal Circuit judges, as opposed to objective error, by examining dissent rates in claim construction decisions among Federal Circuit judges. She found, however, that Federal Circuit judges dissented in only 3% of claim construction appeals. Using linear regression, she also concluded that the Federal Circuit claim construction rulings were driven to a statistically significant degree by Federal Circuit judges’ scientific or technical training, political affiliation (based on the political party of the appointing President), or prior patent experience.

Several follow-on studies – Chu (2001); Bender (2001); Zidel (2003) – found higher

reversal rates (approaching 50%) than those reported by Moore (2001), but these higher rates were attributable to the omission of summary affirmance cases. Moore (2005) followed up her initial study and found that the claim construction reversal rate continued to rise in the three years (through 2003) following her initial study.

Schwartz (2010) added additional years to Moore's studies, looking back to 1991 and forward to 2008. His study separated the reversal rate over distinct time periods: January 1991 to *Markman I* (April 1995); *Markman I* to *Markman II* (April 1996); *Markman II* to *Cybor* (March 1998); *Cybor* to *Phillips* (July 2005); and *Phillips* to December 2008. He found that the reversal rate rose from a low of 17.7% in the period between *Markman I* and *Markman II* to 32.1% in the period between *Cybor* and *Phillips*. Schwartz also found that the reversal rate of claim construction cases in the pre-*Markman* era was much lower than that of the post-*Markman* era. Sichelman (2010) analyzed reversal rates from 2000 through 2007 on a host of patent litigation issues. Compared to the reversal rates of other issues, claim construction was reversed 33% of the time, higher than all but two of the issues (novelty and indefiniteness).

The debate over the standard of appellate review continued to fester after *Phillips*, motivating Anderson and Menell (2014) to undertake a comprehensive assessment of the history of claim drafting, the historical jurisprudence of claim construction and appellate review of claim construction, and the empirical effects of the *Phillips* decision on a broad range of claim construction measures, including reversal rates and evidentiary sources, by technology area and Federal Circuit judge.

Our data set covered the period January 1, 2000 until December 31, 2011, which placed the *Phillips* 2005 decision squarely at the midpoint. We used Boolean queries to identify all Federal Circuit claim construction decisions (including Rule 36 summary affirmances) and worked with a team of research assistants to collect and code a database covering 1,930 individual claim terms from 1,067 cases. (Id. at 78-79). The database comprised the following variables by claim term reviewed by the Federal Circuit: lower court; decision date; posture on appeal (jury trial, bench trial, summary judgment, mandamus, other); Federal Circuit panel; dissenting judge (if any); precedential nature of disposition (precedential, nonprecedential, summary affirmance); final disposition on appeal; technological field(s) (up to four); final disposition of claim construction (affirmed, reversed, avoided); whether the Federal Circuit discussed the characteristics of the person having ordinary skill in the art; the type of evidence discussed (intrinsic evidence – specification, same claim, other claims, prosecution history; extrinsic evidence – expert testimony/tutorial, dictionary/treatises, other).

Our data confirmed the results of Moore (2001, 2005) and Schwartz (2010) for the years in which our studies overlapped. Of most significance, the data revealed a significant drop (from 37.2% to 24% on a per term basis) in the claim construction reversal rate. We found that the rate fell across all Federal Circuit judges and across all technology except business methods. The drop occurred immediately following the *Phillips* oral en banc argument, five months before the decision was rendered. Thus, we were able to rule out learning effects by district courts, since the drop occurred prior to the decision in the *Phillips* being announced and approximately two years before any post-*Phillips* district court decisions could have reached the Federal Circuit. A simple linear regression of the variables that we collected confirmed that the oral argument date was statistically significant in explaining the change in reversal rate.

Notwithstanding our empirical demonstration that the Federal Circuit had “informally” shifted its standard of review toward greater deference, we nonetheless advocated for a formal change to a hybrid standard of review. Beyond the jurisprudential point that the Federal Circuit had misapprehended the Supreme Court’s reference to the mongrel (mixed law/fact) nature of claim construction in its *Markman* decision, we contended that the de novo standard of review stood in the way of district courts developing an adequate record for understanding specialized claim terms from the perspective of skilled artisans and discouraged clearly articulated decisions.

