

## CAUSATION, PROOFS AND SCIENCE: THE DARK SIDE OF NUMBERS

Bruno Tassone<sup>\*</sup>

### Abstract

A great number of modern studies on causation argue that it is not possible to build a theory which can be applied to any situation, up to the point of either: evoking different truths narrated by the characters of the well-known Akira Kurosawa movie “Rashomon” (Cendon); stating that “causality is a nail to which the judge can hang the hat he likes most” (Hart and Honoré); or just seeing it as a tool which permits the most “unscrupulous” legal policy operations (Alpa).

The problems of this legal category have been magnified since many jurisdictions have reverted to the “more likely than not” standard, which has brought them to consider causation established if the plaintiff succeeds to prove that it is more probable than not that the damage was caused by the defendant; and since they have acknowledged the so-called “loss of chance” doctrine, where a plaintiff can claim damages if he is simply being neglected the possibility of getting benefit or avoiding harm with the probabilities of these happenings higher than 50%.

The just outlined scenario turns to important legal and interdisciplinary questions, such as, whether there might be a possibility of establishing causation and/or imposing a compensation for the “loss of chance” relying on statistics, epidemiological and other scientific studies. In more general terms, the paper confronts the question whether these studies can provide a solution to the legal “innumeracy” that erode many judgments and foster bias (that often leads to an erroneous view that if the defendant is black and poor, he is more likely to steal). In this context, we turn to another question: of whether we should carry out trial by mathematics – as suggested by a well-known article (Tribe) - and whether we should

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<sup>\*</sup>Full Professor of Comparative Private Law at Universitas Mercatorum and Adjunct Professor of “Principles of Civil Law” at Luiss Guido Carli, has previously been Associate Professor of Private Law at Universitas Mercatorum and Researcher in Private Comparative Law at Università “Luigi Vanvitelli”. [btassone@luiss.it](mailto:btassone@luiss.it)

allow it to become the foundation for determining the evidence; or whether this approach will inevitably take us into the past, to the judicial standards of the Middle Age proceedings (where it took several lower class witnesses to rebut the statement made by just one testimony that belonged to an upper class). Thus, the paper considers not only the legal relationship between the cause and effect, but also whether we are facing the future where the assessment of evidence shall be entrusted to computers and Artificial Intelligence.

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### **Keywords**

Torts – Liability – Medical Malpractice – Negligence – Causation – But-For Test – More Likely Than Not – Preponderance of the Evidence – Compensation – Indemnification – Damage – Loss of Chance – Probability – Scientific Evidence – Statistics – Epidemiology – Civil Law – Common Law – Comparison – Policy

## **1. Introduction**

A great number of modern studies regarding causation conclude that it is not possible to build a theory which can be applied in any situation. To put it briefly, in order to describe the problems that causation nowadays faces we can recall the “blanket syndrome”, which states that covering one’s feet will get one’s neck exposed, and covering one’s neck will expose one’s feet.

Furthermore, those problems have been magnified since Italian Courts – along with other jurisdictions – have reverted to the “more likely than not” standard, pursuant to which causation is established if the plaintiff succeeds to prove that it is “more probable than not” that the damage was caused by the defendant. The standard, amongst other things, raises legal, scientific and linguistic issues regarding the meaning of the word “probability”, a multi-faceted concept.

Another set of problems stems from acknowledging the so-called “loss of chance” doctrine (hereinafter “LOC”), where the plaintiff can claim damages if they are simply being neglected the possibility of getting a benefit or avoiding a detriment. Some systems require the lost probabilities to be higher than 50%. Other systems insist that it is sufficient for them to be fairly substantial, while some believe, in principle, no threshold should be established at all. In all such cases the plaintiff is entitled to a partial compensation.

Nevertheless, it is still unclear how a finding of causation based on a probabilistic approach (because of the said more likely than not standard) is to be coordinated with the indemnification of a “loss” also defined in stochastic terms.

