No. 2024-2296

In the

# United States Court of Appeals for the Federal Circuit

EXAFER LTD.,

*Plaintiff-Appellant*,

v.

MICROSOFT CORP.,

*Defendant-Appellee*.

Appeal from the United States District Court for the District of Texas, No. 1:20-cv-131, Judge Robert Pitman

## BRIEF OF PROFESSOR CHARLES DUAN AS *AMICUS CURIAE* IN SUPPORT OF THE PETITION FOR REHEARING

Charles Duan
*Counsel of Record*
American University Washington College of Law
4300 Nebraska Avenue NW
Washington, DC 20016
(202) 274-4124
notices.ecf@cduan.com

*Counsel for Amicus Curiae*

## CERTIFICATE OF INTEREST

Pursuant to Rules 29(a) and 47.4 of the Federal Circuit Rules of Practice, counsel certifies as follows:

(1) The full name of every party or amicus represented by me is **Professor Charles Duan**.

(2) The above-identified parties are the real parties in interest.

(3) The corporate disclosure statement of Rule 26.1 of the Federal Rules of Appellate Procedure is as follows: There is no parent corporation to or any corporation that owns 10% or more of stock in the above-identified parties.

(4) The names of all law firms and the partners and associates that have appeared for the party in the lower tribunal or are expected to appear for the party in this court, not including those who have entered or are expected to enter an appearance before this court, are: **None**.

(5) The title and number of any case known to counsel to be pending in this or any other court or agency that will directly affect or be directly affected by this court's decision in the pending appeal are: **None**.

(6) All information required under Fed. R. App. P. 26.1(b) (organizational victims in criminal cases) and 26.1(c) (bankruptcy case debtors and trustees): **None**.

Dated: May 20, 2026

*/s/ Charles Duan*
Charles Duan
*Counsel for Amicus Curiae*

## TABLE OF CONTENTS



## TABLE OF AUTHORITIES

### Cases

**Other Sources**

## INTEREST OF *AMICUS CURIAE*

Professor Charles Duan[1] teaches at the American University Washington College of Law. His interest is in the proper development of patent law in ways that are doctrinally consistent and in the public interest.

## INTRODUCTION AND SUMMARY OF ARGUMENT

When determining a reasonable royalty, the formula is simple: royalty base times royalty rate. And the rule for selecting the royalty base is also clear: the smallest salable patent-practicing unit (SSPPU), unless "demanding" requirements are met for considering the entire market value of the product. The panel decision in the present case ignored that rule, suggesting that any royalty base with a "causal connection" to the relevant patent may be acceptable. This deviation from circuit precedent is reason enough to grant rehearing.

But what is so important about a correct royalty base? After all, if the royalty base is 100 times too large, one can simply divide the royalty rate by 100, and the resulting award is theoretically the same. Commentators have thus called

[1]This brief is being tendered with a motion for leave to file this brief. Pursuant to Rule 29(c)(5), no counsel for a party authored this brief in whole or in part. No person or entity, other than *amicus*, its members, or its counsel, made a monetary contribution to the preparation or submission of this brief. *Amicus* would like to thank Morgan Doyle of the American University Washington College of Law for contributing to the research and writing of this brief.

for softening the SSPPU requirement; the panel decision can be understood as within that line of skepticism.

This brief offers a key justification of the royalty base rules, from the perspective of human psychology. People, including the jurors and factfinders who assess reasonable royalties, deal more accurately with reasonably sized numbers compared with extremely small ones. Most people can visualize 10% or 20%. But cognitive biases produce errors when estimating very small quantities like 0.01% (0.0001 as a fraction), often overshooting an order of magnitude or more over the true values.

These effects explain the rules limiting the selection of the royalty base. If the chosen royalty base is 100 times larger than the SSPPU, then juries will have to deal with minuscule royalty rates like 0.01%, heightening the risk of overcompensation especially for patents of marginal value. The SSPPU requirement keeps royalty rates within the range of human understanding, so decisions are based on case-specific facts rather than arbitrary cognitive biases.

Psychology gives scientific backing to this Court's royalty base rules, and it rebuts criticisms of those rules. But the panel decision opens the door to royalty bases that could force factfinders to grapple with incomprehensibly tiny rates, inviting systematic overcompensation of patentees. That potential for long-term error further justifies rehearing.