Miller (2015) and Cotropia (2015) have found that claim construction reversals are more likely in high technology areas. Miller (2015) defined software patents as those in which “at least one claim element in the patent consists of data processing—the actual manipulation of data—regardless of whether the code carrying out that data processing is on a magnetic storage medium or embedded in a chip.” Using a database of Federal Circuit opinions issued between January 1, 2002 and December 31, 2012, Miller found a reversal rate of 40% for software patents and 24% for non-software patents. Overall, he found that software patents were responsible for 40% of the difference between the Federal Circuit’s overall claim construction reversal rate (29%) and its 18% reversal rate on all other patent issues.

Similarly, Cotropia (2015) found that claim construction of electronics, information technology, and business methods (as a group) were more likely to be reversed if the patentee won below, but not if the accused infringer won below between 2010 and 2013. These results, however, were not statistically significant. Cotropia grouped patents in one of three groups (Biologic/Chemical, Electronics/IT/Business Methods, and Mechanical) unlike previous studies that break down patents into more individualized groupings.

Lefstin (2007) studied dissenting opinions at the Federal Circuit to gauge the legal indeterminacy that surrounds claim construction. He analyzed all published opinions from 1998-2005 (*Markman* to *Phillips*) to determine how often they provoked dissenting opinions. Although there are numerous ways to analyze the meaning of dissents, comparing dissents within the same court reveals whether they occur because of uncertainty in the law or other, court-specific reasons. Using dissent as a sign of indeterminacy, Lefstin found the dissent frequency for claim construction to be similar to that of a number of issues in patent law (infringement, invalidity, inequitable conduct, other), at 8.3%. Thus, he concluded that there is no more legal indeterminacy in claim construction than other areas of patent law.

Lefstin also compared claim construction dissent rates at the Federal Circuit to dissent rates in contract interpretation cases at the Circuit Courts of Appeal. He concluded that while claim construction is more likely to attract a dissent, this result can largely be explained by the Federal Circuit’s propensity to dissent. Ultimately, he concluded that claim construction was not substantially different from other doctrines, yet “[t]he relative indeterminacy of claim construction appeals fluctuates with little apparent pattern over the period 1998 to 2005 although the marked increase of indeterminacy in 2004 remains prominent.”

Krause and Auyang (2014) focus their analysis on the directionality of reversal. Using a dataset of post-*Phillips* claim construction reversals, they find that a higher percentage of reversals (70.2%) result in broadening of patent claims, from which they conclude that district courts systematically err in the narrowing direction. This inference, however, does not account for selection effects that could influence the observed mix of broadening/narrowing errors, such as the fact that the number of appealed patentee wins is much less than the number of appealed

patentee losses (Cotropia 2015). Furthermore, the mix of appeals based on alleged infringement versus validity errors could also skew the mix of broadening and narrowing reversals..

B. Claim Construction Methodology

The second group of studies identifies the sources examined by appellate judges in performing claim construction and how they weigh those sources. These studies look for judge-level effects to explain the claim construction process.

Wagner & Petherbridge (2004) focused on the methodological split among Federal Circuit judges. Their study grouped judges into three categories: (1) proceduralists, who give primary weight to the claim language (and the ordinary meaning, often derived from dictionaries); (2) holistics, who interpret patent claim terms using an open-ended methodology drawing upon the full range of interpretive tools—claim language, specification, prosecution history, dictionaries, and expert testimony; or (3) “swing” judges, a middle group that does not subscribe to either the procedural or holistic methodology. They looked at the Federal Circuit opinions from April 26, 1996 (Markman II) through November 1, 2002 which “offer[ed] an observable patent claim construction analysis.” (Id. at 1145). Thus, their database included 393 cases, but did not include Rule 36 cases or a number of opinions which did not lend themselves to claim construction analyses. (Id. at 1146 n.143).

Wagner and Petherbridge found that the proceduralist methodology was employed almost twice as often as the holistic approach, a trend that seemed to be increasing with time. But, they found that claim construction appeal outcomes were highly dependent on the composition of the appellate panel, and thus Federal Circuit claim construction appeals were largely determined by one’s draw of judges. They concluded that the court was divided into “factions” of proceduralists and holistics. In a follow-up study, Wagner and Petherbridge could not confirm that *Phillips* had a “significant impact on the stability and predictability” of claim construction: rather, they felt that *Phillips* had further divided the Federal Circuit on claim construction (Wagner & Petherbridge, 2011).

With the Federal Circuit’s 2002 *Texas Digital* decision, attention shifted to the use of dictionaries as a tool for making claim construction more predictable. Miller & Hilsenteger (2005) examined the use of dictionaries in claim construction decision. They used Boolean searches on Westlaw to flag potential claim construction decisions employing dictionaries between 1995 and 2004. (Id. at 845). They found significant increases in the citation of dictionaries in both district court and Federal Circuit decisions using both narrow and broad search criteria as a percentage of cases. (Id. at 845-50).