Those problems are especially difficult in the medical malpractice area, where the link between the defendant’s behavior and the plaintiff’s damage can often be established only through statistics, medicine, epidemiology and other sciences. However, the consideration of how other disciplines define probabilities can unveil a new way to solve them and to lead to innovative legal solutions.

The first Paragraph displays a brief sketch on the current causation and LOC applications in the field of med-mal in the Italian system. The second Paragraph enriches it with a comparative perspective. The third Paragraph then highlights some scientific and linguistic issues related to the concept of “probability”. The final Paragraph proposes a possible framework to sort (some of) them out.

## 2. Causation and LOC: A Difficult Relationship

As pointed out above, it is generally agreed within the Italian scholarship that it is nowadays impossible to build a theory of causation *bonne à tout faire* (Capecchi 2012; Pucella 2007; Tassone 2007; Nocco 2010; Tassone 2020a).

The idea – sometimes expressed in colorful terms, as an event is said to have as many explanations as “the truths narrated by the characters of the Akira Kurosawa movie *Rashomon*” (Cendon 2015: 11) – is accepted also beyond Italian boundaries<sup>1</sup>: up to saying that “causation is a peg on which the judge can hang any decision he likes” (Hart and Honoré 1985: 488).

Eventually, even the Italian Supreme Court of Cassation admitted that

causation is an almost insolvable hermeneutic problem on the level of pure legal dogmatics, [being] inevitably destined to be resolved within the (more pragmatic) boundaries of a “historical” dimension, or, if you like, of legal policy (Cass. April 18, 2005, no. 7997).

The dominant model has been – and still is, with some “temperaments” – the one of the *condicio sine qua non* which roughly corresponds to the “but-for” test and its variations in Common Law countries<sup>2</sup>.

Nevertheless, the theory is as fascinating as empty: to say that the conduct A is not the cause of the effect B if without A – mentally subtracting its existence – B would still take place, it is necessary to know in advance the relationship between A and B;

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<sup>1</sup> Whereas all quotations will be extremely limited for reasons of space, for a comparison among six legal systems Infantino 2012, to be added to Porat and Stein 2001.

<sup>2</sup> See the “relevant factor” (Hart e Honoré 1985: 157), the NESS (Necessary Element of a Sufficient Set) test developed on its basis (Wright 1988), the adjustment known as INUS (Insufficient but Nonredundant part of an Unnecessary but Sufficient Set) test (Mackie 1965) and the “material contribution to harm” depicted by the House of Lords in *Bonnington Castings Ltd v. Wardlaw* [1956] AC 613. For more references, Green 2015 and Turton 2016.

so that while the world – even that of knowledge – becomes more and more complex, causation has to be filled through science.

Besides, the theory is inapplicable where causation can be assessed only in a probabilistic way, especially where a so-called “general causation” – instantiated by a recurring model situation in the field of med-mal – comes into play.

Assume that a patient is hospitalized for a bowel infarction and is taken into surgery only three and a half hours later and dies. Clinical studies show that if the surgery takes place within two hours, the patient has a 30% chance of survival. This means that, in principle, there is no way of knowing whether the patient fell into the “lucky” group – that of 30% – or the “unlucky” one, so that the *conditio sine qua non* is a blunt weapon: even if the patient had been operated sooner, we do not know whether or not they would have survived.

Before further elaborating on the example, Courts all over the world are aware of the problem raised by general causal explanations (for an overview, Tassone 2020a: 231).

To this regard, a judgment which sprouted a new interest for causal studies in the Italian system – that of the Supreme Court of Cassation, Criminal United Sections, of July 10, 2002, rendered on a bowel infarction case –, stated that

is not allowed to automatically draw from the probability coefficient expressed by the statistical law the confirmation, or not, of the prosecutor hypothetical accusation about the existence of the causal link [and] the judge must verify its validity in the specific case, on the basis of the circumstances and the available evidence,

so that

at the outcome of the reasoning on the evidence [...] the conclusion that the doctor’s conduct was a necessary condition of the event with a “high degree of rational credibility” or “logical probability” is justified and certain from a procedural point of view.

Such a landmark judgement is a very good example of “legal transplant”, as was strongly influenced by the U.S. formants.

