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Piece Problems: Component Valuation in Marketing and in Patent and Tort Law

Saul Levmore*

The problems referred to in the title of this chapter concern evaluating a given variable when it is one of several that have combined to bring about a result. In some cases, there is an easy market solution. Imagine that you contract to buy a house and then the beautiful kitchen stove, one of many things that attracted you to the property, is destroyed before you close the transaction or occupy the property. How much should the price now be reduced? Here there is an upper limit based on the cost of a comparable replacement appliance. A more precise valuation would also be easy if identical houses, lacking this one feature, had recently been sold. The stove is just a piece of the larger transaction, and with these convenient facts, there is not much of a “component valuation problem.” Additionally, the stove is unlikely to have been of greater value because of its interaction with other items in the house; colors and sizes are fairly standardized. “Conjoint analysis” – a term that usually refers to survey evidence that tries to elicit the value of a component – is therefore unnecessary, or at least uncomplicated, because value does not depend on an interaction among variables in a way that is not directly observed. It is also interesting because it does not present a difficult Game Theory problem, or result that might be described in common parlance as something that depends on the relative bargaining skill of the parties.

In contrast, consider an important patent case, discussed shortly, concerning a company that adds three components, ABC, to a product in order to fetch a higher price and capture a larger market share. It turns out that the use of A knowingly infringed on the patent of another. What are the damages owed to this patent holder? It would be convenient if the two parties had recently bargained for the right to use A and nearly come to an agreement – though this would introduce relative bargaining power rather than some clean measure of value; it would also be nice if A were the only new feature in the product sold, instead of being combined with B and C. In these cases, we would know the value of A to the breaching party or to the market. I aim to show that this component valuation problem in patent law is often like the “conjoint analysis” question in marketing research, a topic also discussed presently. I then show that it is also comparable to tort law’s difficulty in carrying out the doctrine of comparative negligence, after a factfinder determines that multiple parties’ negligence caused an injury. I like to think that drawing attention to the resemblance if not the equivalence of these matters is part of a connective tissue between the literature and practice of marketing and of law. Finally, I suggest that some solutions to the problem in one area might be useful, or hint at untried solutions, in another. As we will see, it is probably impossible to find a single, perfect solution that fits all cases in these areas (or even all that arise in any one of these fields), but it is interesting to think that areas of law might be informed by the marketing literature, and *vice versa*.

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A good starting point is *Cornell University v. Hewlett Packard*.¹ It is a difficult case to understand or summarize, even for lawyers, unless they have expertise in patent law as well as in judicial equivocation. The critical points for the present purpose can be refashioned as follows: Cornell had a patent on a method (though that is a loaded word in patent law) for speeding up computer processing. HP earned billions of dollars selling a product that it knew included Cornell's innovation, and arguably it encouraged its customers to infringe on Cornell's patent, and it did so without acquiring Cornell's consent. HP's product combined the Cornell innovation, which we will call A, with other advances in computer processing. Let us refer to HP's accompanying features, not wrongfully taken from Cornell, as B and C. Cornell objected and sought a recovery in the amount of HP's gain. Eventually, Cornell was found to have a valid patent on A.² HP enjoyed a huge advantage over competitors, and its large profits came from the combination, ABC – though the court seemed skeptical that HP's success had much to do with the presence of Cornell's piece, A. Patent law can be understood as attempting to recreate the value that the owner would have extracted from the infringer,³ although once there is a finding (as there was) that HP knowingly used the patented A, we might expect courts to be generous in valuing the patent, though rarely so far as to extract all the gains that the infringer derived from infringing on the patent.⁴ To the extent that courts do entertain “the entire market value rule,” perhaps to deter infringements and promote bargaining, this court might have given Cornell a recovery from HP of (1), all the profit HP earned from these sales, arguably attributable (even if barely so) to the ABC improvement and advantage over its competitors.⁵ It is unsurprising that some courts will aim at a smaller number, reflecting the benefit that A alone added to this profit.⁶ After all, if Cornell and HP had bargained, it is the value of A to HP that they would have

¹ *Cornell Univ. v. Hewlett Packard*, 609 F.Supp.2d 279 (2009). See Elizabeth Bailey, Gregory Leonard, & Mario Lopez, *Making Sense of “Apportionment” in Patent Damages*, 22 Colum. Sci. & Tech. L. Rev. 255, 259 ((2011) (“In short, Judge Rader identified the portion of the revenue of the overall product (the server) that was closely related to the patented technology, namely the processor, and then used that revenue as the royalty base.”)