For those terms for which the Federal Circuit consulted a dictionary during the study period, Miller & Hilsenteger also measured the number of dictionaries referenced per claim term. They found that in approximately 20% of instances, the Federal Circuit referenced more than one dictionary. (Id. at 860-61). They also analyzed the type of dictionary consulted, finding that general purpose dictionaries (70.5%), as opposed to specialized technical dictionaries (29.5%), dominated the data set. (Id. at 861). Focusing more specifically on how dictionaries were used, Miller & Hilsenteger found examples of serial dictionary use – i.e., where dictionaries were used to interpret dictionaries. (Id. at 863-64). They also found that Federal Circuit judges with patent law or technical backgrounds were more likely to cite specialized dictionaries than their

generalist colleagues. (Id. at 864-65).

Based on these findings, Miller & Hilsenteger came to see that *Texas Digital*'s elevation of dictionaries to a higher status in the claim construction framework may be illusory due to the wide range of definitions within and among dictionaries available. (Id. at 866-83). They note, for example, that the outcome of particular appeals – affirmance or reversal – can depend on which general purpose dictionary the Federal Circuit chooses to reference. (Id. at 876-79). They conclude their analysis by recommending that the Patent Office solve the dictionary choice problem by requiring applicants to designate their default dictionary preferences (general purpose and specialized) in the patent application. (Id. at 883-904).

Just as Miller & Hilsenteger (2005) came to press, the Federal Circuit's en banc *Phillips* decision down-played the role of dictionaries in claim construction. The decision noted that "[t]he main problem with elevating the dictionary to such prominence is that it focuses the inquiry on the abstract meaning of words rather than on the meaning of claim terms within the context of the patent." (*Phillips v. AWH Corp.*, 415 F.3d 1303, 1321 (Fed. Cir. 2005) (en banc)). As a result, "too often [the *Texas Digital*] line of cases has been improperly relied upon to condone the adoption of a dictionary definition entirely divorced from the context of the [patent's] written description." (Id.).

Anderson and Menell (2014) look at the evidence examined in claim construction appeals. The study found that while reliance on claim language and the specification has remained largely unchanged, reliance on prosecution history has declined since 2003, in agreement with Wagner and Petherbridge's findings. Similarly, reliance on extrinsic evidentiary sources, dictionaries in particular, has diminished since *Phillips*. This is consistent with *Phillips*'s emphasis on intrinsic evidence. Furthermore, Anderson and Menell (2014) found a large increase in cases decided by summary affirmance (Rule 36).

C. Judicial Behavior: Learning and Collegial Effects

The final group of studies looks at claim construction as a proxy for appellate behavior more generally.

Schwartz (2008) examined whether district court judges improve their performance of claim construction over time. He constructed two databases, one of claim construction appeals and the second of biographical information on the individual judge. The appellate database is similar to the databases created by Moore (2001, 2005) and Anderson & Menell (2014). The biographical database contains the size of each district judge's patent docket, from 1995 to 2005. Then, Schwartz determined whether the judges improved after each subsequent Federal Circuit appeal.

Schwartz found no evidence that district judge reversal rates dropped as judges gained experience. Schwartz's study indicates that neither the reversal rate nor judges' ability to "learn" how to construe claims have improve over time. That is, judges were no more likely to be reversed on their first appealed claim construction case than they were on their fifth. Furthermore, Schwartz found that a district court judge's first reversal does not have a substantive or statistically significant effect on the future performance of the judge. That is, it does not appear that district court judges had improved their claim construction accuracy after their first reversal from the Federal Circuit. Using the biographical database, Schwartz also analyzed a number of judge-specific factors (age, legal experience, patent-specific experience) to

present summary statistics of district court judge reversal rates. He concluded that experience did not affect claim construction reversals. Age, on the other hand, may play a role as the reversal rate drops until age 70, at which time it spikes to nearly 40%.

Schwartz suggested three possible explanations for his findings: (1) inherent indeterminacy of claim construction; (2) lack of guidance from the Federal Circuit; or (3) failure of district court judges to properly apprehend claim construction analysis.

