Revista Ítalo-Española de Derecho Procesal
Vol. 1 | 2018 11 pp.
Madrid, 2018

ISSN: 2605-5244

INFERENCES IN JUDICIAL DECISIONS ABOUT FACTS

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ABSTRACT: The essay deals with some problems concerning the logical structure of evidential inferences. First of all some premises are stated, mainly about the nature and the function of evidence in connection with the theories of judicial decisions. Then the core of the essay is devoted to the analysis of such inferences, based maily upon the inferential model proposed by Toulmin. Such a model is used in order to look at the most important and frequent situations in which complex sets of inferences are necessary in order to achieve a rationally justified decision. A final part is devoted specifically to the problem of statistical evidence, in general and in the cases of toxic torts.

KEYWORDS: evidence; truth; probability; inference.

SUMMARY: 1. Some premises. – 2. Some theories of factual decision. – 3. Models of inferential reasoning. 3.1. Complex inferences. – 4. A special problem: statistical evidence. 4.1. A doubtful case: toxic torts. Selected bibliography

1. SOME PREMISES

The arguments that will be shortly developed in this paper move from some premises concerning the goals and the main features of the decision that the trier of fact has to make on the facts in issue in any procedural context.

a) The basic premise is that such a decision deals with statements (usually a set of statements) describing events that are relevant for the application of a legal rule in the specific case. In a sense, it is the rule that is taken as the legal standard determining the decision that is applied to as the criterion to determine the legal relevance of the facts in issue.

b) The second basic premise is that among the goals of any judicial decision on facts there is the judgment about the truth or falsehood of such statements. In a sense, the judicial process may be interpreted as a complex proceeding oriented to the search of truth about the facts in issue. It means that the decision about such facts has to be *accurate*: all the statements concerning facts should be taken as true or false, and the truth or falsehood of such statements should be justified in a detailed and analytical way.

c) The third basic premise is that such a final decision about all the factual statements should be based upon: 1) all the available evidence concerning the facts in issue; 2) a rational reasoning based upon such evidence. This second point is specially important in order to reject various theories according to which the decision about the facts in issue could or should be no more than the outcome of an irrational *intime conviction*.

d) A further fundamental premise is that in the judicial context any talk about the search of truth is properly referred (setting aside the other several theories of truth) to the concept of truth as *correspondence* of factual statements to the events that are described in such statements. So to say, the decision about the facts in issue should be based upon an accurate and complete *reconstruction* of what happened in the reality of such facts. However, it seems obviously clear that for many reasons in a judicial proceeding no *absolute truth* can ever be achieved; judicial truth is obviously a *human truth*, and therefore it cannot but being *relative*, i.e. depending on the amount and the quality of the information provided by the evidence, and on the rational validity of the reasoning that is used to process such information and to reach the decision about the facts.

e) Evidence is the only means by which the trier of fact may reconstruct what happened in the reality. Private knowledge of such facts is not admissible as a basis of the decision. In a very general sense, *evidence* is any kind of information that is relevant (i.e.: useful) for the knowledge of any fact in issue.

f) Usually in any judicial proceeding several items of evidence are presented and collected with the aim of gathering all the possible information about the facts in issue. As abovesaid, all these informations should be considered and used *rationally*, i.e. with the aim of deriving from them a rationally justified decision about the truth or falsehood of the facts in issue. Some theories, proposed mainly with the purpose of describing how *jurors* deal with the evidence, say that jurors make an *olistic* evaluation of all the items of evidence, and of all the facts in issue, ending up with a complete *narration* of the facts that is supposed to be the final outcome of such a "global" judgment. Not discussing here whether or not this is a reliable description of how jurors reach their verdict, a criticism is that in such a way it is impossible to determine whether their judgment is rational and accurate (also because a verdict of a jury never is justified).

On the contrary, saying that the decision of the trier of fact has to be accurate and rational, being oriented to finding out the truth about the facts in issue, requires the adoption of a different perspective about the evaluation of evidence, that is: an *analytical* perspective, according to which *any* item of evidence concerning *any* fact should be taken in specific consideration in order to determine which information it provides, and whether or not such an information is relevant for the final decision about the truth of the factual statements.