² Verdict & Settlement Summary, *Cornell Univ.*, No. 2008 WL 3166856 (N.D.N.Y. June 9, 2008).

³ See 35 U.S.C. § 284, stating that damages awarded for infringement shall be “in no event less than reasonable royalty for the use made of the invention by the infringer, together with interest...” I try to avoid the question of the relationship between “reasonable” royalty and the “game” that is played between the parties.

⁴ Compensation for patent infringement has traditionally not been punitive. See *Dowagiac Mfg. Co. v. Minn. Moline Plow Co.* 235 U.S. 641 (1915), quoting *Tilghman v. Proctor*, 125 U.S. 136, 145 (1888) (“It is inconsistent with the ordinary principles and practice of courts of chancery, either, on the one hand, to permit the wrongdoer to profit by his own wrong, or, on the other hand, to make no allowance for the cost and expense of conducting his business, or to undertake to punish him by obliging him to pay more than a fair compensation to person wronged”). However, a court may under the Patent Act increase up to three times any damages found by a jury or otherwise assessed. 35 U.S.C. § 284.

⁵ Essentially, the market value rule allows compensation for the value of an item as-sold where the value for a patented component part is inseparable from the value of the whole. *Cornell Univ.*, 609 F.Supp.2d at 286, quoting *State Indus., Inc. v. Mor-Flo Indus., Inc.*, 883 F.2d 1573, 1580 (Fed.Cir. 1989) (“When applied, this rule ‘permits recovery of damages based on the value of the entire apparatus containing several features, where the patent related feature is the basis for customer demand’”).

⁶ In the *Cornell* case, while the court acknowledges that there is no market for the patented process itself, it awards damages based on “the smallest salable infringing unit” of HP's servers and workstations – their processors – to approximate the benefit HP acquired from Cornell's patent. *Cornell Univ.*, 609 F.Supp.2d at 287-88.

divided. A court might therefore give Cornell not (1) but rather (2), the amount of the profit attributable to the inclusion of A, or (3), an amount reflecting a guess as to how the parties (or perhaps typical parties) would have divided the profit attributable to A through contract negotiation. (3) is a fraction of (2). Of course, if Cornell markets its patent to many users, the price might be lower, akin to the “reasonable royalty” measure of damages, familiar to patent lawyers.⁷ If we go down this road, the list of possible results gets large, as it will include “infringement damages,” because HP might be said to have deliberately infringed, and other terms of art. But inasmuch as my goal is not to explore patent law, but to analogize from the way it grapples with component valuation problems, I will avoid subjecting readers to the details of damages in patent law, especially because they can be found amidst excellent analyses elsewhere.⁸ Returning instead to option (2), note that while it aims at the value of A somehow separated from BC, and certainly separated from HP’s larger product in which ABC was contained – it plainly discourages patent infringements. This is because if HP had bargained for the right to use A, as reflected in (3), it would presumably have done better than giving all the marginal profit away. Such an intermediate recovery avoids giving Cornell undeserved credit for HP’s unobjectionable use of BC, not to mention its cleverness in combining A with BC.

This last point is important, and was noted by the court. Finding the amount attributable to the inclusion of A is more difficult than implied by listing the options (1), (2), and (3). Courts can be expected, and perhaps encouraged, to reward the company that thought of *combining* the three elements, ABC. At times that innovator will be a patent holder like Cornell, but it is more interesting when it is a company like HP which might have taken A but never used A on its own, always ingeniously combining it with BC. For our purpose, it will be sufficient to recognize that (2) may be closer to (1) than it first seems, because courts might (learnedly or intuitively) upgrade (2) to a level we can designate as (4), at least when it seems appropriate to reward the innovative step taken by the apparent infringer in combining the patented element with other elements, whether they are patented or freestanding. Approach (4) thus blends the conventional idea of marginal value (of A alone) with the value of combining it with other elements.

