Negligence, Causation and Information

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This note suggests a model to unify, in a simple information-based framework, the notion of negligence and the various notions of causation. In effect, the model demonstrates that negligence, probabilistic cause and cause-in-fact represent an identical concept applied to different information sets. This note uses the unified framework to develop a simple algorithm for the practical application of the principles of causation in the law of negligence.

Ce commentaire présente un modèle qui unifie la notion de négligence et les diverses notions de causalité, dans un cadre simple fondé sur l'information. En fait, ce modèle démontre que la négligence, la *probabilistic cause* et la *cause-in-fact* représentent un concept identique appliqué à de différents ensembles d'information. Ce commentaire emploie un cadre unifié en vue de développer un algorithme simple devant servir l'application pratique des principes de causalité dans l'étude du *tort* de *negligence.*

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I. Background

To establish liability in negligence, it is not sufficient merely to show that the defendant is negligent. It is also necessary to show that the negligent action was somehow closely connected to the damage suffered by the plaintiff. The courts apply a number of doctrines to determine whether there is a sufficient connection. The court may decide that although the action of the defendant was negligent, it did not "cause" the accident or it was not "proximate to" the accident.

> *Example 1.* A driver using due care runs over the plaintiff's dog which ran unexpectedly into the street.
>
> *Example 2.* A bus driver who is carelessly travelling at excessive speed arrives at a location just in time for the bus to be hit by an unseen falling rock from an adjacent cliff. The plaintiff, a passenger, sues.
>
> *Example 3.* A fire negligently set by the defendant, who was carelessly playing with gasoline, merges with a fire of natural origin and destroys the plaintiff's house.

In the first case, the defendant escapes liability because he exercised due care, that is, he was not *negligent*. In the second case, the defendant escapes liability owing to lack of *probabilistic cause*. In the third case, the defendant escapes liability owing to lack of *cause-in-fact*, also called direct causation or but-for causation.[1]

Thus, there are three theories that explain the outcomes of these three cases. It would be desirable if all three could be unified within a single framework. A major obstacle to unifying the doctrines of negligence and causation has been the following fact: a model of causation must explain cases in which a defendant who has exercised a socially non-optimal level of care can still escape liability owing to lack of causation.

It would appear that negligence must be something quite different from causation because negligence depends on optimal care and causation does not. If we look at these concepts in terms of information, we see that negligence, probabilistic cause, and cause-in-fact represent an identical concept

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[1]The notions of probabilistic cause and cause-in-fact used here are those defined by S. Shavell, "An Analysis of Causation and the Scope of Liability in the Law of Torts" (1980) 9 J. Legal Stud. 463 at 468:

> One action is a *probabilistic cause* of a consequence relative to another action if the probability of occurrence of the consequence is higher given the first action than given the second.

Ibid. at 467:

> One action is a *cause-in-fact* of a consequence relative to another action if, given the state of world, the consequence would have been different had the second action been taken.

applied to different information sets. Thus, a simple unified theory is possible. This theory yields a simple practical algorithm for the solution of problems of causation.

II. The Algorithm and Its Application

An example of a problematic case is that of *Weeks* v. *McNulty*.[2] The defendant, Frank McNulty, was the owner of the Hotel Knox which was destroyed by fire in 1897. Arthur E. Weeks, who was a guest in the hotel at the time, was killed in the fire. His wife sued to recover damages for the death of her husband, alleging that the defendant was negligent in failing to provide fire escapes as required by local ordinance. The evidence, however, indicated that Arthur Weeks never went to the window to look for a fire escape: "It is not shown that deceased was at a window, or in any position where a fire escape would have afforded him any benefit whatever."[3] Thus, the court held that the question of negligence was irrelevant since "no causal connection between the violation of the ordinance and the injuries sustained by the plaintiff"[4] had been shown.

The analysis of the issues involved in this case, and in the hypothetical cases cited earlier, begins with an algorithm for negligence and causation. This algorithm is presented below, followed by its application to *Weeks*. The algorithm and the underlying model are explained in Part IV.

