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Historical narratives, evidence, and explanations

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ABSTRACT. The aim of this paper is to analyze the logic of evidential reasoning that is based on explanations of particular events. It will be argued that a pragmatic approach to explanation is best suitable for evidential reasoning, given the role empirical and common sense generalizations play in the explanation of historical events. Common sense generalizations will be interpreted as definitional truths in idealized models and it will be shown how this interpretation can make sense of the way such generalizations are used in order to provide explanations.

1. Historical narratives and their evidence

A *story* is a hypothetical historical narrative describing a process, or a narrative of particular events arranged in time and forming a meaningful totality. Historians tell stories to provide understanding of the past and use narratives as a way of explanation: "A narrative explanation, presumably, presents an account of the linkages among events as a process leading to the outcome one seeks to explain" [Roth, 1988, p. 1]. William Whewell's term '*colligation*' has been borrowed by William Henry Walsh to describe "the procedure of explaining an event by tracing its intrinsic relations to other events and locating it in its historical context" [Walsh, 1951, p. 59]. 'Historical' or 'genetic' explanations are also used in evolutionary biology [Schaffner, 1993, p. 325-61].

The *naturalist tradition* maintains that explanation (and prediction) in the social sciences haves the same logical structure as in the physical and biological sciences. Social sciences explanations are arguments (either deductively valid or inductively strong) that involve laws. According to the S-R model of explanation [Salmon, Jeffrey, Greeno, 1971], or to the D-N-P model [Railton, 1978], explanations are not arguments and the *explanandum* can be given a low

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probabilty by the *explanans*, even though good explanations should be *nomic* explanations. One can tell stories, but there are no narrative explanations: it is the associated theory which provides what explanatory insights we have into the story.

Defenders of narratives as explanations acknowldge that good narratives must be supported by *evidence*: "Narratives are constrained by the facts, since they are constructed from verifiable statements. They are subject to objective evaluation […] [but] as is to be expected, are underdetermined by their evidence, agreement on evidence still allows for the construction of logically incompatible histories" [Roth, 1988, p. 13].

My topic is not to argue whether narratives are good explanations or not, but to support the claim that providing good evidence-based 'stories', whatever their explicative power is, entails providing explanations of particular facts, for evidence is a matter of *explanation*, even though 'good' explanations are not necessarily 'covering laws' explanations (but they may be). I shall start from a remark made by Hempel in his seminal 1942 paper about the role of laws in history.

"Even if a historian should propose to restrict his research to a 'pure description' of the past, without any attempt at offering explanations or statements about relevance and determination, he would continually have to make use of general laws. For the object of his studies would be the past – forever inaccessible to his direct examination. He would have to establish his knowledge by indirect methods: by the use of universal hypotheses which connect his present data with those past events. This fact has been obscured partly because some of the regularities involved are so familiar that they are not considered worth mentioning at all; and partly because of the habit of relegating the various hypotheses and theories which are used to ascertain knowledge about past events, to the 'auxiliary sciences' of history. […] the separation of 'pure description' and 'hypothetical' generalization and 'theory-construction' in empirical science is unwarranted; in the building of scientific knowledge the two are inseparably linked" [Hempel, 1942, p. 48].

In the same years, the historian Marc Bloch wrote that: "Qu'il s'agisse des ossements murés dans les remparts de la Syrie, d'un mot dont la forme ou l'emploi révèle une coutume, du récit écrit par le témoin d'une scène ancienne ou récente, qu'entendons-nous en effet par *documents* sinon une 'trace', c'est-à-dire la marque, perceptible aux sens, qu'a laissée un phénomène en lui-même impossible à saisir ? Peu importe que l'objet originel se trouve par nature inaccessible à la sensation, comme l'atome dont la trajectoire est rendue visible dans le tube de Crookes – ou qu'il soit seulement devenu tel aujourd'hui par l'effet du temps, comme la fougère, pourrie depuis des millénaires, dont l'empreinte subsiste sur le bloc de houille ou comme les solemnités tombées dans une longue désuétude que l'on voit peintes et commentées sur les murs des temples égyptiens.

Dans les deux cas, le procédé de reconstitution est le même et toutes les sciences en offrent de multiples exemples"[Bloch, 1949, p. 21].