# ARGUMENT

## I. Human Psychology Renders Judgments About Small Percentage Rates Inaccurate, Often by Wide Margins

In a study of estimations of small fractions, test subjects were shown a pattern of dots, mostly black and a few white, and asked to estimate the fraction of dots that were white. *See* Dale J. Cohen et al., *What Very Small Numbers Mean*, 131 J. Experimental Psych. 424, 427 (2002). Consistently, subjects overestimated when the fraction was extremely small, often choosing 0.01 when the true answer was 0.0002 for example. *See id.* at 428 & figs.1–2. For proportions less than 1%, the factor of overestimation was often ten to fifty times. *See id.* at 429, 438.

Regular fifty-fold errors in patent damages would be unsettling to say the least, and the legal methodology for reasonable royalty computations ought to minimize such errors. Understanding the arbitrary influences on decisionmaking—what psychologists call "cognitive biases"—helps to explain those legal rules and aids in their correct application.

At least two such biases affect royalty rate estimation: *availability bias*, the tendency to focus reasoning on familiar concepts rather than unfamiliar ones; and *anchoring*, the tendency to produce estimates close to recently presented information, even if irrelevant. These biases especially affect small estimation values of less than 1%.

### A. Availability Bias Inhibits Reasoning About Small Numbers

Anyone can be forgiven for mixing up a million, a billion, or a trillion; it is difficult to comprehend numbers so large. *See, e.g.*, David Landy et al., *Estimating Large Numbers*, 37 Cognitive Sci. 775, 776 (2013). This exemplifies *availability bias*: the tendency to make assessments based on "the ease with which instances or occurrences can be brought to mind." Amos Tversky & Daniel Kahneman, *Judgment under Uncertainty: Heuristics and Biases*, 185 Science 1124, 1127 (1974). People can accurately reason about "available" numbers in the tens, hundreds, or thousands. *See* Landy et al., *supra*, at 777–78. But outside that range, people reason by erroneously adjusting numbers back toward familiarity—treating large numbers as if they were smaller, for example. *See, e.g., id.* at 792; Aaron Saiewitz & M. David Piercey, *Too Big to Comprehend? A Research Note on How Large Number Disclosure Format Affects Voter Support for Government Spending Bills*, 32 Behav. Rsch. Acct. 149 (2020); Ilyse Resnick et al., *Dealing with Big Numbers*, 41 Cognitive Sci. 1020 (2017).

For extremely small numbers, availability bias explains the tendency toward overestimation. Numbers like 1% or 5% are common in daily life, but fractions like 0.02% are "infrequently experienced," giving rise to "extreme difficulty interpreting these values." Cohen et al., *supra*, at 440. The natural tendency, then, would be to favor estimates that are closer to 1% than 0.02%. *See id.* at 428 &

fig.2; *see also* Anna M. Waldron et al., *The Current State of Public Understanding of Nanotechnology*, 8 J. Nanoparticle Rsch. 569 (2006).

For royalty rates, availability bias suggests that where the "true" rate is below 1%, juries will likely tend to overestimate the proper royalty in the direction of more familiar, larger percentages. Such systematic overestimation of royalty rates would render reasonable royalty awards arbitrarily based on cognitive biases rather than case-specific facts.

### B. Anchoring Steers Toward Inappropriately Larger Values

A second cognitive bias is *anchoring*: the tendency of a person to produce estimates close to a number on that person's mind, even if the number in mind is irrelevant to the estimation task. *See* Tversky & Kahneman, *supra*, at 1128–29. Anchoring effects on jury decisions are well-known. *See, e.g.,* Shari S. Diamond et al., *Damage Anchors on Real Juries*, 8 J. Empirical Legal Stud. 148, 173 (2011); Cass R. Sunstein et al., *Punitive Damages: How Juries Decide* 67–70 (2002); Edith Greene et al., *Juror Decisions About Damages in Employment Discrimination Cases*, 17 Behav. Sci. & L. 107, 119–20 (1999); Gretchen B. Chapman & Brian H. Bornstein, *The More You Ask For, the More You Get: Anchoring in Personal Injury Verdicts*, 10 Applied Cognitive Psych. 519, 537 (1996). And anchoring concerningly invites arbitrary decisions unrelated to the facts or evidence in the case.

There are two reasons why anchors are effective: priming effects and adjustment. *See* Daniel Kahneman, *Thinking, Fast and Slow* 120 (2011). Anchors have a priming effect on subjects, selectively evoking compatible evidence in a person's mind, which justifies an answer close to the anchor. *See id.* at 122. Anchors also serve as a starting point from which individuals adjust their estimations until they reach the outer bounds of their confidence. *See id.* at 120.