Algorithm for Negligence and Causation

1. The court should determine:

a. *ex ante* information. This is information known at the time defendant chose c, the action. This information is represented by S.

b. *accident type.* This information includes knowledge that the accident, if it occurs, will be of a certain type. This information is represented by T.

c. *ex post* information. This is all the information known at the time of trial. This information is represented by V.

2. The court should determine:

a. the socially optimal action to be taken by the potential injurer given what was known to him at the time the action was chosen (S). The socially optimal action is represented by c*. Note that c* depends only on S.

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[2]101 Tenn. 495, 48 S.W. 809 (S.C. 1898) [hereinafter *Weeks* cited to S.W.].

[3]*Weeks*, *ibid.* at 812. If he had looked out the window, he would have seen it was possible to leap to an adjoining building. Since he did not do this, the court concluded that he never looked for an escape out the window.

[4]*Ibid.*

b. the actual action chosen. This action is represented by c.

3. The court should determine:

a. given S (*ex ante* information), whether the expected loss of c is greater than that of c*. If it is, then there is *negligence, i.e.*, $EL^{vic}(c,S) > EL^{vic}(c^*,S)$

b. given T (accident type), whether the expected loss of c is greater than that of c*. If it is, then there is *probabilistic cause, i.e.*, $EL^{vic}(c,T) > EL^{vic}(c^*,T)$

c. given V (*ex post* information), whether the expected loss of c is greater than that of c*. If it is, then there is *cause-in-fact, i.e.*, $EL^{vic}(c,V) > EL^{vic}(c^*,V)$

4. Liability results if, given S, T, V, and c* = f(S) and action c,

$$EL^{vic}(c,S) > EL^{vic}(c^*,S)$$
$$EL^{vic}(c,T) > EL^{vic}(c^*,T)$$
$$\text{and } EL^{vic}(c,V) > EL^{vic}(c^*,V)$$

Application of the Algorithm to Weeks *v.* McNulty

1. Determine the information sets:

a. S = building capable of burning

b. T = fire

c. V = decedent never looked for a fire escape

2. Given S, determine:

a. c* = install fire escapes

b. c = do not install fire escapes

3. Compare expected loss of c with that of c*:

a. given S, expected loss greater with c — thus negligence

b. given T, expected loss greater with c — thus probabilistic cause

c. given V, expected loss *not* greater with c — thus no cause-in-fact.

4. No liability for defendant.

III. The Model Explained

A. Definitions and Assumptions

In general, there are many accidents that can occur and many persons who can affect the probability and the severity of injury. For expositional ease I use the case of one potential injurer and a potential victim who is passive, that is, a potential victim who can affect neither the probability of occurrence nor the severity of the accident. All of the basic ideas can be presented using this simple framework. (The extension to multiple potential injurers and to nonpassive victims is straightforward and does not affect the basic results.)

The injurer chooses an action, c, from a set of possible actions. If we were omniscient, we could observe the state of the world in complete detail at the time the action was chosen. Given this perfect information, we could determine whether the ensuing chain of events would lead to an accident and, if so, we could determine the extent of injury.

In the real world, there is uncertainty. The amount of uncertainty depends on the amount and the type of information that we have at a given time. The algorithm categorizes information as *ex ante* (S), *ex post* (V), and as information as to accident type (T).

Even if we do not have perfect information we can estimate expected loss by assigning probabilities to outcomes based on the information that we have.[5] Given the available information (I) and the action chosen by the potential injurer (c), the expected loss to the potential victim is represented by

$$EL^{vic(c,I)}$$

where I is replaced by S, T, or V depending on the information assumed. For example, $EL^{vic}(c,S)$ represents the expected loss to victims of action c given what is known when action c is taken. In *Weeks*, it is the expected injury to potential victims from all types of possible accidents given that no fire escapes were installed.[6] $EL^{vic}(c,T)$ is the expected loss from a given type of accident. In *Weeks*, it is the expected loss owing to fire. We pretend that we are at the point of choosing the action (in this case, the choice of whether to install fire escapes) and ask how this choice affects the likelihood

[5] I will call a loss an "expected loss" even if it is certain. More rigorous set-theoretic definitions of information and expected loss are given in the Appendix for the interested reader. The above definitions, however, capture the essence.