It s not a mere concidence that we can find these parallele remarks made in the same years by a logical positivist and a historian who was among the founders of the *Annales* school of historiography. Bloch's book was a *manifesto* for a new historical methodology that aimed to overcome the dualism between *Geistwissenschaften* and *Naturwissenschaften*, and the author's was well aware of the new role assigned to probability by statistical mechanics and quantum theory in scientific explanations. *Interpretivists* [Collingwood, 1946] were putting forward another version of this old dualism, claiming that explanations of human behavior are structured differently from explanations of the behavior of physical objects since human behavior consists of *actions* done for reasons rather than events resulting from causes. Collingwod made a distinction between the *outside* and the *inside* of an event. By the 'outside' of an event, he meant its physical properties as the spatial and temporal location and the fact that bodies are actors in events: for example, the passage of Caesar across the river Rubicon at a certain date. By the 'inside' he meant the mental properties of the actors, as Caesar's intention to defy Republican law. An action is the unity of the outside and the inside of an event and the historian's task is to study actions, thinking himself into this action, and discerning the thought of its agent. Only the outside of an event can be linked by universal hypotheses to another physical event, a trace, because both are physical events, and there is a natural process connecting them: the passage of Caesar across the river Rubicon was a physical event that may have left physical traces. A historical process is a process of thoughts, but did Caesar's beliefs and desires leave physical traces as well?

We can answer in the affirmative if we take actions as *classes of events*, because also actions occur and they have relatively clear beginnings and endings and (unclear) spatial boundaries [Thomson, 1977]. Actions can be causes of which events are effects, but, if Donald Davidson is right, we cannot have 'covering laws' of the kind Hempel was looking for: there are causal laws connecting reasons and actions but they cannot be psychophysical laws, and they cannot have the form of statements asserting a regular connection between a psychological cause and an action, viz. any person who is disposed to act rationally will, when in situation of type *A*, usually do *B* [Davidson, 1980; 1993].

Interpretivists also can answer in the affirmative. William Dray, for example, in denying that the covering law model was apt to the explanation of human behaviour, acknowledged that this explanation "has an inductive, empirical side, for we build up to explanatory equilibrium *from the evidence*. To get inside Disraeli's shoes the historian does not simply ask himself: 'What would I have done?'; he reads Disraeli's dispatches, his letters, his speeches, etc. – and not with the

purpose of discovering antecedent conditions falling under some empirical validated law, but rather in the hope of appreciating the problem as Disraeli saw it. The attempt to provide rational explanation is thus – if you like the term – 'scentific explanation' in a broad sense" [Dray, 1957, p. 131]. How this "inductive, empirical" work on evidence is done? The inference process which provides the factual information for rational explanations must use some empirical generalizations and they are exactly the same kind of generalizations Dray thought were of little or no importance in understanding human behaviour. It is true, though, that these empirical generalizations do not satisfy the scientific standards Hempel was aiming to.

Social constructivism and *Hermeneutics* take the task of social scientists to interpret the social discourse. In their most radical versions, they have claimed that there is no a *logic of evidence*, but only a discursive practice that create 'facts'. External factors, social and political, not only determine what interpretive and explanatory hypotheses will be taken seriously and accepted, but also what data will be construed as evidence. "With the decline of the positivist tradition in the philosophy of science […] the status of scientific rationality was profoundly problematized. The resulting emphasis on the primacy of the theory, combined with the attempt to give sociological accounts of science that put 'good' and 'bad' science on completely equal footing, threatened to reduce the role of evidence, facts, and proof to the point of nonexistence" [Chandler, Davidson, Harootunian, 1994, p. 5].

After post-modernist hang-over one can recognize, with the historian Carlo Ginzburg, that "The fashionable injunction to study reality as a text should be supplemented by the awareness that no text can be understood without a reference to extratextual realities. Even if we reject positivism, therefore, we must still confront ourselves with notions like 'reality', 'proof' and 'truth'. […] We can conclude, therefore, that the tasks of both the historian and the judge imply the ability to demonstrate, according to specific rules, that *x* did *y*, where *x* can designate the main actor, albeit unnamed, of a historical event or of a legal act, and *y* designates any sort of action. But sometimes cases a judge would dismiss as juridically nonexistent turn out to be fruitful to a historian's eye" [Ginzburg, 1994, p. 295-6].

The comparison between the work of the historian and the work of the judge is a classical topic, but it is particular meaningful because it is precisely in the field of the law that the logic of evidence has been recently the object of thorough attention. The early attempt by John Wigmore to develop a diagrammatic approach to the analysis and presentation of legal arguments has been renovated by the so called *New Evidence Theory* of David Schum and William Twining, taking advantage of the new logical and computational resources offered by *Graph Theory* and *Bayesian*

Networks [Wigmore, 1937; Schum, 1994; Kadane, Schum, 1996; Anderson, Twining, 1998; Anderson, Schum, Twining, 2006; Twining, McCrudden, 2006].