As the O.J. Simpson case makes clear, it welcomes the distinction between general and specific causation<sup>3</sup>. Furthermore, applying the “beyond any reasonable doubt” standard in the criminal setting – now provided by Art. 533 of the Italian Code of Criminal Procedure – it paved the way to the “more likely than not” in the civil one: which the Supreme Court sustained a few years later<sup>4</sup>.

Nevertheless, in the short run the Civil Sections of the Supreme Court avoided a “fontal collision” with the *dictum*: still on a case of bowel infarction Cass., March 4, 2004, no. 4400, stated that damages resulting from incorrect or late diagnosis can lead to the loss of chances of survival or recovery, which are themselves a “protected legal situation”, so introducing LOC in the field of med-mal<sup>5</sup>.

After the above mentioned decisions were pronounced the “more likely than not” has not only been quickly consolidating, but – starting from Cass. July 2011, no. 15991 – it has been applied according to its “weak version”. It is sufficient that the conduct of the plaintiff be the cause of damage with a degree of probability higher than the one of other single causes and not in “absolute” terms (i.e., higher than the one of each of all the other causes joined together).

Therefore, the judgement states

in the field of damage stemming from infected blood transfusions, if the possible contributing causes appear to be multiple and quantifiable up to ten, each with a probabilistic incidence of 3%, while the transfusion reaches a degree of probability equal to 40%, the claim has not to be dismissed.

Coming back to LOC, few years later the Supreme Court established that even chances lower than 50% are recoverable, which enlarged its potential sphere of

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<sup>3</sup> On the distinction Nesson 1979, Kaye 1982, Dore 1983, Wright 1988 and Stella 2003: 291.

<sup>4</sup> Supreme Court of Cassation, United Sections, January 11, 2008, nos. from 576 to 585.

<sup>5</sup> LOC has been accepted in the Italian system since the mid-80s, even though both its legal foundations and its sphere of application are still controverted. Born in the context of labor career progressions, it was applied some years later in public competitions and landed into the realm of medical malpractice. After such a moment its expansion seemed to be relentless, involving, for example, professional liability in general, the right to self-determination and many other cases. For a critical overview, see La Battaglia 2019.

application<sup>6</sup>. Therefore, the Court of Cassation tried to put some limits, for the first time, in the year 2018, completing its work in 2019<sup>7</sup>.

In particular, in November 2019 its Third Section decided to publish the so-called “health system project”, rendering over sixty judgments on the matter, with ten of them expressing its final view on quintessential issues and a specific decision devoted to LOC: which is now seen by the majority of judges as an autonomous legal “item” featured by the system, to be compensated if the deprived possibilities were “serious, appraisable and consistent”<sup>8</sup>.

Thus, to obtain redress the plaintiff must only prove that they were deprived of those possibilities “more likely than not” because of the defendant’s behavior, which creates a problem of coordination with causation.

Indeed, even from this brief sketch some questions arise, leaving aside the issue of the “refinement” of the statistic class of reference<sup>9</sup>:

First, is the “probability” implied by the “more likely than not” other than the one implied by LOC?

Second and if so, how can an assessment of causation in probabilistic terms can live together with a legal situation defined in the same way?

Third, if the case is the contrary, how are probabilities to be defined and how do they relate to ones implied by the “general causation” assessment?

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<sup>6</sup> Cass., March 27, 2014, no. 7195.

<sup>7</sup> Cass. March 9, 2018, no. 5641, and Cass. March 19, 2018, no. 6688.

<sup>8</sup> Cass. November 11, 2019, no. 28993.

<sup>9</sup> Assuming that the 30% was drawn considering a target group of people over fifty, where the patient was an Olympic champion, do the general health conditions matter? What if the case is about a transplant and the key issue is the patient rejecting the new organ? Unfortunately, “more often than not” the answers to such questions do not make general causation applicable to a single case, but only allow to better define the class of reference (as explained in Tassone 2020b: c. 358). If those factors have not been considered because they are irrelevant, they make no difference. If they are relevant, the study cannot be used to assess causation and a further study is needed. But it is very likely that it only brings a change in the percentage of success, saying nothing about the specific situation.

