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## Introduction

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CAUSATION, LIABILITY AND  
APPORTIONMENT: COMPARATIVE  
INTERDISCIPLINARY  
PERSPECTIVES

RICHARD W. WRIGHT,  
FLORENCE G'SELL  
AND SAMUEL FEREY  
Symposium Editors



## INTRODUCTION

RICHARD W. WRIGHT, FLORENCE G'SELL AND SAMUEL FERÉY\*

Causation of the plaintiff's injury by the wrongful aspect of the defendant's conduct is a basic requirement for the defendant's liability for the injury in every legal system of which we are aware. However, elaboration of the concept of causation and its role in establishing and apportioning liability has until recently been infrequent in common law jurisdictions and continues to be rare in most civil law jurisdictions other than Germany. The articles in this symposium, which are also being published in French by Bruylant,<sup>1</sup> are part of an effort to focus more attention on these issues from a comparative interdisciplinary perspective. The articles are based on papers presented at a conference organized by professors Samuel Feréy and Florence G'sell that took place in September 2014 before an audience of judges, academics and practicing lawyers in the Grand Chambre of the Cour de Cassation (the highest court in France for civil and criminal cases) and at the University of Panthéon-Assas (Paris 2), organized by the Bureau of Theoretical and Applied Economics and the François Gény Institute of the University of Lorraine and the Center for Law and Economics of the University of Panthéon-Assas. This conference was part of the Damage project supported by the French National Research Agency.<sup>2</sup>

The organizers of and participants in the Paris conference were especially appreciative of and honored by the agreement of the Premier Président of the Cour de Cassation, Bertrand Louvel, to provide a welcoming speech to open the conference and to have it published in the conference proceedings.<sup>3</sup> His speech included not only a gracious welcome but also extensive discussion of the concept of causation and its application by the

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1. CAUSALITÉ, RESPONSABILITÉ ET CONTRIBUTION À LA DETTE (Samuel Feréy & Florence G'sell eds. and trans., 2016).

2. The organizers of the symposium acknowledge the financial support from the French National Agency for Research (JCJC Damage program, ANR-12-JSH1-0001, 2012-2016).

3. Bertrand Louvel, Opening Remarks—Welcome, *in* 91 CHI.-KENT L. REV. 457 (Andrea Richard, Estournal trans., 2016) (this issue).

Cour de Cassation. Following Louvel's welcoming speech, the articles in this symposium are divided into three groups, each containing three articles. The first group discusses the philosophical, legal and economic theories of causation. The second group discusses liability when there is inherent uncertainty regarding causation. The third group discusses apportionment of liability among multiple legally responsible causes.

Much of the discussion of causation in law, philosophy and economics is clouded by a failure to recognize or distinguish the several quite different senses of necessity and sufficiency that are employed in causal analysis. In descending order of stringency, the strict necessity criterion requires for a condition X to be a cause of Y that X be necessary for the occurrence of Y whenever Y occurs (that is, in the absence of X, Y could never occur); the strong necessity criterion (described as the *sine qua non* or but for criterion in the law) requires only that X have been necessary for the occurrence of Y in the specific situation, considering all the other then existing conditions; and the weak necessity criterion requires only that X have been necessary for the sufficiency of a set of existing conditions that was sufficient for the occurrence of Y (the so-called NESS criterion). The strict sufficiency criterion requires that X be sufficient by itself, without any other existing conditions, for the occurrence of Y (which is never true); the strong sufficiency criterion is the same as the weak necessity criterion; and the weak sufficiency criterion "requires" only that X be a part of some set of existing conditions that was sufficient for the occurrence of Y (which will always be true no matter how causally irrelevant the condition actually is).

## I. CAUSATION THEORIES

The first two articles in this group provide an overview of the current philosophical and economic theories of causation, in general and as applied in the law. In their article,<sup>4</sup> Richard Wright and Ingeborg Puppe assert that considerable confusion has been generated in philosophy, law and economics by the use of causal language to refer not merely to causation in its basic (natural/actual/factual) sense, which focuses solely on the content and working out of the laws of nature, but also to the quite different normative issues of moral and legal responsibility. To reduce such confusion and encourage proper identification and analysis of the distinct causation and responsibility issues, they urge that, in the legal context at least, causal language should be used to refer solely to causation in its basic sense. They

4. Richard W. Wright & Ingeborg Puppe, *Causation: Linguistic, Philosophical, Legal and Economic*, 91 CHI.-KENT L. REV. 461 (2016) (this issue).

also argue, contrary to frequent statements in legal sources that the law need not and should not concern itself with the philosophical analysis of causation, that such analysis is essential for distinguishing and correctly analyzing causation in its basic sense. They criticize the strong necessity (*sine qua non*, but for) criterion, which is generally described in philosophy, law and economics as the exclusive test of causation and applied through a counterfactual analysis, and the various attempts to modify it to enable it to resolve properly situations involving overdetermined causation.