"What we might call the Wigmorean view can be restated as follows: in the context of an argument about a question of fact every inferential step from evidence to *interim* proposition to ultimate *probandum* or hypothesis requires a warrant. Such warrants typically takes the form of 'background generalizations'" [Twining, 2003, p. 99]. These *background generalizations* are "derived from the 'stock of knowledge' that is more or less shared in the relevant society or community. The stock of knowledge may vary in respect of perceived reliabilty from scientifically established laws through experience-based generalizations to sheer speculation or prejudice" [Twining, *ibid.*]. The term 'warrant' is borrowed by Stephen Toulmin's path-breaking work on the analysis of arguments [Toulmin, 1958]. Toulmin's account was based on the *datum-warrant-claim diagram*. The claim is the conclusion of the argument which is supported by the datum, and the warrant provides justification for the statement that the datum supports the claim. Warrants can be scientific laws as well as common sense generalisations, and they are what, in another context, Alison Wylie calls "linking principles": "the various kind of background knowledge – the linking principles, 'middle-range theory' – that mediate the interpretation of archeological data as evidence and establish a connection between surviving archaelogical traces and specific events and conditions in the past that are thought to have produced them" [Wylie, 1996, p. 755].

It is worth to mention another approach to legal argumentation, *Anchored Narratives Theory*, according to which judicial proof proceeds by constructing alternative stories in which the sequence of events is glued by causal or intentional connections, and the elements of a story are anchored in the available evidence by means of generalizations that express how observations can be inferred from evidential sources by means of defeasible argumentation [Wagenaar, van Koppen, Crombag, 1993].[1]

From these recent works the topic of evidence emerges as "as a multi-disciplinary subject [that] is about inferential reasoning. The common ground is some general philosophical issue about logic, probability, truth and knowledge. 'Evidence' is a word of relation used in the context of argumentation. (*A* is evidence of *B*) In that context information has a potential role as relevant evidence if it tends to support or tends to negate, directly or indirectly, a hypothesis or *probandum*. One draws inferences from evidence in order to prove or disprove a hypothesis or *probandum*. The framework is argument, the process is proof, the engine is inferential reasoning from information" [Twining, 2003, p. 97]. The remarks made more than fifty years ago by Hempel and Bloch maintain their validity and relevance: "Problems of evidence and inference could not be kept

[1] Recent works on defeasible reasoning are Prakken, G. Vreeswijnk [2002], and Walton [2006].

separate from questions about interpretation and narrative." [Twining, Hampsher-Monk, 2003, p. 7].

2. The logic of historical evidence

The evidential reasoning of the historian and the judge seeks for a connection between a particular observed event, described by a proposition *E*, and another, not observed, particular event that occurred in the past, described by a proposition *H*. Archeological data, DNA data, eye-witness reports, written documents are observable events. Hearsay testimony must be reported by someone. Missing documents must have left surviving traces which allow to say that they existed in the past. Missing data can have an evidential import precisely through the circumstance that certain facts that should have been expected did not occur and someone or something must bear testimony that they did not occur. *Historical evidence* is not confined to historians and judges. Life sciences are trying to recostructing the evolutionary past of living species, a growing and important amount of data of today physics are traces left by past events in history of the Universe.

Which kind of connection must exist between a known proposition *E* and an uncertain proposition *H*, in order to be able to say that *E* is (historical) evidence for *H*? Why does (or should) one believe that *H* is (possibly) true, knowing that *E*? A widely accepted answer to this question, one that goes back to William Whewell, is: because *H* is a *possible explanation* of *E*. According to this answer, *E* is evidence for *H* if there exists an *explanatory relation* between *H* and *E* [Harman, 1965; Lipton, 1991; Achinstein, 2001]. Another way of saying the same thing, that is rather popular among the scholars of evidence, is saying that *E* is evidence for *H* if *H* can be *abductively inferred* by *E*. What they have in mind is really *inference to the best explanation*, as it is shown in the following passages by two representatives of the *New Evidence Theory*, Terence Anderson and William Twining. They equate the *probandum*, the hypothesis put forward by the proponent of evidence in an adversarial legal trial, with the *explanans*, and the *probans*, the evidentiary facts, with the *explanandum*.