2. SOME THEORIES OF FACTUAL DECISION

Leaving aside the theories that consider the decision about the facts in issue as a merely irrational activity, and those that deal only with the psychology of judicial decisions, it is worth stressing that there are several tentative explanations of how a decision about the facts in issue may or should be achieved. All these explanations cannot be discussed here in detail, but some of them deserve to be mentioned.

According to one of these theories that is rather widely accepted in legal theory, the decision on the facts should be derived from an *inference to the best explanation*. The basic idea is that in a judicial context there are two (or more) descriptions of the facts connected with the evidence, and that such a connection provides an *explanation* of such facts. Between the explanation offered by the plaintiff and the explanation offered by the defendant, the trier of fact should choose the *best* one. At first glance this seems reasonable, but there are at least four problems here: a) there are no clear criteria by which such a choice should be made. Sometimes it is said that the best explanation has to be coherent with the common sense, reasonable, able to connect in one narration the facts and the evidence, but all these criteria seem to be too vague and uncertain. b) Such a theory is clearly based upon an *olistic* perspective, since each explanation has to be taken as a *whole*, but this is in conflict with what has been said above in favor of an *analytical* consideration of each fact and of each item of evidence. c) Moreover, if the best explanation has to be narratively coherent, this means that it has nothing to do with the truth or falsehood of the statements concerning the facts in issue, while -as it has been told above- this is just the problem that the decision must solve. d) The relatively best explanation may even have a very low degree of evidentiary confirmation, and it may be "relatively" best while the other explanations are worse, but once again this has nothing to do with the truth or falsehood of the factual statements.

Among the theories that try to offer a rational analysis of the factual decision based upon the evidence, perhaps the more popular -since its beginning in the Seventies in some areas of the American legal theory- is based on the application of the calculus of quantitative ("pascalian") probability, and in particular on the use of the so-called *Bayes theorem*. About such a theory

there is a number of books and essays: then it cannot be discussed in all its aspects, but the basic idea may be expressed in synthetic terms. Such an idea is roughly the following: we start with the *prior probability* of a factual statement and then, applying the Bayes theorem, we can establish how much a new information or evidence about that fact determines a variation in its probability. The outcome is an *a posteriori probability*, that is a number between 0 and 1 (or between 0 and 100) that is the resulting probability of that statements on the basis of the new evidence.

Here the problem is neither the calculus of mathematical probability nor about the Bayes theorem, the validity of which is not discussed. The problem is whether or not this type of calculus is applicable -as several scholar say- in a judicial context. The solution of this problem is negative, for various reasons. The main negative reason is that in a judicial context we almost never have a prior probability numerically determined of anything, and we cannot *create from nothing* such a probability just in order to start the calculus: clearly any number we can produce as an outcome would be arbitrary and nonsense. Another relevant reason is that, according to the most recent versions of this theory, it could explain only how to calculate the effect of just *one* item of evidence, but so far it cannot be applied to the most common judicial situation, in which there are several or even many items of evidence. Moreover, the calculus that such a theory suggests is so complex and sophisticated that no juror or judge would be able to perform it in a correct way.

However, since the judicial truth is never absolute and is always *relative,* it seems that we may analyze the structure of the factual decision in terms of *probability*. Of course not in terms of bayesian probability, but in terms of *logical ("baconian") probability*. Logical probability is -speaking in very simplified terms- the logic of the connections among statements, i.e.: the logic of the inferences that are constructed in order to justify reasonings about statements and to reach a conclusion about one statement according with the information provided by other statements. This kind of logic derives from the classical tradition (the Aristotelian syllogism was an inference connecting two premises with a conclusion) and is applied in a variety of areas in which there are no numbers or statistics but there are rational and logically valid arguments. For these reasons it may be taken as a useful tool for the analysis of the reasoning about evidence, aimed to achieve the confirmation of statements concerning the facts in issue.