Indeed, anchoring has already presented a problem for reasonable royalty law. Until 2011, expert witnesses on royalty rates regularly applied the "25 percent rule of thumb." *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1311 (Fed. Cir. 2011). Following the pattern of priming and adjustment, the experts would then "adjust this 25% up or down." *Id.* This Court rejected the 25 percent rule because of the arbitrariness of anchoring—the rule "fails to tie a reasonable royalty base to the facts of the case at issue." *Id.* at 1315.

Anchoring can occur even without an explicitly presented anchor value. In 1975, one psychologist found that experimental subjects gravitated toward "cognitive reference points," such as whole, round numbers like 50 and 100. Eleanor Rosch, *Cognitive Reference Points*, 7 Cognitive Psych. 532, 534, 544–45 (1975). This tendency is unsurprising—whole, round numbers are learned early in childhood, so they persist as anchors in the mind. *See* Yujing Ni & Yong-Di Zhou, *Teaching and Learning Fraction and Rational Numbers: The Origins and Implications of*

*Whole Number Bias*, 40 Educ. Psych. 27 (2005); Martha W. Alibali & Pooja G. Sidney, *Variability in the Natural Number Bias*, 37 Learning & Instruction 56 (2015); Santiago Alonso-Díaz et al., *Intrinsic Whole Number Bias in Humans*, 44 J. Experimental Psych.: Hum. Perception & Performance 1472, 1472 (2018). Biases relating to whole, round numbers arise in many contexts, including price estimation. *See, e.g.,* Monica Wadhwa & Kuangjie Zhang, *This Number Just Feels Right: The Impact of Roundedness of Price Numbers on Product Evaluations*, 41 J. Consumer Rsch. 1172, 1182–83 (2015). And the data of the study by Cohen and colleagues suggests whole-number anchoring at work, as test subjects consistently chose decimal proportions of 0.01, 0.02, 0.03, and so on. Cohen et al., *supra*, at 428 fig.1.

Anchoring effects potentially pose problems for extremely small royalty rate determinations. By definition, quantities like 0.01% are not whole numbers, so a cognitive bias toward whole, round numbers would steer jurors toward larger values like 1%. And the anchoring effect of a large royalty base would further steer jurors away from even a justifiably small royalty rate.

## II. Royalty Base Jurisprudence Reduces the Likelihood of Arbitrary Awards Influenced by Cognitive Biases

Cognitive biases explain the rules governing the royalty base. Generally, the royalty base must be the "smallest salable unit embodying the patented invention." *See, e.g., Power Integrations v. Fairchild Semiconductor*, 904 F.3d 965, 977

(Fed. Cir. 2018). Two narrow exceptions exist. (1) The entire market value of a multi-component product may be used as the royalty base if the product "the feature patented constitutes the basis for consumer demand." *Id.* (quoting *Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1336 (Fed. Cir. 2009)). (2) Where past licenses are relied upon, separate determination of the SSPPU may not be required. *See Commonwealth Sci. & Indus. Rsch. Organisation v. Cisco Sys., Inc.*, 809 F.3d 1295, 1302–03 (Fed. Cir. 2015).

The SSPPU baseline rule helps to situate the royalty rate within a range that minimizes cognitive bias problems. Consider a product like a mobile phone that costs $1100, where the SSPPU is a $10 chip within the phone and the plausible reasonable royalty range is $0.50–2.00. Where the SSPPU is used as the royalty base, a jury would be considering royalty rates between 5 and 20%. These numbers are familiar to most people, avoiding availability bias problems. And even if jurors fixate on whole, round numbers, there are sixteen of them between 5 and 20%, enabling the jury to calibrate the royalty rate with reasonable precision.

By contrast, if the entire phone is used as the royalty base, then the plausible royalty rate range is 0.045% to 0.182%. Availability bias potentially impedes appreciation of the differences between these small values, both of which seem just like small fractions of a percent. *Cf.* Richard H. Stern, *What Are Reasonable and Non-Discriminatory Terms for Licensing a Standard-Essential Patent?*, 37 European

Intell. Prop. Rev. 549, 554 n.26 (2015). And because these numbers are so small, jurors may overestimate and favor a rounder royalty rate like 1%, awarding a royalty greater than the SSPPU value. Even if the royalty rate is given in dollars and cents rather than percentages, anchoring is still a problem: Compared to a $1100 phone, a $10 royalty might look so small that a juror would adjust upwards toward the anchor price.