Alternatively, we might estimate the likely bargain between the parties by doing something like (5): give Cornell half the value of (1), the profit earned from the combined ABC improvement in a perfectly competitive market. The division by one-half reflects the idea that the parties might be imagined as having equal bargaining prowess when they divide the surplus. In the litigated case, the court eventually imagined a royalty based on (2), but it might have done otherwise if

⁷ The Patent Act calls for damages adequate to compensate for infringement in no event less than a reasonable royalty. If the patent owner lost profits as the result of infringing activities, the profits lost may be a measure of damages. If there were no lost profits or they cannot be ascertained with reasonable accuracy, an amount adequate to compensate for the infringement not less than a reasonable royalty is the measure of damages. A reasonable royalty is sometimes said to be a floor for damages, meaning the damage award may be no lower. This means that if there is a basis for awarding damages under both the lost profits and royalty measures, the damage award may be based on the measure that yields the larger amount. This does not mean that in other situations damages may be greater than a reasonable royalty.” “§9:26, Two basic measures of damages”, 2 Patent Law, Legal and Economic Principles § 9:26 (2d ed. 2015).

⁸ Greg Allenby, Jeff Brazell, John Howell & Peter Rossi, *Valuation of Patented Product Features*, 57 J.L. & Econ. 629 (2014).

the parties had not taken extreme positions, and had instead offered testimony aimed at something like (3).⁹ Their dogmatism suggests (6): final offer arbitration (as suggested by one commentator¹⁰), asking the parties to (each) suggest an amount of damages, but promising to constrain the court to a choice between these two proposed amounts. This approach aims to make the court's job easier, by capturing the parties' private information, and encouraging reasonable claims by them, and perhaps settlement.

It is easy to be attracted to option (1), not only because of the difficulty of extracting A from ABC, and that of recreating the bargain that would divide the gain from innovation between Cornell and HP, but also, or more important, in order to be sure to deter the taking of patented inventions. But it is important to see the danger of over-deterrence, which option (1) can easily bring about by threatening a party like HP with disaster if it innovates. HP may well have known of Cornell's patent claim on A, but HP may have been uncertain about the legal viability of this patent, given that it could have considered Cornell's contribution to be an abstract idea rather than a process, machine, or article of manufacture.¹¹ Ideas alone are not protected. It is for this reason that I downplay the importance of the intentionality of HP's behavior; it may have been intentional, though a better word might be "knowing," but it may have thought that the patent would eventually be found invalid. Another over-deterrence concern has already been noted; HP might have figured out the value of the ABC combination, and Cornell might have held out in negotiations in order to extract the value of the combination of its patented piece with BC. Law must not discourage HP (or in some cases Cornell) from innovating with its combinatory insight, even as it rewards Cornell for its invention, assuming it is eventually found to be novel and so forth.

⁹ The decision is analyzed in <http://www.wac6.com/wac6/2010/10/patent-damages-apportionment-and-the-cornell-case.html> For some excellent discussion of the component valuation problem, see note 8 supra as well as J. Gregory Sidak & Jeremy O. Skog, *Using Conjoint Analysis to Apportion Patent Damages*, 25 Fed. Circuit B. J. 581 (2016); Gregg Allenby, Peter Rossi, et al., *Calculating Reasonable Royalty Damages Using Conjoint Analysis*, 45 AIPLA Q.J. 233 (2017). An innovation in this literature is the idea that when people are surveyed or otherwise studied, they should compare an offering not just to an enhanced or narrowed item but also to items offered by other sellers, adjusted as they would be if the product in question has been without the patented piece. Another insight offered by Sidak and co-authors is that the game changes when surveys ask about the future, when in fact the question is what would have happened in the past.

¹⁰ Mark Lemley & Carl Shapiro, *A Simple Approach to Setting Reasonable Royalties for Standard-Essential Patents*, 28 Berkeley Tech. L. J. 1135 (2013).