"Does the evidentiary fact point to the desired conclusion (not as the only rational inference, but) as the inference (or explanation) most plausible or most natural out of the various ones that are conceivable? Or (to state the requirement more weakly), is the desired conclusion (not the most natural, but) a natural or plausible one among the various conceivable ones? […] How probable is the *Probandum* as the explanation of this *Probans*?" [Anderson, Twining, 1998, p. 71].

The task of the opponent is to provide an alternative explanation for the evidentiary fact: "its force may now be diminished or annulled by showing that some explanation of it other than the proponent's is the true one. Thus every sort of evidentiary fact may call for treatment in a second aspect, by the opponent, viz.: What are the other possible inferences which are available for the

opponent as explaining away the force of the fact already admitted" [Anderson, Twining, 1998, p. 73].

In this view, 'evidence' is a matter of degrees, and "its force" is determined by the interplay of competing explanations. Peter Achinstein's proposal for taking into account the quantitative aspect of evidence consists in requiring that the explanation must be true with high probability: *E* is *potential evidence* that *H* if and only if *E* is true, and *E* does not entail *H*, and the probability that there is a *true explanatory relation* between *H* and *E*, given *E*, is greater than 1/2. [Achinstein, 2001, p.160-4; p. 170]. He is able to show that this definition implies that the probability of *H* given *E* is greater than 1/2.

Therefore, if we want to follow Achinsten's proposal, the answer to the question: Why does (or should) one believe that *H* is (with probability > 1/2) true, knowing that *E*? would be: Because there is, with probability > 1/2, a true explanatory relation between *H* and *E*.

Achinstein's definition of potential evidence is too strong and, under a liberal reading of what might count as an explanatory relation, raises a troublesome issue. As far as the latter point is concerned, a true explanation might be a causal explanation.[2] In such a case we are talking of a casual relation holding between particular events, and the probability that such a relationship exists cannot be a subjective probability (because it must be a *true* relation). Now, unless the relationship at hand is deterministic, derivation of the probability of the existence of a causal relationship between particular events from statistical correlations is a difficult problem [Pearl, 2000].

With regards to the first point, namely, that the definition is too strong, IBE theorists, and Achinstein with them, are taking 'evidence' as meaning *strong positive* evidence, that is, evidence that raises the probability of the hypothesis at hand beyond a given threshold. This understanding of 'evidence' is coherent with the philosophical point of view according to which believing is an 'all-or-nothing' matter: one can believe that a proposition is true only if its probability is great enough. Indeed, in Achinstein's view, *E* is evidence for *H* if *E* gives a *good reason* to believe that *H*, and, of course, *E* cannot be a good reason to believe that *H* is false, so that the probability of *H* given *E* must be greater than 1/2 [Achinstein, 2001, p. 7].

What is called 'identification evidence' offers a counterexample to Achinstein's definition of potential evidence. The so called "island problem" [Egglestone, 1983, Appendix 3] is a toy example that illustrates the basic structure of any identification problem. A murder has been committed in an island, on which *N* male inhabitants remains. A totally reliable eye-witness has seen the murderer running away and he was bald. Horace is bald and the probability that *another*

[2] Achinstein refers for the definition of a true, or "correct", explanation to his own illocutionary approach to the theory of explanation which is neutral on the kind of the purported explanatory relation [Achinstein, 1983].

random male in the island is bald is *P*. Let *H* the proposition stating that Horace is guilty, and let *E* be the proposition stating that the man seen by the eye-witness was bald. Is *E* potential evidence that *H*? Why has this event occurred, namely the observation, spatially and temporally located, of a bald man running away? One possible answer is that *H* is true, and the explanatory connection would be deductive. Achinstein shows [Achinstein, 2001, p. 155] that *E* is evidence that *H*, only if:

(1) p(there is an explanatory connection between *H* and *E*| *H* & *E*) □ $p(H|E) > 1/2$.

In our example:

(2) p(there is an explanatory connection between *H* and *E*| *H* & *E*)=1.

Therefore, *E* is evidence that *H*, only if $p(H|E) > 1/2$. The posterior probability is given by: [3]

(3) $p(H|E) = 1/(1 + NP)$

Let's take $N = 100$ and $P = 0.04$. Then, $p(H|E) = 1/5$, and *E* is *not* potential evidence according to Achinstein's definition.