### 3. Comparative Considerations and Common Law Reactions

In the light of the difficult relationship between causation and LOC, it is no coincidence that legal systems all around the world have different approaches as to its admissibility (for an overview Saporito and Tassone 2020: 99).

It is well known that the doctrine originated in the French system, along with a decision of 1889<sup>10</sup>. But even in the system to which the birth of LOC is attributed, the doctrine is controversial, as the proposal to amend the *Code Civil* presented some years ago clearly confirms<sup>11</sup>.

Therefore, it's worth testing a number of common assumptions as the one spotting the French system as the only cradle of LOC: to discover that *chance* is already dealt with by the English system with *Chaplin v. Hicks* of 1911, become very popular also because of John Maynard Keynes treaty on probabilities, which in turn strongly influenced Common Law systems (Keynes 1921: 3)<sup>12</sup>.

Furthermore, fifty years later – in *Kitchen v. Royal Air Force Association* – one finds Courts admitting the compensation for the loss of a *chance* of certain consistency where a lawyer belatedly filed an appeal<sup>13</sup>.

However, a line which seems in harmony with the Italian and French evolution – one would expect an extension from the field of professional liability to that of med-mal – comes at some point to an end or, in any case, is strongly questioned. In *Wright (A Child) v. Cambridge Medical Group* of 2011 – after a leap of another fifty years –, the sharp rejection of a typical LOC claim in the area of medical negligence area is based

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<sup>10</sup> Cass. req. July 17, 1889, in *Rec. Sirey*, 1891, I, 1399. On the French system Feola 2004.

<sup>11</sup> Art. 1346 (“[t]he loss of opportunity is a repairable prejudice distinct from the benefit that the chance would have provided if it had been fulfilled”) of the Draft Reform of the Law of Obligations (Arts. 1101 to 1386 of the Civil Code) and Statute of Limitation Law (Arts. 2234 to 2281 of the Civil Code), available on [www.lexisnexis.fr](http://www.lexisnexis.fr).

<sup>12</sup> On the influence of *Chaplin v. Hicks* [1911] 2 KB 786, in Australia and North America, Coote 1988: 761, and Feldman 1987: 139.

<sup>13</sup> *Kitchen v. Royal Air Force Association* [1958] 1 WLR 563.



on the peremptory assertion that such doctrine has no citizenship<sup>14</sup>: following the position taken by the House of *Lords* in *Hotson v. East Berkshire Area Health Authority* of 1987 and in *Gregg v. Scott* of 2005<sup>15</sup>.

Moreover, North American jurisdictions as well are beset with strong doubts on the role of LOC, as stressed out by the rulings of two Supreme Courts which – even at a short distance – assumed very different positions<sup>16</sup>.

More generally, it results that some States are very favorable to LOC and others are vehemently opposed to it, with the related inventories needing a constant update, because of an incessant evolution<sup>17</sup>; and another overview leads to highlight a general trend using LOC to temper the effects of the all-or-nothing principle (stemming from the application of the “more likely than not”), but – unlike the English system – limiting such a solution, mainly, to the area of medical negligence<sup>18</sup>.

In addition, the negative reactions arisen in Common Law countries go beyond those ones.

For example, the Canadian Supreme Court flatly denied the eligibility of LOC in *Laferrière v. Lawson*, which concerned Quebec, a system heavily tributary of the French experience<sup>19</sup>: a decision which triggered a serious reflection on the reasons behind

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<sup>14</sup> *Wright (A Child) v. Cambridge Medical Group* [2011] EWCA Civ 669, [2013] QB 312.

<sup>15</sup> *Hotson v. East Berkshire Area Health Authority* [1987] 2 All ER 909 and *Gregg v. Scott* [2005] UKHL 2.