¹¹ Patents are limited to "any new and useful process, machine, manufacture, or composition of matter," to the exclusion of abstract ideas. See 35 U.S.C. § 101; see also *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980) (citations omitted). However, despite its description as a process, Cornell's patent is not clearly viable under existing case law. In *Gottschalk v. Benson*, the Supreme Court denied the patentability of a binary code conversion process, stating that "[t]he mathematical formula involved here has no substantial practical application except in connection with a digital computer" and that its patent would in essence be "a patent on the algorithm itself" – something the Court deemed an abstract idea. *Gottschalk v. Benson*, 409 U.S. 63, 71 (1972). Similar decisions were reached in *Parker v. Flook*, 437 U.S. 584 (1978) and *O'Reilly v. Morse*, 15 How. 62 (1854). Given these decisions, HP might have believed there was a reasonable argument for overturning Cornell's patent as too abstract and unconnected from application to be a "process" in the sense of 35 U.S.C. § 101.

To be sure, under-deterrence is also a concern. It is apparent that if HP must pay very little when it is sued for using patented material, inventors will learn that their outputs can be taken with no substantial reward to them, and as a result they may invest too little in inventive behavior. We do not know the optimal size of the monopoly-reward to grant inventors, but this is a job for Congress. A less apparent inefficiency, or problem with, under-compensation, is that users like HP may strategically mix in material under patent with other things in order to *create* a component valuation problem. ABC may actually be an inefficient way to build something, but HP will have an incentive to put these three things together in order to pay very little for the patented A, which would have been costlier for HP had it been used on its own or obtained through a proper bargain with Cornell. In short, it is reckless to allow anyone to avoid paying for the “value” of a patent by setting things up in order to benefit from a component valuation issue, but we should not unthinkingly prefer method (1) in order to penalize the apparent misbehavior, and discourage potential inefficient strategizing, by HP. Unsurprisingly, it would be nice to get the payment to Cornell just right, and limited to A, with or without a sweetener to deter knowing violations or court tests.

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Consider an individual Y who owns a multi-level parking facility in one city and then is impressed by what he observes in a garage, owned by X, while visiting another city. The parking garage excites Y because it has features previously unknown to him; it includes painted numbers on the floor of each parking space, and it designates each floor of the facility with the name of a local sports team, and then plays the team’s theme song near the elevator on that floor. These innovations make it easier for patrons to remember where they parked. Y returns home and copies these practices with some variation, because his garage is in a different town and is of a different style. The changes are fairly inexpensive to introduce, even if Y dutifully pays something to use any copyrighted music. Y might learn that X, or a supplier to X, claims a patent on these innovations, but Y has no fear of liability because these simple but clever features are mere ideas and, in any event, are probably obvious to many people who have thought about minimizing the number of patrons who need help locating their cars. Y regards the patent claim to be frivolous. In fact, and somewhat amazingly, a patent *has* been processed for the designation and musical accompaniment of floors in parking garages. The patent application, and the first decision accepting it, insisted that the music is not a mere idea because it is attached to a “machine,” in the form of the computer directing the music.

The very idea of a patent for parking garage innovation is quite incredible to most observers, but here the point is simply that HP, like (the imagined) Y, may have misjudged the reach of patent law. And in terms of liability, the idea is that an award, such as that suggested by (1), might discourage innovation in garages owned by people like Y, as well as in computer programs developed by firms like HP. Note also that in the garage case it must be difficult to assess damages even of the kind indicated by (1) – which seems easier than (2) and some of the other methods. It is unlikely that a court would find convincing evidence of how many customers paid a few dollars more to park in the garage that had this extra musical feature, and this is especially so given that it is combined with the painting of numbers on spaces – and no one claims that this feature is also patentable. A stingy but perhaps fair and workable approach to damages might be to see how many fewer calls for help customers made to the manager of Y’s garage after it was

improved; the value of the innovation to Y – even if his upgrades attracted no additional customers and did not enable an increase in prices – was the reduction in labor costs previously devoted to helping patrons find their vehicles. Note that even this approach fails to separate a single conglomerated feature.