[6] An action also imposes a cost on the potential injurer, sometimes called the "cost of care". This can be represented by $EL^{inj}(c,S)$.

and severity of injury if a fire should occur. $EL^{vic}(c,V)$ is the loss we would expect when choosing an action given that we know everything that is known at the time of trial, such as whether the decedent looked for a fire escape.

The socially optimal action in the circumstances depends only on S, the information known at the time the action was taken. It is called c* and can be represented as a function of S ($c^* = f(S)$).[7]

B. Negligence

A system of negligence liability is one that incorporates the doctrine of negligence as defined below. Recall that at the time of trial S, T and V are known, but at the time the defendant chose the action only S was known.

> *Doctrine of Negligence.* The defendant is liable for damages by reason of action c, given S, T, and V, and $c^* = f(S)$ only if
>
> $$EL^{vic}(c,S) > EL^{vic}(c^*,S).$$

First we find the optimal action, c*, given what the defendant knew at the time of choosing the action. Then we compare c and c* assuming that we know only what was known at the time the action was chosen. If, given this information, the choice of c inflicts on the rest of society a greater expected loss than c*, then the defendant is deemed negligent.

Of course, in tort law, liability will not be assigned on the basis of negligence alone. There must be negligence, harm and a causal connection between the two. Without this causal connection, the defendant will escape liability. The reasons for limiting the scope of liability are twofold: one, to make the system conform to our notions of fairness, and two, to lower the amount of damages paid and the resultant transaction cost losses.[8] Both these goals are accomplished without the loss of behavioural efficiency through the application of the doctrines of causation: cause-in-fact and probabilistic cause.

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[7]The expected cost to society given the information known at the time of the action, S, and given the action, c, is $EL^{vic}(c,S) + EL^{inj}(c,S)$.
We want people to choose the action that minimizes social costs. We call this action c*. A tort system is said to be behaviourally efficient if it induces potential injurers to adopt c*.

[8]As Shavell has stated, *supra*, note 1 at 465, "restricting the scope of liability results in a decline in the administrative costs connected with the use or threatened use of the legal system". More important, however, is the notion that it is unfair to make a negligent defendant pay for injuries that are unrelated to the defendant's action. Without some requirement of a connection, the negligence of a defendant would leave him or her potentially liable for any and all accidents, related or not.

C. Cause-in-Fact

Recall again that at the time of trial S, T, and V are all known, but at the time the defendant chose the action only S was known. The doctrine of cause-in-fact incorporates all information known at the time of trial.

> *Cause-in-Fact.* The defendant is liable for damages by reason of action c, given S, T, and V, and $c^* = f(S)$, only if
>
> $$EL^{vic}(c,V) > EL^{vic}(c^*,V).$$

First we find the optimal action, c*, given what the defendant knew at the time of choosing the action. Then we compare c and c* assuming that we know everything that we know at the time of trial. If, given this information, the choice of c inflicts on the rest of society a greater expected loss than c*, then there is direct causation. An example of a negligent defendant escaping liability for lack of cause-in-fact is the case where a fire negligently set by the defendant merges with a fire of natural origin and destroys the plaintiff's house. Assume that the defendant was *playing with gasoline.* The optimal action, given what was known at the time of the action, was *not playing with gasoline.* Given what is known at the time of action, playing with gasoline inflicts higher expected losses on others than not playing with gasoline and thus, it is negligent. Given what is known at the time of trial, however, playing with gasoline results in the same loss as not playing with gasoline so the defendant escapes liability even though he adopted a sub-optimal level of care.