3. MODELS OF INFERENTIAL REASONING

The inferential structure of the reasoning that the trier of fact has to develop in order to evaluate the evidence and to draw conclusions from the information provided by the evidence may be described in various ways. However, a useful way is to apply the inferential model that was proposed in 1958 by Stephen Toulmin and is currently used by several authors.

Such a model basically combines three factors and allows us to determine whether a hypothesis H, the liability of which has to be established, is confirmed by the available information E. The outcome may be positive if a reference may be made to a *warrant W* that connects E and H in such a way that, given E, H is logically confirmed. Then the structure of the inference is

$$(1) \qquad \begin{array}{c} E \rightarrow H \\ \uparrow \\ W \end{array}$$

That is: H is logically confirmed by E on the basis of W.

Such a model is very useful because it is very simple and may be applied in order to analyze very different inferences. If, for instance, I have to establish in H if Socrates is mortal, and I know in E that Socrates is a man, I can say that Socrates is mortal because I refer to a warrant that says that all humans are mortal.

Of course, then, it is easy to see that the real basis of the inference is W: then the degree of logical confirmation of H on the basis of E is determined by W. When W is a general law, as in the example of Socrates, the inference is *deductive*, but in many cases W is a statistical regularity or even a common sense generalization: in such casis the confirmation of H may be only *probabilistic*. However, in such cases the problem is to determine the real cognitive content of such generalizations. If such a content is uncertain, then the conclusion concerning H cannot be validly drawn.

3.1. Complex inferences

The model of inference just described explains the *simplest* and *atomic* logical structure of evidential inferences, but the situation in which it corresponds to the *whole* inference is rather infrequent.

What often happens, actually, is that the evidentiary inference is much more complex, consisting in a combination of *basic* inferences as the one just described. There is a wide variety of such combinations, that cannot be analyzed here. However, the basic structure of some of such combinations may be analyzed.

A) One possibility exists when there is an *inferential linear chain,* in which the final inference about H is the outcome of another previous inference, such as

$$(2) \qquad \begin{array}{c} E' \rightarrow H' \\ \uparrow \\ W' \end{array} \quad \text{where} \quad \begin{array}{c} H'=E \rightarrow H \\ \uparrow \\ W \end{array}$$

However, also E' may be in its turn a hypothesis confirmed by another inference, and so on. Therefore, we may have a complex linear chain of this type

(3) $E^n \rightarrow H^n \rightarrow .....E' \rightarrow H' = E \rightarrow H$

$\uparrow \qquad\qquad\qquad \uparrow \qquad \uparrow$

$W^n \qquad\qquad\qquad W' \qquad W$

In such a situation, the confirmation of the final H is given by W, and the confirmation of all the Hs is given by the respective Ws. The basic principle is that the *force* of the whole chain is equivalent to the force of its *weakest* ring: if one ring breaks down, the whole chain breaks down.

B) A situation that is rather frequent in judicial context but has a complex inferential structure, is that in which for the same H there are various evidentiary items E', E" and E"'. If we admit that E' → H; E" → H, and that E"' → H, and also that these inferences (each one with its own W) are reciprocally compatible and independent. we have a situation like

(4) E'

↘

E"→H

↑

E"'

inwhich each of the three converging inferences provides a positive confirmation of H. Correspondingly, such a confirmation is given by the combination (we could say the *sum)* of the outcomes of the three inferences. We should consider, however, that each of the Es may be in its turn the outcome of a linear chain of inference of the type

described above in A).

C) A special but frequent situation of converging inferences may happen when none of the Es is by itself sufficient to give H a real confirmation (although each E gives H *some* confirmation, although insufficient). This is the case in which there are several items of circumstantial evidence, but none of them is able by itself to support H. However, usually it is admitted that in such a situation a set of insufficient circumstantial evidence may lead to a final positive confirmation of H. The solution is not of summing up the outcome of different (but each insufficient) inferences, but to build up a different inference corresponding to:

(5) E'

E" } → H

E"' ↑

W

In this type of inference the three Es are not different premises of different inference but are -taken *together*- a *unique* E, that is the premise of a *unique* inference that may justify H according to W. Obviously such a W should connect the set of E', E" and E"' with H.