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In the case of HP's knowing violation of Cornell's patent, how should damages be calculated? The garage example is instructive, but partly inapplicable. An attractive rule might call for a search for competitor firms, as suggested by Sidak and neighboring authors,¹² that sold a product with BC but not with A. If there is such a set of sales, and especially a large set (in order to exclude that annoying problem of understanding the game normally described as the bargain between two parties) then we could compare the prices with HP's in order to get at the value of A.¹³ Law could then use method (2) or (3). Similarly, in the parking garage situation, there must be some garage owners who offer spaces with visible numbers but not with team (or country or show-tune) names and songs, and this could provide information about the value of the patented innovation. These pieces of information do not need to be in Y's city. In short, information can be provided by add-ons in similar markets. If there is a great deal of money at stake, as there was in the Cornell-HP case, we could even imagine a firm, perhaps at the direction of the court and at the expense of the litigants, creating a market for a computer with BC but not A, and then another in the same market with ABC, in order to see how much consumers would pay for the addition of A. The idea is to estimate a bargain between the infringer and the patent holder by looking for information in comparable markets and then awarding the differential value, or one half of this value.

There will be markets – like parking garages – in which the innovation does not generate higher prices. The market price may be dictated by first-time users who will simply search for the lowest price or best location near their destination. The advantage to the innovator then comes in the form of more repeat customers, as users appreciate the added features. In this case, the damages for a wrongful taking of patented inputs are a function of the profit per customer times the increase in the number of patrons or the occupation rate. As we will see, this is something missing from the marketing literature, where it might also be applicable. Meanwhile, it is sufficient to note that there are a number of ways of properly assessing damages in a patent law case like *Cornell v. Hewlett Packard*, and they all involve assessing the value of a component, whether through price, profit, or volume. Cornell, to its disadvantage, insisted on a version of (1), claiming that billions earned by HP should be turned over to the patent holder, Cornell, because of a single component, wrongfully used by HP, and contributing to its profit. At the very

¹² See supra notes 8 and 9.

¹³ Patent law does on occasion use information from other sellers to assess values. See, e.g., *Grain Processing Corp. v. Am. Maize-Products Co.*, 185 F.3d 1341, 1351 (1999) (stating that “only by comparing the patented invention to its next-best available alternative(s)... can the court discern the market value of the patent owner's exclusive right, and therefore his expected profit or reward, had the infringer's activities not prevented him from taking full economic advantage of this right”); *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (1970) (noting that the “utility and advantages of the patent property over the old modes or devices” and the customary “selling price” may be used to establish reasonable royalty for a patent license).

least, it needed to show evidence of the incremental impact on HP's profits from the inclusion of the patented and unlicensed component, simplified here as A. But it might also have pointed to an increase in sales, akin to the repeat customers in the parking garage case. The increase alone might seem to suggest something close to a fraction of (1), but this ignores the fact that any increase likely comes from the combination of ABC, and presents the (now familiar) decoupling problem.

The garage example, though slightly contrived, also suggests a new method that may be transferable to marketing research. It is to sample some actual patrons as they enter the garage and ask them to identify features of the facility that attracted them to it. They are apt to mention location and price, but if they also refer to innovations that differentiate the garage from competitors, that would suggest increased business and revenue because of the named characteristics. It may even be possible to use this kind of retrospective survey to estimate the wrongful gain. On the other hand, if very few of these garage patrons, and especially repeat customers, can even identify the naming of levels or the accompanying music, it is more difficult to argue that the infringement should generate substantial damages. In sum, it is easy to see why an infringer may have known of the improvement but genuinely believed that it would not survive a legal challenge to its patent. It is also worth reiterating that a valid patent may increase the number of sales or decrease the infringer's costs, but not the price of the product in which it is embedded along with other characteristics.

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Anyone schooled in marketing research will see both similarities and distinctions between "conjoined analysis" in marketing and the component valuation difficulty in assessing damages in patent law. Beginning with this important subject in marketing research, imagine an automobile manufacturer deciding whether to add a back-up mirror, two, four, or eight more airbags, and an auto-lane keeper to next year's model of one of its popular vehicles. The manufacturer knows the production cost of each feature but not the willingness of consumers to pay. Unlike innovations in many other industries, it is too costly to simply try out combinations and observe customer reaction. Trials are costly, and it is prohibitively expensive to fabricate and market prototypes. It is also impractical to offer models with every combination of options, and the after-market is unable to supply most of these bells and whistles. A restaurant can easily vary its menu in order to see what works, but a modern automobile manufacturer cannot do so. The decision-making problems are exacerbated by the fact that there is likely to be interplay among options, and this is what makes the problem interesting. For example, consumers will value a rear-seat airbag differently if the vehicle already has two of these safety features in that region. A noise-absorbing fabric affects the value of an improved sound system, and so forth. The problem would be hard enough with five unrelated items in play, but given the importance of combinations, five items make for 120 possibilities. Even if the airbag choices are not interactive (one cannot have four as well as six airbags), there are plenty of possible combinations. Moreover, even when there is no physical connection between features, there is a price interaction, as consumers might pay more for a feature so long as the entire price of the vehicle does not exceed budgetary constraints. Given the cost and time of production, manufacturers turn to marketing experts, and their most popular approach is to survey a population resembling likely