The same can be said about *Weeks.* Given what is known at the time the defendant became the owner of the hotel, it is clear that fire escapes should have been installed. Not installing fire escapes is negligent. Given what is known at the time of trial, however, it is clear that even with fire escapes the loss to the plaintiff would have been the same. Thus, the defendant escapes liability.

D. Probabilistic Cause

The doctrine of probabilistic cause depends on an intermediate amount of information, more than that available *ex ante,* but less than that available *ex post.* Recall again that S, T, and V are known at the time of trial, but only S was known at the time the action was chosen.

Probabilistic Cause. A defendant is liable for damages by reason of action c, given S, T, and V and $c^* = f(S)$ only if

$$EL^{vic}(c,T) > EL^{vic}(c^*,T).$$

First we find the optimal action, c*, given what the defendant knew at the time of choosing the action. Then we compare c and c* assuming that we know that the accident will be of type T. If, given this information, the choice of c inflicts a greater expected loss than c*, there is probabilistic cause.

An example in which a negligent defendant escapes liability owing to lack of probabilistic cause, is the case of a bus driver who, negligently travelling at high speed, arrives at a location just in time for the bus to be hit by a falling rock, injuring the plaintiff. Given what is known at the time of choosing the action, the optimal action is *not to speed* as speeding inflicts higher expected losses on others than not speeding. Thus, it is negligent. Given what is known at the time of trial, not speeding would have avoided the loss. Thus, there is cause-in-fact. However, given this type of accident (rocks falling) and the information known at the time of the choice of action, it is clear that speeding and not speeding produce the same expected loss. (In fact, the probability of being hit by a rock may even be *lower* if one is speeding.) Therefore, we conclude that there is no probabilistic cause.

E. An Equivalence Theorem

In order to contrast these doctrines, I will state them again.

Equivalence Theorem. A defendant is liable for damages by reason of action c, given S, T, and V, and $c^* = f(S)$, only if

$$EL^{vic}(c,S) > EL^{vic}(c^*,T) \quad \text{(negligence)}$$
$$EL^{vic}(c,T) > EL^{vic}(c^*,T) \quad \text{(probabilistic cause)}$$
$$\text{and } EL^{vic}(c,V) > EL^{vic}(c^*,V) \quad \text{(cause-in-fact).}$$

This is the central result of this paper. It can be restated as follows:

Equivalence Theorem: Negligence, probabilistic cause and cause-in-fact are the same expected loss concept applied to different information sets.

Finally, a few technical comments are in order. First, the known theorems on efficiency remain intact. In a negligence system, negligent defendants can be excused from liability for lack of probabilistic cause or for lack of cause-in-fact *without* impairing behavioural efficiency. The proof of this becomes trivial using this information framework.[9] Another less known result is that the doctrine of unusual, unrelated, or unforeseeable accidents

[9] The proof is in the Appendix which is provided to demonstrate how easily theoretical problems are resolved within an information-based framework.

(also known as the foreseeability doctrine) is not a causation concept at all but is nevertheless behaviourally efficient if correctly applied in a negligence system.[10] Lastly, the introduction of multiple potential injurers can lead to game behaviour with inefficient equilibria. This problem, which is the result of embedding causation in a negligence system, is resolved by the doctrine of joint liability.[11]

III. Examples

The algorithm involves three steps. First, determine the information sets. Second, determine the optimal action given what the defendant knew (or should have known) at the time the action was taken while also noting the action the defendant did in fact take. Third, compare the optimal action with the actual action given the three information sets to determine the effect on the expected loss of the plaintiff.

Example 1: Berry *v.* Sugar Notch Borough[12]

The plaintiff, Bryan C. Berry, was a motorman who operated a trolley car on a line running through the borough of Sugar Notch. The plaintiff was operating the trolley at excessive speed during a windstorm. While passing under a large chestnut tree, the tree was blown down crushing the trolley car and injuring the plaintiff. The condition of the tree before the accident was questionable and the borough was found negligent in not having removed it. The borough, however, sought to bar recovery based on contributory negligence, arguing that if the plaintiff had not been speeding, then the trolley car would not have been at the precise place where the tree fell at the precise time that it fell. The court must rule on the issue of contributory negligence.