D) Moreover, we may then imagine a group of situations in which the common feature is that the items of evidence that are available as Es are not converging in the same direction, that is: are not univocally supporting the final H. It means that there are *diverging inferences* that may be based upon the existing evidence.

The simplest of such situation may be that of the *ambiguous* E, wich means that E does not support only H, but also "not H", in such a way:

(6) E→H
↘ not H

In such a case the problem is about the Ws justifying different conclusions, and a choice is possible only when one of the two inferences is supported by a W. If none is supported, no conclusion is possible about H.

A different form of ambiguity of E may be the following:

(7) H
↑
E→H'
↓
H"

that is a situation in which from the same E different inferences (on the basis of different Ws) may be drawn about different Hs. It may happen that the various Hs are compatible (for instance when they refer to different facts). In such a case we might say that E is *plural*.

We may also have a different and more complex situation, that is unfortunately very frequent, when at the same time there are different items of evidence, but each of them supports different Hs according to different Ws, in this way:

(8) E→H
↑
W
E'→H'
↑
W'
E"→H"
↑
W"

Here the problem arises when the several Hs are about the same fact, and that each H has its own confirmation supported by a specific e and by a specific W. Then the choice that the trier of has to make should be in favor of the H that has a strongest degree of confirmation. There is no problem, however, when the various Hs refer to different facts.

E) Last, but not least, we have to consider the very frequent situation in which there are items of evidence leading to opposite conclusions about the same H, in this way:

(9) E→H

↑

W

E' → not H

↑

W'

In this case we have an inference confirming that H is true and an inference, based upon a different E, confirming that H is false. Once again, in such a situation the choice of the trier of fact should be guided by the comparison between the degrees in which the two inferences support their respective conclusion.

Of course this list of situations is far from complete, since the reality of many judicial decisions about the facts in issue requires an extremely complex and sophisticated logical analysis. However we may think that a thorough use of these inferential models, and of their combinations, may help the trier of fact to reach a logically justified decision and to give rational reasons for such a decision.

4. A SPECIAL PROBLEM: STATISTICAL EVIDENCE

The problem of the inferences connecting rationally the evidence at hand with a conclusion concerning the facts in issue may be interpreted –and actually it is interpreted- on the basis of various conceptual models. A complete analysis of all these models cannot be made here, then a specific attention will be paid only to situations in which statistics may be or are actually used.

However, one of these models may be set aside immediately, that is the theory according to which the so-called *naked statistical evidence* may support a conclusion about the facts in issue even when there is no other evidence. It is a well known and disputed theory but a full discussion of it is not relevant here, because of at least two reasons. One is that in the administration of justice there is no interest in paradoxes as those of the blue bus or the public of a rodeo. The judge does not play with paradoxes: he has to deal with specific and concrete empirical facts that occurred in the past. Another reason is that –as it is commonly said- statistics have nothing to say about specific past facts, since they deal with populations or sets of events and –moreover- are oriented towards the future rather than towards the past. This does not prevent, of course, the reference to statistics in the analysis of the evidence, but it shows that *naked* statistics cannot be taken as an autonomous and sufficient item of evidence.

A more positive and fruitful approach to the problem of the judicial use of statistics requires a due consideration of the inferences by which evidence is connected to a conclusion concerning the facts in issue. The set of such inferences is sometimes very complex and may be analyzed by means of different logical models.

One of these models is the Hempel's model of a *nomological-deductive* inference. This kind of inference is so called because it connects a premise with a conclusion on the basis of a *general covering law*, and therefore the conclusion is certain in a *deductive* way. So far, however, we are simply dealing with a modern version of the Aristotelian syllogism, and there is no problem of statistics. The problem arises when the reference is made to a *quasi* nomological-deductive model, that is to a *probabilistic* version of the original model. It happens when there is not a covering general law, but there is a *statistical frequency* of the connection between premise and conclusion, and such a frequency has a specially high value (of 90% or even more). In such a case it is said that the conclusion may be considered as *practically certain,* since its truth is highly probable. There are, however, some criticisms that can be addressed to this theory. On the one hand, it may be said that it does not represent what normally happens in judicial contexts, where the reference to general laws, but also to very high probabilities, is not impossible but is not frequent. Then this model cannot be taken as a general model of judicial inferences.