buyers. There is some literature that suggests the reliability of these surveys,¹⁴ and this is not the place to take on this literature, tempting as I find the prospect of doing so with respect to marketing as it is with regard to the growing popularity of survey evidence in law. Most of the optimistic survey literature expresses concern for the danger that those who take the time to respond to surveys might not be representative of larger populations, but there are more serious problems. These surveys may not replicate; in some cases they ask consumers to imagine their future selves (with unknown family income and preferences) and even where this is avoided, they are often asking persons who are not actually buying a good and who might have very different responses when real money, family pressure, and other things are at stake.

The marketing literature is, unsurprisingly, sophisticated. It recognizes that survey respondents will not have the patience to evaluate 120 combinations and so it focuses statistical techniques on asking a manageable number of questions of the type “what would you pay for x” (where x contains a combination of features) or “please rank the importance to you of the following three features.” The survey expert then estimates based on an assumption of linear functions and other ways of reasoning from several aggregated responses to creating a map of likely preferences for all combinations of the variables.¹⁵ If we see that survey respondents will pay between \$100 and \$1,200 more for eight airbags than for two, but barely more if there is also a lane-keeper function in the package, then it is possible to interpolate to the demand for four additional airbags – assuming a linear, or other correctly specified, demand curve.¹⁶

An optimist might say that in the case of parking garages, and setting patent law aside, Y can simply go home and copy X’s innovation, because X must have studied the costs and benefits, and decided that the innovations were worthwhile. And if Y learns that X innovated after seeing the features in yet another facility, owned by W, and X paid the patent holder before installing the system in X’s garage, Y might free-ride on X’s decision-making; X must have decided that the patent was valid and worth accessing. Customers are unlikely to have very different valuations or memories just because they live in different cities, and patent law is also likely to be applied in similar fashion in different cities. The same strategy, or confidence in markets, might be used for automobiles. If another manufacturer includes six additional airbags and charges \$Z more, then instead of paying for marketing research, a manufacturer might simply copy what it can see, and add six airbags, assuming the cost of doing so is less than Z. It might even extrapolate and imagine a demand function before offering four or eight airbags at different prices, in order to attract consumers who prefer a lower price or more airbags than a competitor offers. A marketing expert might object to such an heroic assumption about perfect markets, but the same might be said about the expert’s own assumptions regarding linear demand curves.

This sort of learning across disciplines runs in both directions. Patent lawyers and judges could learn some mathematics and engage in extrapolation, especially when there are no comparable

¹⁴ See generally Olivier Toubia, *Conjoint Analysis*, in HANDBOOK OF MARKETING ANALYTICS 52 (Natalie Mizik & Dominique Hanssens eds., 2018); David Bakken & Curtis Frazier, *Conjoint Analysis: Understanding Consumer Decision Making*, in THE HANDBOOK OF MARKETING RESEARCH: USES MISUSES AND FUTURE ADVANCES 288 (Rajiv Grover & Marco Vriens eds., 2006).

¹⁵ Bakken & Frazier, *id.*, 290-92, 295.