1. Determine the information sets:

a. S = speeding can be dangerous

b. T = random unseen object strikes trolley

c. V = tree fell at point x, time t

2. Given S, determine

a. $c^* = 70$ km/h or less

b. $c = 110$ km/h

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[10] This is also shown in the Appendix.

[11] A discussion of this is beyond the scope of this note. However, its solution is straightforward.

[12] 191 Pa 345, 43 A. 240 (S.C. 1899).

3. Compare expected losses of c and c*:

a. given S, expected loss greater with c; thus *negligence*

b. given T, expected loss *not* greater with c; thus *no probabilistic cause*

c. given V, expected loss greater than c; thus *cause-in-fact.*

Verdict: Plaintiff Not Barred (Lack of Probabilistic Cause)

Note: The court finds direct causation since if the plaintiff were not speeding he would not have been at point x, at time t.

Example 2: **New York Central Railroad Co. *v.* Grimstad**[13]

Angell Grimstad fell off a barge into the water. He could not swim. His wife, Elfrieda Grimstad, ran immediately to the cabin to fetch a small line. The barge was not equipped with life buoys. When she returned, Mr Grimstad had disappeared. The jury found that the New York Central Railroad Company had been negligent in not equipping the barge with life-preservers. Yet the court reversed the decision on appeal, speculating that the time necessary to fetch and use a life-preserver is probably the same as with a small line, and that Mr Grimstad would have drowned anyway.

1. Determine the information sets:

a. S = people fall overboard and drown

b. T = drowning

c. V = decedent disappeared quickly

2. Given S, determine:

a. c* = have life-preservers

b. c = no life-preservers

3. Compare expected losses:

a. given S, expected loss greater with c; thus *negligence*

b. given T, expected loss greater with c; thus *probabilistic cause*

c. given V, expected loss *not* greater with c; thus *no cause-in-fact.*

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[13]264 F. 334 (2d Cir. C.A. 1920).

Verdict: Not Liable (Lack of Cause-in-Fact)

Example 3: **Kirincich *v.* Standard Dredging Co.**[14]

Stefan Kirincich was a deck-hand on a derrick barge owned by the Standard Dredging Company. Kirincich fell into the water and cried for help. The other dock-hands repeatedly tossed small lines but failed to toss anything more buoyant. Stefan Kirincich finally drowned. His brother sued.

1. Determine the information sets:

a. S = people fall overboard and drown

b. T = drowning

c. V = decedent could not find the lines thrown to him

2. Given S, determine:

a. c* = throw large buoyant object

b. c = throw thin non-buoyant rope

3. Compare expected loss of c and c* :

a. given S, expected loss greater with c; thus *negligence*

b. given T, expected loss greater with c; thus *probabilistic cause*

c. given V, expected loss greater with c; thus *cause-in-fact.*

Verdict: Liable[15]

V. Conclusion

This note makes two points. First, it demonstrates that the notions of negligence, probabilistic cause, and cause-in-fact can be integrated into a simple, unified framework based on information. Indeed, the model demonstrates that negligence, probabilistic cause, and cause-in-fact represent an identical concept applied to different information sets. The second point is that this framework can be used to develop a simple and practical algorithm for applying these doctrines to actual case experience.

[14]112 F.2d 163 (3d Cir. C.A. 1940).

[15]Other cases to which the algorithm can be applied include *City of Piqua* v. *Morris*, 98 Ohio St. 42, 120 N.E. 300 (S.C. 1918) and *Ferroggiaro* v. *Bowline*, 153 Cal. App. 2d 759, 315 P.2d 446 (Dist. C.A. 1957).