They argue, instead, for increased recognition and application in such situations of the more comprehensive weak necessity/strong sufficiency, laws-of-nature-based, “covering law” account, as initially elaborated by John Stuart Mill and further developed in the modern legal literature as the “NESS” (necessary for the sufficiency of a sufficient set) criterion. They explain that the covering law account of causation underlies and incorporates the strong necessity criterion and the (also often referenced) independent strong sufficiency criterion, each of which has limited applicability, while going beyond both to encompass all instances of causation. They argue that it alone is able to explain and justify the decisions of the courts, which currently rely on unexplained and unelaborated findings of causation in overdetermined causation situations.

Wright and Puppe rely on the covering law account to explain the proper evidential requirements for proof of general and specific causation. They argue that proof of causation in a specific instance should and usually does require the formation of a warranted belief, based on concrete evidence specific to the particular instance, in the complete instantiation of the relevant covering laws in the specific instance. They criticize a common interpretation of the standard of persuasion for civil cases in some common law jurisdictions as merely requiring a 50+ percent statistical probability, and they note the confusion and paradoxes that result from the courts’ applying the statistical probability interpretation in certain situations involving inherent uncertainty regarding causation. They argue that, in those situations, the inherent uncertainty should be explicitly acknowledged and distinguished from the normative responsibility issue of whether some second-best just liability scheme should be adopted by, for example, reversing the burden of proof on causation or imposing liability proportional to the probability of causation.

Wright and Puppe conclude by explaining the basic inconsistency of the causation requirement for liability with the efficiency theories of liability, which focus on efficient deterrence (creating *ex ante* incentives for social welfare maximizing conduct) rather than *ex post* rectification of un-

justly caused injuries. They note the recognition of this inconsistency by most efficiency theorists and the analytical and descriptive failure of some efficiency theorists' attempts to fit the causation requirement into their theories.

In her article,<sup>5</sup> Florence G'sell also notes that the term "causation" has different interpretations and usages depending on the relevant interests in the particular context, while also asserting that philosophy and law have a common interest in explaining how a specific situation came about and attributing legal responsibility for particular consequences. Focusing primarily on the concept of causation in its basic explanatory sense, she also mentions the adequacy theory's risk-based approach to assigning legal responsibility for actually caused harms, which also relies upon causal laws, although as a basis for prediction rather than explanation. She summarizes the three main types of current theories of causation in philosophy—the counterfactual strong necessity theories, the regularity and covering law theories, and the probabilistic theories—prior to discussing and briefly criticizing their extensions and applications in legal theory and practice.

G'sell notes that, among other difficulties, the counterfactual strong necessity theories are unable to handle properly situations involving overdetermined causation by duplicative or preemptive causes. She describes the weak necessity covering law theories as being more promising, generally accepted by legal scholars in common law jurisdictions, and capable of explaining legal practice in civil as well as common law jurisdictions. However, she points out, there have been questions raised regarding the ability of covering law theories to handle indeterministic causal processes and Wright's claim that a non-circular definition of causal laws has been or can be provided. She concludes that the *ex ante* probability theories promoted by efficiency theorists are better suited for *ex ante* causal prediction than *ex post* causal explanation, and she observes that probabilistic analyses generally are not employed to define or determine causation in civil law jurisdictions, which instead tend to employ presumptions or reversals of the burden of proof or proportional liability for lost chances when causation is inherently uncertain.

In the third article in this group,<sup>6</sup> Bruno Deffains, Claude Fluet and Maïva Ropaul focus solely on the economic theories of causation in the

5. Florence G'sell, *Causation, Counterfactuals and Probabilities in Philosophy and Legal Thinking*, 91 CHI.-KENT L. REV. 503 (2016) (this issue).