<sup>16</sup> It was only one month apart that the Supreme Courts of Massachusetts and Kentucky in 2008 admitted and denied the redress for the loss of chances below 50%, respectively with *Matsuyama v. Birnbaum*, 890 N.E.2d 819 (Massachusetts 2008) and *Kemper v. Gordon*, 272 S.W.3d 146 (Kentucky 2008).

<sup>17</sup> As an example, a count carried out in 1995 indicated 24 States in favor, 12 against and 4 taking contradictory decisions (Hodson 1995: 34). A 2012 article argues that LOC has made inroads into the system of 26 States, with 19 of them and the District of Columbia continuing to oppose its recognition, in addition to 5 States where the situation is not well defined (Shnoor and Bacon-Shnoor 2012: 1). Finally, an even more recent review confirms the significant rift that continues to exist in the American context: as an Author maintains that 23 States – lead by Massachusetts – have given way to LOC, while 20 States driven by California with the support of the District of *Columbia* are oriented in a negative way (Casaceli 2014: 521).

<sup>18</sup> Shnoor 2009: 33.

<sup>19</sup> *Laferrière v. Lawson*, [1991] 1 S.C.R. 541.

this setback also because some Courts applied its rules in other Provinces, such as Ontario and, in part, British Columbia<sup>20</sup>.

Finally, also in Australia the highest Court has shown to be refractory, if not hostile, to LOC, especially with the decision made in *Tabet v. Gett*, to be mentioned also for its comparative gaze (extended to France, Belgium and Germany)<sup>21</sup>. Still, the judgment was followed by a less restrictive legislation, likely to exceed the High Court's *dictum*<sup>22</sup>: which in its turn is particularly relevant as in conflict with supervening laws and with other judgements (rendered by appellate courts) very favorable to LOC<sup>23</sup>.

There are very noteworthy decisions here as well<sup>24</sup>; in addition to some scholarly works, such as the papers by Harold Luntz (2011), aimed at verifying its penetration into the law of medical negligence in Common Law countries<sup>25</sup>.

The investigation starts from the paradigmatic situation where a doctor makes a wrong diagnosis that precludes a timely treatment. The delay in discovering of a tumor impairs the chances of patient's survival up to 5 or 10 years – the typical temporal projections considered by medical studies – further reduced where one moves from the time when the correct diagnosis could be made.

Such a model situation – where statistics state that the patient has an X% chance of survival up to a Y of time, and yet lives longer – strongly question the idea that *chance* is autonomous legal asset, as constantly maintained by the Italian legal system.

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<sup>20</sup> *Cottrelle v. Gerrard* (2003), 67 OR (3d) 737 (CA). In the legal literature, Brown 2011: 3, and Knutsen, 2010: 153.

<sup>21</sup> *Tabet v. Gett* 2010, [2010] HCA 12.

<sup>22</sup> See the Section 5D of the *Civil Liability Act 2002 New South Wales*, which leaves room for the compensation of LOC as an “exceptional case” in respect to the but-for test and if “in accordance with established principles”.

<sup>23</sup> *New South Wales v. Burton*, (2006) DDCR 398 (NSW CA).

<sup>24</sup> *Grant v. Australian Knitting Mills Ltd.*, (1933) 50 CLR 387, although later reformed by the Privy Council with *Grant v. Australian Knitting Mills* [1936] AC 85. More recently, *Chappel v. Hart* (1998) 195 C.L.R. 232, *Naxakis v. Western General Hospital* (1999) 197 C.L.R. 269, and *Amaca Pty v. Ellis*, [2010] HCA 5, (2010) 240 CLR 111.

<sup>25</sup> See also Lunney 2014: 205, and Stapleton 2011: 331.

Provided it was so, it would not be possible to deny compensation, even in that fortunate event, and LOC must find other grounds.

Furthermore, the enquiry into the way statistics are built is useful to spot common errors, at times committed by the Supreme Courts as well<sup>26</sup>; and enlightens some further problems that the relationship between law and science raises<sup>27</sup>.

The above leads us to conclude that the enquiry on Common Law approach is useful not only because they are usually less considered than the French one.