¹⁶ The linearity assumption is common in the literature and probably uncalled for, but I leave that objection for another day.

firms to study.¹⁷ If Cornell does not see other firms charging more because they provide BC (so that the value of A can be deduced), it could survey actual or likely buyers about the value of BC and then of ABC, and present this evidence in court. Following an idea advanced earlier, Cornell, or an expert designated by the court, might also ask actual customers what attracted them to HP's product, and with this tactic discover the importance of A compared to B and C. It would be surprising to find that customers had paid HP a substantial premium and yet could not even identify A, but stranger things have happened, and the cost of such an inquiry is low, as it is in both the parking garage and automobile cases.¹⁸

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Consider next the application of the doctrine of comparative fault in tort law. S drives too fast and is unable to stop in time to avoid hitting T, who is backing out of a driveway without pausing and taking due care. For many years, a wrongdoer like S was absolved of tort liability because T was contributorily negligent. The rule was not a bad one.¹⁹ Drivers like S could not foresee their victims' negligence, and they knew they would be liable for significant damages if their speeding caused an accident when the party they injured was not negligent. Here, T's negligence is a kind of windfall for S, but it serves to motivate drivers like T to take care as well. Over time, and perhaps because most people's ethical intuition was that S should not be completely absolved, especially where S's behavior was intentional; indeed, there is an intuition that S should slow down even more in recognition of the fact that people like T might not be wearing a seat-belt or might pull out of a driveway too quickly. For one or more of these reasons, the law in most jurisdictions switched to the rule of comparative negligence. Under this rule, the jury or judge is asked to "compare" S and T's fault, and divide the loss between them accordingly. There are many ways to interpret and carry out this instruction, but almost every one of these promotes (at least in theory) efficient behavior. As long as at least one driver is induced to take proper care, the others will also be motivated to take care, knowing that if they do not, they might be left to pay the entire loss.

Comparative negligence is especially, or even always, attractive when an innocent victim is injured by multiple wrongdoers. Imagine for instance that J, K, and L operate grossly polluting factories on a river's banks, and the combination of their pollutants damages downstream parties. Law wants the wrongdoers to pay, but how should payment be divided among JKL? Again, we wish we knew the marginal, or incremental, contribution of each, but these are interconnected.

¹⁷ Inter-disciplinary learning is possible but unnecessary where firms and their lawyers have figured things out on their own. For example, marketing experts, and indeed run-of-the-mill business owners, regularly check out what competitors and their customers are doing, just as HP's gain from A is easily deduced if a competitor firm incorporates BC without A.

¹⁸ After writing this paper, I was fortunate enough to run across a related, but perhaps even more unlikely, idea of using tax law (or really imagined transfer prices) to estimate hypothetical bargains in patent law, and then also to use patent law to estimate transfer prices for tax law's purposes. This is quite similar to the cross-discipline strategies advanced here. See Susan C. Morse, [Seeking Comparable Transactions in Patent and Tax](#), 37 Rev. Litig. Brief 201 (2018) (thoughtful and insightful discussion of borrowing in both directions).

Perhaps we go harder on J if K and L were already on the river, and their wastes were absorbed harmlessly. After all, it was the third set of discards that “caused” harm. This is an interesting problem, because a single owner of all three factories might find it most efficient to clean up the second or first factory. The marginal wrongdoer is easy to misidentify, just as denying recovery to one who “comes to a nuisance” is often inefficient. Here, there are increasing returns, which is to say harms, to scale, for the whole is greater than the sum of the parts.

The torts problem is analogous to the vexing problem in patent law, where we tried to reward the inventor, but also not to inhibit innovation, often in the form of combining patented and unpatented elements, by a user who may be an infringer. In both settings, the word “marginal” is misleading whether for gains (as in the patent cases) or losses (in the tort cases). In tort law, one possibility is to allocate liability in proportion to how much the wrongdoers saved by polluting, rather than behaving non-negligently and investing in scrubbers or taking waste products to designated dump locations. Another is to penalize intentional torts more severely than miscalculations.²⁰ But however this question is resolved, there is again the problem of component valuation.

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It may be that tort law has little to offer patent law and even less to give marketing and, in turn, tort law has little to learn from these other areas. This is so even though the three fields have component valuation problems in common. An important difference between torts and marketing begins with the observation that so long as the downstream victims are not over-compensated, there is little risk of over-deterrence. If J pays more than its fair share, whatever that might be, it can try to bargain with K and L in order to reduce their pollution and, consequently, the downstream losses. More important, if J’s expected liability causes J to take precautions, or even over-care from an economic perspective, K and L will then learn that they will be entirely responsible for any downstream injury. After all, so long as liability is linked to law’s usual negligence principle, J will be absolved, leaving the others to pay. Bargaining of the kind just described is even easier in patent law, where parties can bargain even if they have different estimates of the likelihood of a patent’s viability, but bargaining means nothing to an automobile manufacturer struggling with a decision about improvements. It is tempting to say that patent law and marketing have more to learn from one another because the component problems they share are about dividing gains, while the comparative negligence setting is about dividing losses.