This is clearly absurd, and saying that *E* is not a *good reason* cannot help. Knowledge of *E* raises the probability of *H* from 1/100 to 1/5, and it seems reasonable to say that it is rather 'good' evidence, even though far from being decisive. The example shows the fundamental problem of any definition of evidence that makes use of a probability threshold: something that is not evidence suddenly becomes evidence and *viceversa*. This is contrary to a common understanding of 'evidence' as is esemplified by the *U.S. Federal Rule of Evidence 401*: "Relevant evidence means evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable that it would be without the evidence" [Muller, Kirkpatrick, 1988, p. 33].

It must added that the common understanding of the term 'probability' in the context of the Law of Evidence is not Bayesian: it is not the standard view in this field that degrees of 'probabilities' must obey the rules of mathematical probability. But, whatever the meaning of 'probability' is, *E* is understood as evidence for *H* if *E* is able to change the degree of belief that the fact finder entertains about *H*. It is true that there are thresholds in the common understanding, for example, in the field of law, the '*preponderance of evidence*' and the '*beyond any reasonable doubt*' standards. But they are better interpreted as decision-making thresholds, taking into account

[3] The posterior odds are:

$$\frac{p(H \mid E)}{p(not-H \mid E)} = \frac{p(E \mid H)}{p(E \mid not-H)} \times \frac{p(H)}{p(not-H)} = \frac{1}{P} \times \frac{1}{N} = \frac{1}{NP}$$

Thus, the posteror probability that Horace is guilty is:

$$p(H \mid E) = \frac{1/NP}{1+(1/NP)} = \frac{1}{1+NP}$$

not only the probability of competing hypotheses but also the value of the consequences of alternative decisions [Kaye, 1999].[4]

The existence of an explanatory connection between hypothesis and evidence is a necessary but not sufficient condition, because there may be different potential explanations of the hypothesis. The condition that the hypothesis is more probabile than not upon evidence is too strong to account for common usage of the term 'evidence'. On the other hand, probabilistic relevance is a necessary but not sufficient condition. The 'probabilities' addressed by Rule 401 are subjective degrees of conviction with which an individual believes in a proposition. Different individuals can disagree whether a certain evidence is relevant for the hypothesis, or about its degree of relevance. What can be required is anybody having a *good reason* for believing that a certain evidence is relevant for the hypothesis. A good reason is that the hypothesis is a potential explanation of the occurrence of the event that counts as evidence.

In the context of evidential reasoning, an 'explanation' is an answer to a *why-question*: why did this particular event occur? Why the running away man was bald? Why in this sample of a thin band of reddish clay, the amount of iridium is more than three hundred times normal levels (the question geologist Walter Alvarez and his father, the physicist Luis Alvarez asked in 1978)? Why is this antenna troubled by a uniform background noise, seemingly coming from every point in the sky, night and day (the question Arno Penzias and Robert Wilson tried to answer in 1965). Maybe not any explanation is an answer to a why-question, but in evidential reasoning any explanation is an answer to a why-questions. Another important point is that, in evidential reasoning, explanations make use of the pertinent 'scientific' explanations, depending on the context and pragmatic interests. For these reasons a modified version of van Fraassen's pragmatic model of explanation seems to be well suitable to characterize the explanatory relations existing between an observable event and another event that occurred in the past [van Fraassen, 1980].

A why-question, according to Van Fraassen, is posed in a context that is determined by the *topic* of the question, a proposition E, with its associated *contrast-class* X that includes some other propositions E_1, E_2, …, alternatives to E; and by the body of background knowledge K. A why-question arises in a given context if K entails that E is true, and there is at least one true proposition H, compatible with K, that bears a *relevance relation* R to the couple $\langle E, X \rangle$. The canonical form of an answer to the question 'Why E instead of E_1 or E_2 or …?' is: 'E instead of e_1 or e_2 or …, because H'. We shall say that H is (*potentially*) *explanatory relevant* for E if the following conditions hold:

[4] For a criticism of this view-point, see [Laudan , 2006].

(a) *E* is true;

(b) *H* bears *R* to □*E*, *X*□;

(c) *R* is a *warranted* relevance relation,

. Then, an adequate *explanandum* for '(historical) evidence' would be as follows. A particular proposition *E* is *evidence* for another particular proposition *H* if and only if:

(i) *H* is *explanatory relevant* for *E*;

(ii) *H* is *probabilistically relevant* for *E*.