After all, a wider perspective leads to the consideration that the recognition of LOC in other European systems is not to be taken for granted. For example, according to a careful comparative work, the doctrine is unknown in Austria, Switzerland and Greece, and it has not yet been admitted in Hungary, the Czech Republic, Slovenia, Estonia, Denmark, Switzerland, Norway and Finland<sup>28</sup>.

Eventually, it is not a coincidence that the case-law of a German system – which historically “dialogues” with the Italian one on various issues relating to civil liability

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<sup>26</sup> In *Matsuyama* above the Massachusetts Supreme Court explains that, assuming a life value of 600,000 \$ and a chance of survival reduced from 40% to 10% due to doctor's negligence (because of the delayed diagnosis of a tumor), the damage must be 180,000 \$ (600,000 x 30%, given by 40% – 10%). But the said result would be correct only if the decrease had brought the chances of survival to a zero, not if some chances of survival would remain unchanged despite the said medical negligence, as it is possible to identify not two but three classes of patients. The first is made up of 60 patients who would meet their fate in any case, with or without medical treatment; the second - of only 4 patients who would have survived despite the statistics (i.e. 10% of 40% of patients subjected to the said malpractice); to which is added, *de residuo*, the class of those who would benefit from the treatment. Then, the probability should be calculated assuming as “basis” for the patients affected by the conduct a cohort of 96, so that the lost chances stem from the proportion 30/96, that is 31.25%, having to recalculate in 192,000 \$ the value of them (31.25% x 600,000) with an upward correction of 12,000 \$.

<sup>27</sup> Classes could increase depending on how the case is structured, for example on the basis of the incidence of other factors and – however – percentages can vary as one moves forward from “time 0”, when the correct diagnosis was to be carried out. If the due outcome is the expectation to prolong survival for up to five years, the 36% chance of living for the duration of that timeframe can only be the aggregate result of partial percentages of different magnitudes or (assuming it as a number placed at the end of the period) must postulate that the percentages in the intermediate periods are higher. Moreover, the same evolution of the pathology may require various sub-distinctions: some patients may have a relapse and others may not; some may develop metastases and others may not; some may have operations with their own risks, others - not; and so on.

<sup>28</sup> Graziano 2008: 1009.

– does not contemplate LOC at all and other techniques are used to mitigate the consequences of the “all or nothing” principle<sup>29</sup>.

Finally, the Common Law systems shed a light on how the “more likely than not” is to apply, because of the distinction between what the plaintiff has to prove (conceptual element) and the way in which she has to do it (evidential element)<sup>30</sup>.

The English version of the “more likely than not” standard does not follow that the difference between the probability of an event taking place and the judge’s inherent degree of “belief” should be annulled<sup>31</sup>. According to some Authors, the assessment is, indeed, qualitative and not quantitative<sup>32</sup>. For that reason, they find it more preferable to adopt the “balance of probabilities” expression instead of giving it a numerical formulation<sup>33</sup>.

Apart from a few exceptions, the same generally applies in North American systems as well, even though the “preponderance of the evidence” has a wider use, in line with the recommendation of the Restatement Third<sup>34</sup>.

However, in this perspective the scientific, epidemiological and statistical evidence is included in a broader framework. In other words, they represent a mere element of that “mix” which leads to the conclusion that the plaintiff’s allegation is more likely to be grounded than not<sup>35</sup>.

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<sup>29</sup> See Stauch 1997: 218, Jansen 1999: 275, Cricenti 2019: 2073 and 2020: 64.

<sup>30</sup> Steel and Ibbetson 2011: 451.

<sup>31</sup> Gold 1986: 376; Barnes 2001: 191; Miller 2006: 544, Haack 2014: 19.

<sup>32</sup> Turton 2016: 83.

<sup>33</sup> McIvor 2013: 553.

<sup>34</sup> *Restatement of the Law, Third, Torts: Liability for Physical and Emotional Harm*, 2010, § 28 *Comment c*.

<sup>35</sup> See Saporito and Tassone 2020: 99.