By contrast, Kesan & Ball (2011) and Stiernberg (2013) suggest that experience may in fact benefit district court judges tasked with performing claim construction. Kesan and Ball studied all cases filed between 1995 to 2003. Similar to Schwartz, they found neither general judicial experience nor cumulative patent-specific judicial experience increased the likelihood of affirmance on appeal. However, they found that “recent” experience with patent cases (defined as cases within the previous three years) did increase affirmance odds in claim construction cases. Stiernberg (2013) analyzed claim construction appeals from 2007-2012 and found that district court judge with patent-specific experience were less likely to have their claim construction decisions reversed. Furthermore, in agreement with all previous studies, he found that time on the bench did not affect a judge’s reversal rate.

In a follow up study, Schwartz (2009) examined the administrative law judges (ALJs) of the International Trade Commission (ITC). He found that ALJs are reversed as frequently as district court judges from patent-heavy jurisdictions – approximately 31%. Furthermore, he concluded that ALJs do not get better at claim construction with more experience. Schwartz highlights the potential downsides to conducting such a study, including selection effects, low numbers of cases appealed, and differing standards for claim construction practice.

Lemley and Miller (2015) use claim construction data to evaluate hypotheses about learning and familiarity among jurists. They utilize the Federal Circuit’s program of inviting district court judges (as well as a few circuit court judges) to sit for a week on the court. Their study employs Miller’s claim construction database and compared whether the judge’s claim construction opinions were more likely to be reversed after sitting with the federal circuit than before. They concluded that district judges who sit with the Federal Circuit by invitation are thereafter significantly less likely to be reversed in their claim construction decisions. They attribute the improvement in district judges’ reversal rates to the personal relationships district judges develop with appellate judges while sitting at the Federal Circuit as opposed to a learning effect.

III. Jurisprudential and Policy Ramifications

Claim construction studies have played a substantial role in the development of claim construction jurisprudence and patent policy relating to claim clarity. Shortly after she published her 2005 study on claim construction reversal rates, Professor Kimberly Moore was nominated to the Federal Circuit. She was confirmed by the Senate in September 2006. As noted above, her research criticized the *Cybor* rule and she appeared to favor overturning it. (*Retractable Techs., Inc. v. Becton, Dickinson & Co.*, 659 F.3d at 1373 (Fed. Cir. 2011) (Moore, J., joined by Rader, C.J., dissenting from denial of rehearing en banc)). She ultimately declined the opportunity in *Lighting Ballast Control LLC v. Philips Elecs. N. Am. Corp.*, 744 F.3d 1272 (Fed. Cir. 2014) (en banc), joining the majority opinion upholding *Cybor* on stare decisis grounds. The majority, concurring, and dissenting opinions in *Lighting Ballast* decision extensively discussed the

jurisprudential, empirical, and normative analysis in Anderson and Menell (2014).

On March 31, 2014, the Supreme Court granted certiorari in *Teva Pharmaceuticals USA, Inc. v. Sandoz, Inc.* (134 S.Ct. 1761), a case addressing the standard of appellate review of patent claim construction determinations. Drawing on the jurisprudential and empirical analysis in Anderson & Menell (2014), Menell, Anderson, & Rai (2014) called for overturning the *Cybor* rule and adopting a hybrid standard of review based on the mixed fact/law character of claim construction.

The Supreme Court's decision (135 S.Ct. 831 (2015)) overturned the *Cybor* rule, holding that Federal Rule of Civil Procedure 52(a)(6) requires a court of appeals to uphold a district court's findings of fact unless they are clearly erroneous. (Id. at 835; Anderson & Menell (2015)). The Court noted that its *Markman* decision "neither created, nor argued for, an exception to Rule 52(a)," and recognized that "subsidiary factfinding is sometimes necessary" in patent claim construction, directly contradicting nearly two decades of Federal Circuit jurisprudence. The majority recognized that while "[c]onstruction of written instruments often presents a 'question solely of law,' at least when the words in those instruments are 'used in their ordinary meaning,'" extrinsic evidence may help when "a written instrument uses 'technical words or phrases not commonly understood.'" "And in that circumstance, the 'determination of the matter of fact' will 'preced[e]' the 'function of construction.' . . . This factual determination, like all other factual determinations, must be reviewed for clear error." (Id. at 837-38). The Supreme Court's decision noted the relatively high rate of claim construction reversals in its analysis. (Id. at 839 (citing Menell, Anderson, & Rai (2015)).

Empirical studies of claim construction may also have contributed to the broader policy questions surrounding claim clarity. The Supreme Court's decision in *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S.Ct. 2120 (2014), tightening the standards for invalidating claims for indefiniteness (35 U.S.C. § 112(b)) partially addresses the problem of claim construction by subjecting vague or ambiguous claims to greater risk of invalidation. (Menell (2014)).