More optimistically, tort law and marketing may have more in common than first meets the eye. Recall the oblique reference to the Coase Theorem; one polluter could pay another to cease polluting, or indeed could buy the other polluting firms and do the efficient thing all on its own, internalizing all the costs and benefits. Law could, rather bravely, require the polluters to make buy-sell offers about these prices, along the lines of the “you cut, I choose” method that children often use to divide a dessert, or partners might use when dissolving an investment that they value more than would an outside buyer. Similarly, just as a marketing expert can extrapolate after asking a set of potential customers what they would pay for a feature, or how they would rank combinations of features at a set price, so too law could ask each polluter what it would pay for

²⁰ See generally William Landes & Richard Posner, *An Economic Theory of Intentional Torts*, Int’l. Rev. L. & Econ. (1981).

the others to reduce pollution, or what it would pay for their factories. Honest answers would be encouraged by the fact that the law could occasionally require the parties to follow through and carry out the transaction at the specified price. There is much more to be said about the similarities and differences among these fields, but the aim here is to identify the connective fiber and the kinds of changes it might produce.

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Component valuation issues arise in private affairs as well as in legal matters, and not only in arenas where marketing expertise has been called into play. Thus, businesses must decide how much to invest in various assets and how much to pay key employees, while sellers of goods and services to these businesses are often trying to evaluate their worth to the buyers. In most settings, there is no opportunity for experiments or useful surveys, and parties are left to guess values, knowing that the answer is complicated by interactions with neighboring elements. For example, an athlete may be worth more to some teams than to others, largely because of practiced interactions with teammates. Similarly, political parties and donors learn that some legislators' campaigns are worth greater investments than others, because these candidates, if elected, will play important roles in close legislative votes or in committee deliberations. Unsurprisingly, the experts used by political candidates do work that is quite similar to that of marketing experts employed by manufacturers of consumer products, even though manufacturers want more sales or higher profits, while politicians often aim to attract bare majorities. Component valuation questions are found everywhere,²¹ and I hope this chapter has encouraged readers to think about them a bit differently in their own areas of law, business, and scientific research, and in mundane but equally challenging problems associated with disciplining children, evaluating leaders, and constructing investment portfolios. Most of these areas present "problems" that can be solved where there are numerous comparable transactions, identifiable parties who know their own preferences, or reasons to expect survey evidence or experiments to be revealing. It is tempting, but wrong I think, to say that the problem is just the same as dividing gains in all contracts or solving the "fair-shares" problem in mergers between affiliated corporations. In these situations there is a range of plausible answers and if the parties are left to bargain, we are presented with a manageable Game Theory problem. But the component valuation problem is more than a matter of dividing a pie, as for example when a nearby active market is available for comparison. I have tried to show that the questions addressed in the field of conjoined analysis in marketing research have much in common with problems in assessing damages in patent law and liability in comparative negligence cases in tort law. The marketing-patent law connection has been made in earlier literature, but the analysis here has shown that there is much more to it. In any event, the similarities discussed here lead to the observation that the methods used in each of these (three) areas might help make progress in another. But the

²¹ Other areas include disaggregation in pain and suffering calculations. I have already suggested that the division of benefits in corporate law's treatment of gains from mergers and, therefore, the well-known problem of dividing property in the breakup of partnerships (including marriage) present somewhat different problems. The problem discussed here is not quite the same as the familiar problem of dividing surpluses or thinking about Nash equilibria. Here we seek to disaggregate and identify the gains attributable to one cause, patent holder, or tortfeasor. If possible, the idea is to minimize the temptation to recreate the bargain between two or more specific parties. The problem is familiar to students of Game Theory, and beyond the scope of the present chapter.

strongest conclusion is that by noticing the presence of component valuation problems in a few areas, and observing the ways in which they are or might be handled, we can improve our understanding of how to proceed in a variety of seemingly unrelated fields.