On the other hand, the role of statistics in such a model deserves to be properly defined. It seems clear that if there are statistics suggesting that A provokes B in 95% of the cases, it provides a good reasonable justification for believing that most probably A provoked B also in the specific case. But it would be incorrect to say that in such a case the occurrence of B has a 95% probability, since statistics provide frequencies but do not say anything about a specific instance. Rather, it could be said that in such a case the statistical frequency offers a nice justification for a *practical decision*. In other words, a judge would be reasonably justified in taking the conclusion of the inference *as if* such a statement were true, and to behave as if it were true.

It seems, therefore, that the reference to statistics may have a relevant role in providing a rational justification for judicial decisions, bur here a further problem arises. Actually such a justification may be rational when the probability at stake is very high (that is when the statistical information is *quasi general*) mainly because in such cases the rate of error is very low, and then the probability of a wrong decision is also very low, or at any rate tolerable. But what about the much more frequent case in which the statistical frequency is lower (for instance, of 80% or 70%), and then taking the conclusion of the inference "as if it were true" has a much higher probability to be wrong? Moreover: what about the case in which the statistical frequency is low or very low (for instance 30% or 20%), with the corresponding high probability of error concerning the conclusion? In a sense, it could be roughly said that the *degree of confidence* (or of *belief*) in the truthfulness of the conclusion de-

pends on the degree of probability of the statistics that are used as the basis of the inference.

This does not mean that only statistics with high probabilities should be used, since also low probabilities may be useful. However, an important aspect of the problem is whether and when statistics may or may not be sufficient to achieve the standard of proof that is required in each specific case although it may be admitted that even "low" statistics may be relevant in reaching a conclusion about the facts in issue.

4.1. A doubtful case: toxic torts

Toxic torts are the domain in which the reference to statistics, mainly provided by epidemiology, is most frequent. However, it is also the domain in which the use of statistical evidence raises several problems.

First of all, it is commonly said that in the cases concerning toxic torts the general causation about the toxic effects of the use of dangerous medicaments or of the exposure to dangerous materials needs to be properly demonstrated, and then that also the specific causation of such effects in individual cases needs to be proven. As to the proof of general causation there are no special problems since statistics may provide such a proof. The problem arises concerning the proof of specific causation: it is usually said that statistical probabilities have nothing to say about specific causation, but sometimes it is also said that statistics *may* prove such a causation, since they could provide a proof that achieves the civil standard of the preponderance of evidence, that is a probability of at least 51%. This theory has been accepted by several American courts. The main argument is –in extreme synthesis, the following: if the *relative risk* of disease of those who used a medicament or were exposed to a dangerous material is two times the risk of the non-users or unexposed, *therefore* in such cases there would be a proof of the specific causation in the individual cases, because the standard of the more probable than not has been achieved. Moreover, sometimes it is said that the statistics showing the *double risk* are a *sufficient* proof of the specific causation, and sometimes it is even said that such statistics are *necessary* to prove such a causation.

There is no need to develop here a thorough analysis of this argument, but some critical remarks are necessary. First of all, one may be inclined to believe that if –for instance- the non-users of the medicament or the nonexposed suffer the disease in the proportion of 5%, and the users or the exposed suffer the same disease two times more (that is with a risk of 2), the outcome would be that for the users or the exposed the risk of such a disease is of 10%, but this would not say anything about the specific causation concerning particular individuals. It would just be an information about the general causation in the population of the users or of the exposed, but nothing more. After all, a probability of 10% of risk for users and exposed may be relevant within the

general assessment of evidence, but it is in no way equivalent to a probability of 50% in any case of specific causation.

On the other hand, even admitting that the double risk produces a probability of 50% in specific cases, this does not mean that the standard of the preponderance of evidence (or of the more probable than not) is achieved: 50% is not preponderant upon another 50%, then with 50% of probability the proof is not achieved.

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