Along similar lines, in June 2013, the Executive Office of the President called upon the Patent Office to promote "clearer patents with a high standard of novelty and non-obviousness" and address problems of functional claiming. (Executive Office of the President (2013); Lemley (2013); Menell (2012); Menell (2013)). The PTO has pursued several initiatives along these lines, including promoting the use of glossaries in patent applications, (U.S. Patent and Trademark Office (2014); Miller & Hilsenteger (2005)), and "making claim construction explicit in the record, including the scope of claim terms, and functionally defined clauses." (U.S. Patent and Trademark Office (2015)).

The Federal Circuit has also tightened the standard for subjecting claim terms using generic language to the more limited scope applicable to means-plus-function claim formats. (*Williamson v. Citrix Online LLC*, 792 F.3d. 1339 (Fed. Cir. 2015) (en banc)). Prior to this decision, the Federal Circuit applied a "strong" presumption that a term lacking the word "means" does not invoke § 112(f). In re-characterizing the presumption, *Williamson* explained that a term lacking "means" will nonetheless be construed under 112(f) if the "challenger demonstrates that the claim fails to recite sufficiently definite structure or else recites function without reciting sufficient structure for performing that function." (Id. at 1349). The focus is on the claim language as a whole, not just the isolated term that is akin to "means." Generic terms such as "mechanism," "element," "device" and other such terms that do not connote sufficiently

definite structure in the context of the overall claim are tantamount to stating “means,” and therefore may be construed pursuant to 112(f) if nothing else in the claim provides sufficient structure.

IV. Future Directions

These jurisprudential developments and administrative reforms open up new avenues for empirical research on claim construction and claim drafting.

The Supreme Court’s decision in *Teva Pharms. USA, Inc. v. Sandoz, Inc.* (135 S. Ct. 831 (2015)) opens a new chapter in claim construction case management and jurisprudence. (Anderson & Menell (2015)). It remains to be seen the extent to which district judges will make great use of extrinsic evidence in claim construction proceedings and prepare more careful orders explaining the basis for their claim construction. It is also unclear the extent to which the Federal Circuit will view extrinsic evidence relied upon by district courts as worthy of deference. The *Teva* decision affords the Federal Circuit the ability to find that intrinsic evidence trumps extrinsic evidence.

Other hypotheses that could be tested following the *Teva* decision are whether its more deferential regime results in greater cost and delay as parties engage in escalating battles of expert witnesses and whether greater deference increases the finality of district court decisions – i.e., whether more cases settle prior to appeal. Measuring these effects could prove difficult as a result of roughly contemporaneous changes in patent litigation driven by changes in patent eligibility doctrines (*Bilski v. Kappos*, 561 U.S. 593 (2010); *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, 132 S. Ct. 1289 (2012); *Association for Molecular Pathology v. Myriad Genetics, Inc.*, 133 S. Ct. 2107 (2013); *Alice Corp. v. CLS Bank International*, 134 S. Ct. 2347 (2014)), and rise in the use of post-grant proceedings at the Patent Trial and Appeal Board (PTAB) to invalidate patents. Nonetheless, the greater availability of trial court records provides a window into studying how the *Teva* decision reverberates throughout the patent litigation ecosystem.

The Patent Office initiatives in conjunction with greater judicial scrutiny of patent claiming following the *Teva*, *Nautilus v. Biosig Instruments, Inc.* (134 S. Ct. 2120 (2014)), and *Williamson v. Citrix Online, LLC* (792 F.3d 1339 (2015) (en banc)) decisions provide an opportunity to investigate claim drafting, reissuance, and prosecution practices. These decisions and initiatives have the potential to discourage the use of ambiguous claim language and promote the use of glossaries. In addition, in conjunction with the patent eligibility cases, they are likely to alter the types of patents sought.

The PTAB provides a further opportunity for studying claim construction. The PTAB uses the “broadest reasonable interpretation” standard for construing patent claims in evaluating patent validity. (*In re Cuozzo Speed Techs., LLC*, 778 F.3d 1271 (Fed. Cir. 2015)). It will be useful to evaluate the extent to which the broadest reasonable interpretation standard compares to the actual meaning applied in district proceedings.

Similarly, the *Williamson* decision provides another natural experiment for evaluating patent litigation behavior. It appears likely that a significant number of software patents (and perhaps others) will be more carefully scrutinized in the coming years. This might also lead to an increase in reissuance practice as patentees seek to clarify the scope of their claims in advance of enforcement.

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