6. Bruno Deffains, Claude Fluet & Maïva Ropaul, *Causation and Standard of Proof from an Economic Perspective*, 91 CHI.-KENT L. REV. 527 (2016) (this issue).

law, while acknowledging that the causation requirement is much more easily explained by assuming that justice, rather than efficiency, is the presumed goal of the liability systems. They describe the explicit and implicit attempts by leading efficiency theorists to replace the *ex post* causation requirement with a focus on *ex ante* efficient risk creation, prior to pursuing the other major approach in the efficiency literature, which analyzes the ability of negligence and strict liability rules, with and without the causation requirement, to achieve efficient (social welfare maximizing) deterrence. They focus on unilateral precaution situations (in which only the conduct of the particular defendant has any effect on what happens), with the efficiency theorists' usual assumptions that negligence is defined as inefficient conduct and that the strong necessity (*sine qua non*/but for) criterion is the exclusive test of causation.<sup>7</sup>

Their results are similar to those previously reached by others. Assuming, in addition to the previously mentioned assumptions, no risk aversion, perfect information by all potential parties and adjudicators and perfect enforcement of the liability rule, a negligence rule with or without a causation requirement will be efficient, while a strict liability rule will need the causation requirement and will not work if there is more than one potential defendant. Assuming limited liability and/or imperfect information regarding the actual or efficient levels of care, efficient deterrence is enhanced, but not assured to be optimal, by abandoning the causation requirement.<sup>8</sup>

## II. LIABILITY WHEN CAUSATION IS INHERENTLY UNCERTAIN

Courts today frequently encounter situations in which causation is inherently uncertain, due to lack of sufficient knowledge of the underlying causal laws (the “general causation” or “causal capacity” issue) and/or sufficient information about the circumstances in the specific situation (the “specific causation” issue). When general causation (the abstract ability of a type of condition to cause a type of injury under relevant causal laws) is not sufficiently proved, courts generally deny liability. When general causation has been sufficiently proved but it is inherently impossible to prove or disprove tortious causation by the defendant in the specific instance,

7. For discussion of situations involving bilateral and multilateral contributors, including multiple defendants as well as the plaintiff, with or without perfect information regarding the levels of care, see Richard W. Wright, *Allocating Liability Among Multiple Responsible Causes: A Principled Defense of Joint and Several Liability for Actual Harm and Risk Exposure*, 21 U.C. DAVIS L. REV. 1141, 1169–79 (1988).

8. See *id.*; John Prather Brown, *Toward an Economic Theory of Liability*, 2 J. LEGAL STUD. 323 (1973); Richard W. Wright, *The New Old Efficiency Theories of Causation and Liability*, 7 J. TORT L. 65, 90–95 (2015); Wright & Puppe, *supra* note 4, at 500–01.

courts in some circumstances have adopted second-best liability rules, including presumptions or inferences of causation and full or proportionate liability based on a mere statistical probability (greater or less than 50 percent) of causation, while sometimes erroneously claiming that specific causation has thereby actually been proven.<sup>9</sup>

In his article,<sup>10</sup> Jean-Sébastien Borghetti focuses on a particular legal controversy in France that raises both issues, but especially the general causation issue. He observes that, although scientific studies have so far failed to establish (and indeed tend to disprove) that vaccination against hepatitis B can cause demyelinating diseases such as multiple sclerosis or the Guillain-Barré syndrome, and despite the fact that these adverse conditions possibly can be caused by multiple other conditions, many cases have been brought in France by those suffering these adverse conditions after hepatitis B vaccination, against either the French government (due to compulsory vaccination programs) and/or the manufacturers of the hepatitis B vaccine. The Cour de Cassation, which has jurisdiction over claims against private parties, initially denied compensation due to lack of proof of general causation, while the Conseil d'État, which has jurisdiction over claims against the government, ruled that causation is established if the demyelinating disease occurred within three months after the vaccination and no other cause could be identified. Subsequently, the Cour de Cassation decided to allow a presumption of causation on a case-to-case basis, considering all the facts in the specific case, including the timing of the onset of the disease, the absence of neurological history in the victim's family, the lack of any other identified possible cause, and the intimate belief of the plaintiff's doctor that the vaccination was the cause.