Appendix

Formal Notation

The following discussion formalizes some of the concepts in the body of the note. All optimization is assumed to be in terms of expected value. The injurer chooses an action, or level of care, from a set of actions. There is also a set of random states of nature. A state of nature and an action define the world in complete detail. Let

C = set of actions (or levels of care) for the potential injurer
c = a member of set A (an action or level of *care*)
$\mathcal{S}$ = set of random states of nature
s = a random state

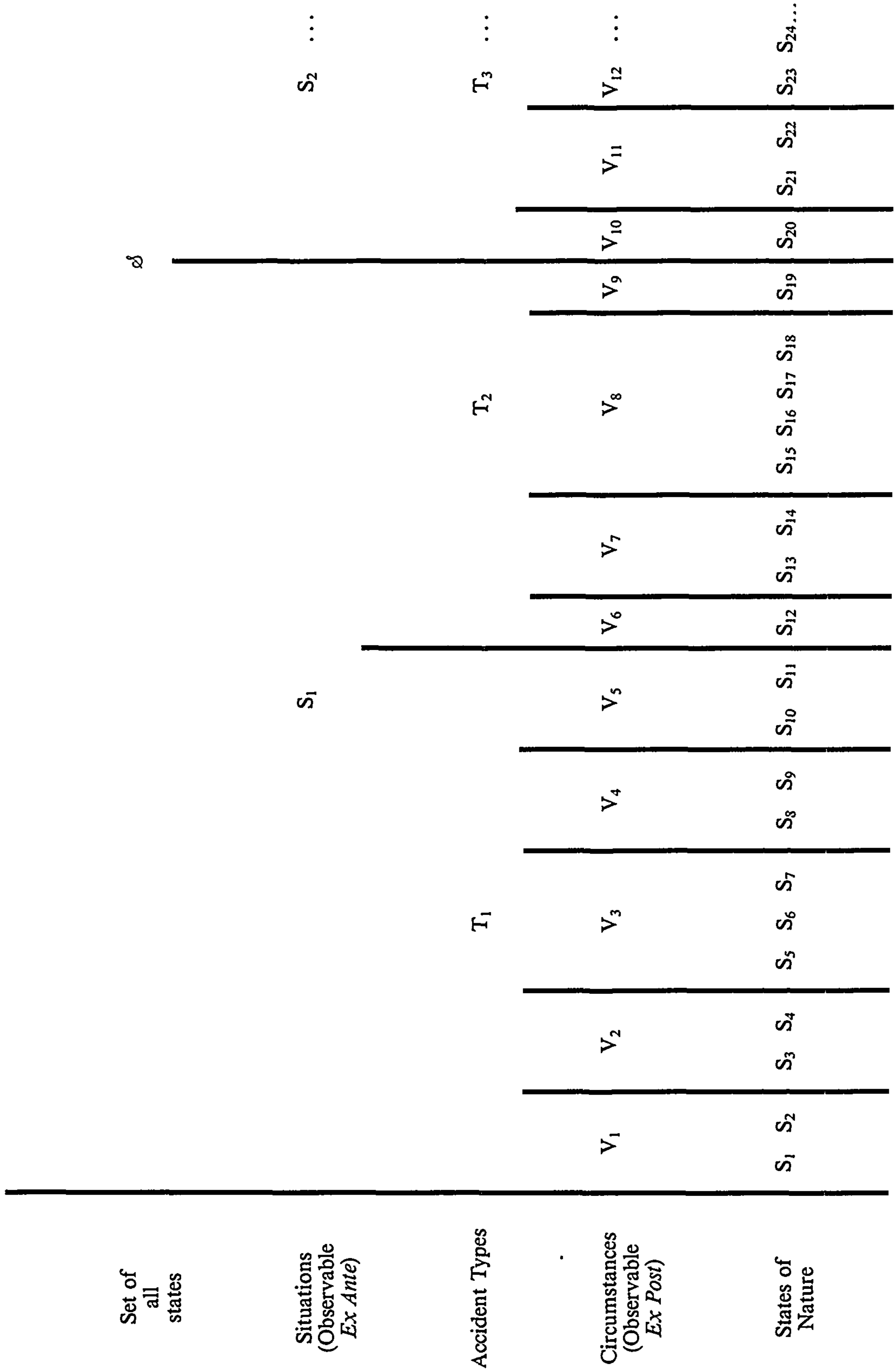
The essence of the analysis is the creation of various partitions of the set $\mathcal{S}$ ranging from coarse to fine (see diagram). The coarsest partition is the partition of $\mathcal{S}$ into subsets that represent the amount of information known at the time of the defendant's action. These are called "*ex ante* information sets" and are represented by S_i. For example, if the *ex ante* information set is S_1, then the defendant knew at the time of his or her action that the true state of nature was one of those in S_1. The S_i are further partitioned into accident types. At the time of trial we know what type of accident occurred. There are many possible classification schemes. An accident type is represented by T_i. Each type is again partitioned into sets that represent the amount of information known at trial. After the accident, it is possible to know not only the accident type, but also many of the circumstances that surround the accident. Thus, we partition each accident type into sets called "*ex post* information sets". These are represented by V_i. This is the finest partition observable *ex post.*