This Court's explanations of the SSPPU and entire market value rules line up closely with these psychological phenomena. The benefit of using the SSPPU as the royalty base is that it is "much more closely tied to the claimed invention." *VirnetX, Inc. v. Cisco Sys., Inc.*, 767 F.3d 1308, 1327 (Fed. Cir. 2014); *see also Cornell Univ. v. Hewlett-Packard Co.*, 609 F. Supp. 2d 279, 287–88 (N.D.N.Y. 2009). That close tie more likely positions the royalty rate near a whole-number percentage, enhancing rational decisionmaking. By contrast, a disproportionately large royalty base "cannot help but skew the damages horizon for the jury." *Uniloc*, 632 F.3d at 1320. Availability bias against small fractions is one way that the damages horizon becomes skewed. And this Court invoked anchoring concerns in reasoning that reliance on the entire market value may "only serve to make a patentee's proffered damages amount appear modest by comparison, and to artificially inflate the jury's damages calculation." *LaserDynamics, Inc. v. Quanta Comput., Inc.*, 694 F.3d 51, 68 (Fed. Cir. 2012).

Cognitive bias research scientifically backs the SSPPU standard and the entire market value rule. *Cf.* Thomas F. Cotter, *Patent Damages Heuristics*, 25 Tex. Intell. Prop. L.J. 159, 203 (2018) (indicating potential relevance of cognitive biases to SSPPU rule); J. Gregory Sidak, *The Proper Royalty Base for Patent Damages*, 10 J. Competition L. & Econ. 989, 1022 (2014) (similar). It also responds to criticisms of these rules. For example, dicta in *Lucent Technologies, Inc. v. Gateway, Inc.* contended that there was "nothing inherently wrong" with using the entire market value as the royalty base, since the royalty rate could be adjusted downwards accordingly. 580 F.3d at 1339; *see also* Cotter, *supra*, at 200.

But adjusting the royalty rate downwards forces the royalty rate into unfamiliarly small territory, increasing the chances that cognitive biases distort awards. Such a result would inappropriately render damages awards "arbitrary" and "unrelated to the facts of [the] case." *Uniloc*, 632 F.3d at 1318. These concerns explain the SSPPU determination "may not be avoided by the use of a very small royalty rate." *LaserDynamics*, 694 F.3d at 67.

## III. The Panel Decision's Expansion of Potential Royalty Bases Invites Erroneous Awards that Exploit Cognitive Biases

In the present case, the panel decision discarded these established rules for royalty base selection, instead (at 6) opening the door to selecting any product bearing a mere "causal connection" to the patented invention. In particular, the

panel decision (at 7) suggested that, for a patent on a method of manufacture, courts may "use the unaccused product made from the claimed method as the royalty base."

These propositions have no logical stopping point and potentially eviscerate existing law on the royalty base. Consider, for example, the problem of a $10 chip in a $1100 phone. The phrase "causal connection" is so ambiguous that it could arguably be satisfied even here, where the chip is causally connected to at least some functions of the phone. And perhaps through a continuation application, one could claim a method of manufacturing a phone, comprising installing said chip in the phone. Such a patent claim would render the entire phone an "unaccused product made from the claimed method." In effect, then, the panel decision wholly circumvents the entire market value rule.

Expansion of the potential royalty base in this manner would thus force assessments of royalty rates in ranges of extremely small fractions, as described above. As a result, the panel decision unnecessarily magnifies the risk that cognitive biases influence reasonable royalty awards.

## CONCLUSION

For the foregoing reasons, rehearing should be granted.

Respectfully submitted,

Dated: May 20, 2026

*/s/ Charles Duan*

Charles Duan
*Counsel of Record*
American University Washington College of Law
4300 Nebraska Avenue NW
Washington, DC 20016
(202) 274-4124
notices.ecf@cduan.com

*Counsel for Amicus Curiae*

## CERTIFICATE OF COMPLIANCE

This document complies with the type-volume limitation of the Federal Rules of Appellate Procedure and the Circuit Rules. The document contains **2,522** words, excluding the parts of the document exempted by Federal Rule of Appellate Procedure 32(f).

This document complies with the typeface and type style requirements of the Federal Rules. The document has been prepared in a proportionally spaced typeface using the *xelatex* typesetting system, in the font Libertinus Serif Regular.

Dated: May 20, 2026

*/s/ Charles Duan*
Charles Duan
*Counsel for Amicus Curiae*