Borghetti acknowledges that a finding of specific causation may be proper when all other possible causes of the injury have been eliminated and there is some plausible scientific hypothesis about how the condition at issue could cause the injury. However, he notes, these conditions cannot be established in the hepatitis B vaccination cases. He sharply criticizes the Conseil d'État's ruling that causation is established if the onset of the injury or illness occurred within three months when no scientific or other rationale was given or currently exists for specification of that time period or any other time period.<sup>11</sup> He criticizes both courts for allowing a finding of

9. See Wright & Puppe, *supra* note 4, at 489–94.

10. Jean-Sébastien Borghetti, *Causation in Hepatitis B Vaccination Litigation in France: Breaking Through Scientific Uncertainty?*, 91 CHI.-KENT L. REV. 543 (2016) (this issue).

11. Cf. item VIII in the Vaccine Injury Table promulgated under the authority of section 312(b) of the National Childhood Vaccine Injury Act of 1986, 42 U.S.C. § 300aa–1, and section 2114(c) of the Public Health Service Act, 42 U.S.C. § 300aa–14(c),

causation in the absence of any scientific basis for such a finding. He calls for more attention to be paid by French courts and lawyers to distinguishing and clarifying causal concepts, including the distinction between general causation and specific causation, while noting that the failure of the courts to do so or to provide any rationale for their decisions enables the courts to change the law at will for policy reasons without explicit acknowledgment that they are doing so. As a consequence, while it is often claimed that civil law courts merely deductively apply their country's legal codes, the French courts are at least as active as any common law court, and likely more so, in making major changes in the law, sometimes contrary to explicit language in the codes, but, unlike the common law courts, without any explanation or justification.

In her article,<sup>12</sup> Lynda Collins argues that courts should be active and creative in relaxing the causation requirement for liability in toxic tort cases and other cases in which there is often inherent uncertainty regarding causation. She notes that scientific uncertainty regarding general and especially specific causation has frequently precluded recovery for plaintiffs even where defendants have negligently exposed them to toxic risk. She identifies three major types of uncertainty: plaintiff indeterminacy (where we know that the defendant has tortiously harmed some proportion of a particular population but no individual can prove causation); defendant indeterminacy (where we know that one or more of a group of defendants has tortiously harmed a particular plaintiff or plaintiffs but it is impossible to identify which specific ones caused the harm); and indeterminacy of harm (where plaintiffs have been tortiously exposed to a risk that may or not have actually caused the harm).

Collins observes that, in Canada and most other countries, there is no recovery for mere tortious risk exposure unless it is proven to have caused measurable psychiatric or economic harm. The problem of plaintiff indeterminacy also remains unsolved, with a resulting under-deterrence of toxic harms and under-compensation of injured plaintiffs. The Supreme Court of Canada has, however, responded to the problem of defendant indeterminacy. Claiming that causation exists only if the strong necessity (*sine qua non*, but for) criterion is satisfied, the Court, in *Clements v. Clements*,<sup>13</sup>

<http://www.hrsa.gov/vaccinecompensation/vaccineinjurytable.pdf>, which sets forth the required time of onset of specified adverse consequences following administration of various vaccines for there to be presumed causation of and liability for the adverse consequence. The only listed adverse consequence for the Hepatitis B vaccine is "Anaphylaxis or anaphylactic shock" within four hours.

12. Lynda Collins, *Material Contribution to Risk in the Canadian Law of Toxic Torts*, 91 CHL-KENT L. REV. 567 (2016) (this issue).

13. *Clements v. Clements*, [2012] S.C.R. 181.

adopted, on explicit policy grounds, a uniquely Canadian test for material contribution to risk as a replacement for proof of causation. However, the test apparently only applies in alternative causation cases, in which it is not known which of several defendants caused the plaintiff's injury. In overdetermined causation cases, including *Clements*, in which it is known (using the weak necessity/strong sufficiency covering law criterion) which defendants caused the plaintiff's injury, the Court claims to employ the strong necessity criterion in a "robust" and "common sense" manner in order to find causation.<sup>14</sup> Collins argues for expanded application of *Clements*'s "material contribution to risk" test to more types of situations, as well as expanded application of the battery action for exposure to toxic substances and reversing the burden of proof on causation upon proof of inadequate testing of a toxic substance.