The state of nature along with the action of the potential injurer describes the world in complete detail, so that given these it is possible to determine whether an accident occurs, the amount of the loss and upon whom it falls. In particular, we can divide the loss between that which falls on the potential injurer and that which falls on the rest of society (victims). These are represented respectively below:

$L^{inj}(c,s)$ (falls on potential injurer)
$L^{vic}(c,s)$ (falls on potential victim)

Note that L^{inj} includes the cost of care.

To each state of the world is attached a probability: $p(s)$.


Set of all states
$\mathcal{S}$
Situations (Observable *Ex Ante*)
S_1
S_2 . . .
Accident Types
T_1
T_2
T_3 . . .
Circumstances (Observable *Ex Post*)
V_1 V_2 V_3 V_4 V_5 V_6 V_7 V_8 V_9 V_{10} V_{11} V_{12} . . .
States of Nature
S_1 S_2 S_3 S_4 S_5 S_6 S_7 S_8 S_9 S_{10} S_{11} S_{12} S_{13} S_{14} S_{15} S_{16} S_{17} S_{18} S_{19} S_{20} S_{21} S_{22} S_{23} S_{24} . . .

If we knew that the true state of nature were in some subset I of $\mathcal{S}$ then we could define $P_I(s)$ as the probability of occurrence of s given I. It can be written:

$$p_I(s) = \frac{p(s)}{\sum_{S \in I} p(s).}$$

Thus, if we knew that the true state of nature were in some subset I, we could write the expected losses given action c as:

$$EL^{inj}(c,I) = \sum_{S_j \in I} p_I(s_j)L^{inj}(c,s_j)$$

$$EL^{vic}(c,I) = \sum_{S_j \in I} p_I(s_j)L^{vic}(c,s_j).$$

We multiply each possible loss with its probability to get expected loss. These are the formal definitions of the concepts used in the paper.

Efficiency

To show that we can remove a subset of accidents from the scope of liability, if the expected harm of that subset is not affected by the defendant's action, is straightforward. For example, divide the set S into two subsets, T_1 and T_2, and note $EL^{vic}(c,S) = EL^{vic}(c,T_1) + EL^{vic}(c,T_2)$ and assume

$$EL^{vic}(c,T_1) > EL^{vic}(c^*,T_1)$$

$$EL^{vic}(c,T_2) \leq EL^{vic}(c^*,T_2).$$

We excuse liability for type T_2 accidents even if the defendant did not use the optimal level of care, c*. Now note from the definition of c* that