#### 4. Probability, Science and Language

The points discussed above offer us a possibility of coordinatig causation and LOC: while the former does not imply a mathematical assessment of the credibility of the plaintiff arguments over the existence of the causal link, the latter requires an estimation of the lost possibilities they had to accomplish a benefit or avoid a detriment (even though it is discussed whether or not the compensation should be awarded in a strictly proportional manner)<sup>36</sup>.

The said picture demonstrates that LOC is often a “fiction”: chances do not exist by themselves and they make up for the structural impossibility or the insurmountable difficulty of predicting the outcome, while not laying the blame on the plaintiff not offering the related evidence.

Therefore, the Italian Supreme Court’s statement that it must be verified whether the probability of avoiding a detriment or achieving a benefit has been “more likely that not” elicited by the defendant is just an “optical illusion”<sup>37</sup>. The conduct of the doctor who does not operate on the patient is by definition such as to preclude, more likely than not, if not in an absolute way, a course of events more favorable to the plaintiff and the same is true in other contexts<sup>38</sup>.

Indeed, the general attitude of suspicion or, in any case, of caution, expressed by the English and North American systems offers other arguments to refrain from theoretical constructions identifying chance as an autonomous “item” to be protected; and comparison supports the idea that LOC should be based on the identification of the dynamics that cause a substantial and/or procedural uncertainty that the plaintiff could not in any way overcome<sup>39</sup>.

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<sup>36</sup> In the English system, *Sienkiewicz by Greif* [2011] UKSC 10, And *Reay and Hope v. British Nuclear Fuels Plc* [1994] Env LR 320.

<sup>37</sup> Cass. November 11, 2019, no. 28993.

<sup>38</sup> That is for the employer who unlawfully excludes the worker from a career progress competition, for the public administration that makes a contract through a private negotiation instead of a tender, for the lawyer who allows a statute of limitation to run.

<sup>39</sup> This is the comprehensive view lately expressed in Tassone 2020a.

Still, a serious reflection on the concept of probability is needed. Non-legal scholarship lists at least five meanings of that concept, related to: 1) the classic theory (La Place, Bayes); 2) the frequentist theory (Von Mises, Pearson); 3) the likelihood ratio theory (Fischer); 3) the logic theory (Keynes, Carnap and Jeffreys); and 5) subjective theory (de Finetti and Bernoulli)<sup>40</sup>. These enquiries permit internal distinctions within the scientific (medical, statistical, epidemiological) evidence and foster the understanding of the concept as well as its legal application: recalling that in Common Law systems the evaluation of the scientific evidence is more investigated than in Italy<sup>41</sup>.

For example, if a given disease can be attributed by 75% to smoking and by 67% to alcohol consumption, one may wonder how it could be possible that the sum of the percentages assigned to each factor is greater than 100%. The explanation is easy considering theory no. 3 mentioned above: all those considered have some impact on the pathological state, so that the single percentage – taken alone – does not bring out an incidence really equivalent to what the number suggests. Epidemiological studies often limit themselves to establishing “associations” between variations in frequency of events in considered classes, so that they do not define how likely it is for a single event to cause another, but rather how unlikely.

It might be a step forward not only to define the probability itself, but to decide which words we use to apply it, as well; considering the variety of “actors” involved in the use of the scientific evidence, such as non-legal literature, legal literature, lawyers, expert witnesses and judges; and here linguistic studies can be helpful both in decrypting the way terminology is employed and in building a common vocabulary to be shared among those actors<sup>42</sup>.

This is both true for causation and LOC: relevant probabilities have been defined from time to time as “serious”, “effective”, “concrete” or “not hypothetical” possibilities of success, up the blaze of “the reasonable certainty of the existence of a non-negligible chance” (Cass. April 22, 1993, no. 4725).

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<sup>40</sup> For further details and the related references, see Tassone 2020a: 265.

<sup>41</sup> See Tribe 1971: 1329; Cohen 1977: 2; Eggleston 1978: 137; Magnusson 2002: 400; Haack 2014: 78.

<sup>42</sup> For a proposal from the legal side, Trimarchi 2019: 662. See also Allen 2017: 133.