In his article,<sup>15</sup> Ken Oliphant reviews the range of judicial techniques that have been developed in common and civil law systems to address the issue of appropriate liability in situations involving inherent uncertainty regarding causation when there are alternative, rather than duplicative or cumulative, tortious causes. He notes that the development of these judicial techniques in each legal system has generally proceeded in an ad hoc and unprincipled fashion, without regard for overall coherence. He argues for a more principled approach in which the appropriate legal response (full liability, proportional liability or no liability) is adopted on the basis of a ranking of the different categories of cases in which the problem of inherent causal uncertainty arises, based on the strength (or weakness) of the arguments in favor of the imposition of at least some liability.

Oliphant explains that the argument for liability of the defendant is stronger if it is certain that the defendant tortiously caused damage to someone, even if it is uncertain whether that someone was the claimant, while being weaker but still significant if the defendant tortiously risked causation of damage but it is uncertain if this risk, rather than some independent risk, eventuated in damage to someone. Conversely, the argument for recovery by the claimant is stronger if it is certain that she suffered tortiously caused damage, even if it is uncertain by whom it was caused, while being weaker but still significant if she was tortiously put at risk of suffering damage, but it is uncertain whether her damage eventuated from a tortiously created risk. The argument for liability is weakest where both tortious creation of the relevant risk and causation by a tortiously created

14. *Id.* at 187–89, 192–96.

15. Ken Oliphant, *Causation in Cases of Evidential Uncertainty: Judicial Techniques and Fundamental Issues*, 91 CHI.-KENT L. REV. 587 (2016) (this issue).

risk are uncertain. He applies these weighting factors to the various categories of inherently uncertain causation situations, with full liability being more appropriate when both the arguments for liability of the defendant and recovery by the plaintiff are strongest, no liability being more appropriate when both arguments are weakest, and proportionate liability being more appropriate when one of the arguments is strong but the other is weak.

### III. APPORTIONMENT OF LIABILITY AMONG MULTIPLE RESPONSIBLE CAUSES

When there are multiple legally responsible causes of a specific injury, the issue arises as to how to apportion the liability among the multiple responsible causes, which may include a negligent plaintiff as well as one or more defendants. Under a “joint and several” (or “solidary”) liability rule, which is the general rule in almost all legal systems, the plaintiff can recover the entirety of her damages, after proportionate reduction based on her percentage of comparative responsibility if she was contributorily negligent, from any one of the legally responsible defendants (tortfeasors). Any tortfeasor who pays the plaintiff can seek contribution from the other tortfeasors based on their respective percentages of comparative responsibility for any payment to the plaintiff in excess of the paying tortfeasor’s percentage of comparative responsibility. Under a “several” or “proportionate several liability” rule, which exists in many states in the United States for varying parts of the plaintiff’s damages due to so-called “tort reform,” the plaintiff may only recover from each tortfeasor a portion of her damages equal to that tortfeasor’s percentage of comparative responsibility. Comparative responsibility is usually based on comparative fault, although it may also take into account relative causal contribution if that is measurable.<sup>16</sup>

In his article,<sup>17</sup> Michael Faure reiterates the usual rules for apportionment of liability (discussed in the prior paragraph) when there are known to be multiple responsible causes of a specific injury, as well as the common (but not universal, especially when there are very many potential tortious causes) imposition of joint and several (solidary) liability in alternative causation situations, in which it is not known which of several defendants who might have tortiously caused the injury actually caused all or part of it.

16. See Wright, *supra* note 7, at 1141–46.

17. Michael Faure, *Attribution of Liability: An Economic Analysis of Various Cases*, 91 CHI-KENT L. REV. 603 (2016) (this issue).

He also discusses the suggestion by the European Group on Tort Law (a group of prominent tort law professors) that liability should only be proportionately several in alternative causation cases.

Faure then focuses on the economic analysis of various apportionment rules from the perspective of efficient deterrence. Surveying the efficiency literature, he states that, for efficient deterrence when each tortfeasor is fully solvent, it is necessary that each tortfeasor either initially or ultimately be held liable only for a portion of the injury to which he contributed that is equal to his percentage of comparative responsibility, regardless of whether or not there is imperfect information regarding expected or actual causation. When there is insolvency, he argues that holding a tortfeasor liable for a share of the damages that exceeds the tortfeasor's percentage of comparative responsibility would result in the tortfeasor's being liable for damages that he did not cause and would be inefficient.<sup>18</sup>

Faure discusses the history and incentive effects of the "channeling" (restriction) of liability to only one of several tortious causes of an injury, as occurs under some international conventions with respect to nuclear liability and marine pollution. He demonstrates that such channeling is inefficient unless the targeted person or entity can control the actions of and/or obtain reimbursement from the other actual or potential tortfeasors. Finally, Faure discusses vicarious liability, whereby one entity is held strictly liable for harm tortiously caused by another, for example, an employer for the harm negligently caused by his employee within the scope of the employment and, in many civil law systems, parents for the harm negligently caused by their children. Such vicarious liability will be efficient only if the entity held vicariously liable can control the actions of and/or obtain reimbursement from the actual tortfeasor.