$$EL^{vic}(c,S) + EL^{inj}(c,S) > EL^{vic}(c^*,S) + EL^{vic}(c^*,S).$$

Subtracting $EL^{vic}(c,T_2)$ from the left-hand side and subtracting $EL^{vic}(c^*,T_2)$ from the right-hand side yields

$$EL^{vic}(c,T_1) + EL^{inj}(c,S) > EL^{vic}(c^*,T_1) + EL^{inj}(c^*,S)$$

and this implies

$$EL^{vic}(c,T_1) + EL^{inj}(c,S) > EL^{inj}(c^*,S).$$

The left side represents expected cost to the injurer if c is adopted and the right side represents the expected cost to the injurer if c* is adopted. The potential injurer will adopt c*. (The same argument holds for V.) Thus, excusing liability for lack of probabilistic cause or for lack of cause-in-fact does not impair efficiency.

Foreseeability

Another application of the information approach is to the doctrine of unusual, unrelated, or "unforeseeable" accidents. (Note that the use of the word "unforeseeable" is a misnomer since one can assign a probability to any event no matter how bizarre or unlikely it seems.) In applying this doctrine, the court must do three things. First, it must set the standard of care while taking into consideration all possible events. Second, it must divide accidents into types, identifying those that are unusual, unrelated, or "unforeseeable". Third, the court must excuse liability for the class of unusual, unrelated, or "unforeseeable" accidents only if the expected loss of this class of accidents is small. If this is done properly, there will be no effect on behavioural incentives. Consider *Palsgraf* v. *Long Island Railroad Co.*[16] The defendant's conductor was careless in helping a passenger board a train. The passenger dropped a package containing fireworks which exploded, causing a set of weigh-scales to fall, thus injuring the plaintiff. The defendant, through its employee, was clearly negligent. In fact, there existed negligence, direct causation and proximity. Yet the defendant escaped liability. This is an efficient result. To see why, consider the case where the plaintiff's care is irrelevant. We can write the social loss function (assuming again only one potential injurer) as

$$EL^{soc}(c,S) = EL^{vic}(c,S) + EL^{inj}(c,S).$$

Suppose that this function is minimized at c*. Note that included in $EL^{vic}(c,S)$ are all possible accidents. Divide the accidents into two types. This division is made *ex ante.*

$$EL^{soc}(c,S) = EL^{vic}(c,T_1) + EL^{vic}(c,T_2) + EL^{inj}(c,S).$$

I will assume that $EL^{vic}(c,T_2)$ is small in a sense to be made more precise below. Note that

$$EL^{vic}(c,T_1) + EL^{vic}(c,T_2) + EL^{inj}(c,S) \geqslant EL^{vic}(c^*,S) + EL^{inj}(c^*,S).$$

I will assume that $EL^{vic}(c,T_2)$ is small enough that

$$EL^{vic}(c,T_2) < EL^{vic}(c^*,S).$$

We can call this second class of accidents the case of unusual, or "unrelated" or "unforeseeable" accidents. From the above two inequalities we get

$$EL^{vic}(c,T_1) + EL^{inj}(c,S) > EL^{inj}(c^*,S).$$

The left-hand side of the inequality is the expected loss incurred by the injurer by adopting c. Note that the injurer is liable for Type 1 accidents.

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[16] 248 N.Y. 339, 162 N.E. 99 (C.A. 1928) [hereinafter *Palsgraf*].

The right-hand side is the expected loss of adopting the optimal c*. It is clear that the potential injurer will adopt c*.

This means that even if we excuse liability in Type 2 accidents, the potential injurer will adopt optimal care. Again, there are three conditions: (1) the optimal level of care must be determined using all accidents; (2) the division into liable and nonliable accidents must be made *ex ante*; (3) the *ex ante* expected loss from nonliable accidents must be small in the sense described above.

Palsgraf is a case involving an unusual accident. Although the dividing line between usual and unusual is not clear, it is sufficient to know that if we divide accidents into two classes, those certainly usual and those possibly unusual, the expected loss in the second class is small. This is clearly the result in *Palsgraf*.