Needless to say, the interaction between law, science and language goes beyond those hints, as comparative studies have shown. For example, dealing with law and language a very influential Author demonstrated that only a peek into a system from an external perspective may highlight its “crypto-types”, of which inside formants are not aware<sup>43</sup>; and such approach can be extended to the relationship among law, science and language, as the consideration of other disciplines lead to ask: when we say that chance is a “lost possibility”, do we refer to a probably? Of which kind? Of which degree?

A fist answer – within the limit of this paper – can be offered together with some interesting conclusions.

## 5. Conclusions

Regarding Thanks to the above framework some guidelines can be proposed as to the application of causation and LOC within the Western Legal Tradition<sup>44</sup>.

The distinction between the kind of probabilities (usually) identified by the general causation (apart from other internal sub-distinctions not to be analyzed in this paper) and the degree of credibility (usually) defining the “more likely than not” (apart from other ways to interpret it, which again is not to be analyzed in the present paper), leads to limit the typical area of the former and the subsequent award of full compensation to cases where a universal or statistical law with a value close to “1” can be applied, not to be confined to a small number of situations, as some say<sup>45</sup>.

It is also possible to maintain that similar consequences are brought by the application of statistical laws that predict their “regularities” for a very high percentage: although here it is to draw the distinction between true “naked statistics” and those which express a degree of certainty with a relativistic nuance only for intellectual humility with respect to the limits of knowledge.

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<sup>43</sup> Sacco 1992: 25.

<sup>44</sup> For more details, see Tassone 2020a: 337.

<sup>45</sup> If they were not available, it would not be possible to commit – for example – to the construction of ships, trains, airplanes and buildings.

Therefore, only for practical – and policy – reasons a statistical law expressing a very high percentage, for example close to 99%, can be used for ordinary causation, so that the quantitative element turns into the qualitative one, even though this is not strictly consistent with the nature of the law considered.

Of course, it is not to be excluded that a statistical law can be subject to *concretization* in the single case, but – as has been already demonstrated – it does happen rather rarely. In such case it might be better to search viable solutions rather than endorse the refrain of many Courts around the world on the abstract distinction between general and specific causation, without providing an indication on how to decide the dispute where only the former is available<sup>46</sup>.

In its turn, the typical area of LOC is that of general causation, where only the time machine would let us know how things would have gone.

The first benefit of this approach is related to the long-established issue of the LOC threshold, which becomes completely meaningless not only for the chances below 50%, but for the higher chances as well.

Secondly, the awareness of the chance being a fiction invented in order to meet relevant instances of justice can be related to continuous activities such as health ones to prevent a systematic effect of under-deterrence. If a certain type of surgery has on average a low probability of success, say 30%, the ones that perform it could assume a structurally negligent conduct, believing that none of the patients could obtain full compensation from the traditional point of view.

Nevertheless, the damage that cannot be ascertained on a single basis – as no one is able to know which patient falls into that class – becomes assessable in an aggregate perspective. If all 100 patients could ideally return to the pre-op moment and have it properly performed, there would be no doubt about the identity of the 30 patients entitled to full compensation. The effect of LOC is then equivalent to that of awarding each one of them 30% of the final damage by developing the (category of) the

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<sup>46</sup> Tassone 2020a: 333.



individual (and abstract) *chance* as a fragment of a broader collective (and concrete) one, according to a newly proposed construction<sup>47</sup>.

In other words, the lack of knowledge about individual causation emerging in such cases offers one of the most convincing explanations of the case-law on LOC developed on both sides of the Atlantic.

Naturally, a step further outlines the issue of the possibility of extending the typical area of LOC, for example, in the different context of non-medical professional responsibility, together with many others, to be coped with a broader framework aimed, *inter alia*, at simplifying complexity.

At the end of the day, causation (the same is true for LOC) is a “vision of the world”: while other branches of science have a lot to say about the “vision” we build, language is essential in deciding how we “name” all the relevant elements which are necessary for defining and applying it.

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<sup>47</sup> Tassone 2020b: c. 358.