In their article,<sup>19</sup> Samuel Ferey and Pierre Dehez diverge from the economists' usual focus on *ex ante* efficient deterrence and instead employ cooperative game theory to evaluate *ex post* the relative causal role of multiple tortfeasors in overdetermined causation situations, for the purpose of apportioning liability among the multiple tortfeasors. Recognizing the failure of the strong necessity (*sine qua non*, but for) criterion in such situations, they provide a typology of overdetermined causation situations that vary depending on whether the various tortious conditions were or were not (in some sense) necessary and/or sufficient conditions. Translating the usual causal terminology into the language of game theory and employing the

18. *But see supra* note 8 and accompanying text.

19. Samuel Ferey & Pierre Dehez, *Overdetermined Causation Cases, Contribution and the Shapley Value*, 91 CHI.-KENT L. REV. 637 (2016) (this issue).

covering law theory's conception of causes as consisting of minimally sufficient sets of conditions, they treat each tortfeasor as a "player" in the "overdetermined causation game."

Ferey and Dehez evaluate each tortfeasor's contribution to the "grand coalition" consisting of all tortious contributors and each possible subset ("coalition") of tortfeasors. The marginal contribution of a tortfeasor to a specific coalition is evaluated by asking whether the result would have been different, and if so to what extent, without that tortfeasor's presence in the coalition, while also counterfactually assuming the non-existence of any tortfeasors excluded from the specific coalition but assuming the continued existence of all non-tortious conditions. The marginal contribution of each tortfeasor to each possible coalition is weighted according to the relative size of the coalition and taken into account in calculating the relative contribution of each tortfeasor to the actual legal injury, using a formula that produces what is known as the "Shapley value."

By taking into account each tortfeasor's marginal contribution to all possible coalitions, rather than only the grand coalition, this approach, unlike the strong necessity (*sine qua non*, but for) criterion but like the weak necessity/strong sufficiency (NESS) criterion, is able to acknowledge causal contribution in many overdetermined causation cases involving duplicative (rather than preemptive) causation and, moreover, to go beyond the NESS criterion by providing a measure of relative causal contribution for the purpose of apportioning liability among multiple tortfeasors. It could easily be extended to include a contributorily negligent plaintiff as one of the players in the game.

In the final article in this symposium,<sup>20</sup> Julien Jacob and Bruno Lovat propose an innovative approach to apportioning liability between an operator of some hazardous activity and the provider of technology employed by the operator, in order to provide optimal incentives for risk control by each, when neither the operator nor the technology provider ("innovator") by itself has sufficient wealth to pay expected damages should harm occur but both together have sufficient wealth to do so. Under the traditional apportionment rules, "joint and several" ("solidary") liability and "(proportionate) several" liability (which they call "non-joint" liability), liability is apportioned after the harm occurs based on an *ex post* assessment of the comparative fault and (perhaps) relative causal contribution of each party in the specific situation. Jacob and Lovat propose, instead, the calculation

20. Julien Jacob & Bruno Lovat, *Economic Analysis of Liability Apportionment Among Multiple Tortfeasors: A Survey, and Perspectives in Large-Scale Risks Management*, 91 CHI.-KENT L. REV. 669 (2016) (this issue).

and promulgation, before any harm occurs and even before any interaction between or activity by the operator and the innovator, of a fixed portion of the damages to be allocated to each party should harm occur as a result of their subsequent interaction. The fixed share would be calculated using a formula that they develop which would take into account, among other factors, the available wealth of each party, the degree of competition in the market for the technology provided by the innovator, the respective costs of taking care or increasing successful innovation, and the effect on the probability of harm (but not its magnitude, which is assumed to be fixed) of their respective levels of care or degree of innovation. The prospective parties would then use this information to decide whether to interact and what level of care or degree of innovation to employ should they interact.