Condition (*c*) is an addition to the original Van Fraassen's formulation, who did not pose any condition to the relevance relation *R*. This has been criticized on the grounds that, accepting van Fraassen's weak definition, one is running the risk of wrecking against "the *Scylla* of the 'anything goes' theory of explanation" [Kitcher, Salmon, 1987]. On the other hand, adding the condition that the relation *R* should be a "genuine" scientific relation, one is sailing against the *Charibdys* of a useless relation of explanatory relevance. Most of our evidential reasoning relies on, and it cannot help to rely on, rough-and-ready *common sense generalizations*.

"In arguments about evidence, several different kinds of *general propositions* play an important role both as discrete steps in an argument and as *background knowledge*. […] *scientific truths* (such as the law of gravity) *common sense generalizations* (such as that running away is indicative of a sense of guilt), *commonly held beliefs* (such as national or ethnic stereotypes, including prejudices, that suggest that a person of such origins has certain characteristics), and *general background information* bearing on the present case (such as a *generalization* about *X*'s habits or *Y*'s character)." [Anderson, Twining, 1998, p. 43]. The scope of common sense generalizations is wide.[5] "In law or medical diagnosis ot historical inquiry, in considering a particular case calling for judgment about a particular event or situation, insofar as the issue is susceptible to rational argument, the main distinction is not between scientific and intuitive (or subjective) judgment. Rather it is between different kinds of generalization (scientific, common sense, case-specific) and particular items of information all of which have evidential functions in the context of an argument and all of which are subject to critical appraisal in respect of their evidential credentials – viz. relevance, credibility and probative force. […] in most context, 'evidence' cannot be restricted to 'hard' scientific data." [Twining, 2003, p. 95-6].

In order to be able to sail in the channel between *Scylla* and *Charibdys*, I take the stance that Kitcher and Salmon have called "modest relativism" [Kitcher, Salmon, 1987. By "a *warranted*

[5] Italian and German legal literature use two technical terms to denote common sense generalizations: *massime di comune esperienza* and *erfahrungssätze*.

relevance relation" I shall intend a relevance relation that, "for some particular science(s) and period of interest" is accepted as a "genuine" explanation. There is no danger of circularity because, as I have already pointed out, in evaluating historical evidence one is a customer of 'scientific' explanations, and not a producer.[6]

3. Scientific laws and common sense generalizations

Scholars of evidence in the law have provided a provisional taxonomy of general statements. The basic distinction is between scientific, common sense, experience-based and case-specific generalizations [Anderson, Schum, Twining, 2006, p. 265-76]. Scientific generalisations are based upon the 'laws of science'. Case-specific generalizations are those that are or may be established upon evidence present in a particular case, as for example, X behaves regularly in a certain way. Experience-based generalizations are generalizations that are the product of direct individual experience, even though some of them may be widely shared in a community, as, for example, experience-based knowledge of policemen, fingerprints experts, physicians, art critics and *connaisseurs*. Common sense generalizations are so widely accepted in the particular community that they often appear in arguments only implicitly as, for example, "the leading principle of folk psychology" [Rosenberg, 1995, p. 31] that "if any agent *X* wants *A*, and if *X* believes that *B* is a means to attain *A* under the circumstances, then X does *A*". Many common sense generalizations are general statements of the form 'if *A*, then *usually* (*sometimes*, *typically*, *frequently*) *B*' as, for example, the statement that 'a veracious eye-witness will usually tell the truth'. Also many generalizations of the special sciences have this form.

There are two possible readings of such statements. The first is to consider them as *probabilistic laws*: 'if *A* then *in most cases* (*in few cases*) *B*'. There are statistical laws in social sciences and they play an important role in evidential reasoning, but common sense generalizations are *not* statistical laws. We don't have any statistics about the frequency with which veracious eye-witnesses tell the truth, nor about the frequency with which agents who wants *A* do *B*, because 'veracious' eye-witnesses tell the truth, and '*rational*' agents behave according to their wishes, *by definition*. What it does make sense is to say that one can have a high *subjective*

[6] The problem of which relevance relations are 'genuine' is well known and it is the object of a never-ending debate in the Law, see [Jasanoff, 1995; Hack, 1998]. A famous, and widely discussed, rule by the U. S. Supreme Court in 1993, the *Daubert Rule*, figures out a role of scientific gatekeeper for the judge when it states that: "Faced with a proffer of expert scientific testimony […] the trial judge […] must make a preliminary assessment of whether the testimony's underlying reasoning or methodology is scientifically valid and properly can be applied to the case at issue. Many considerations will bear on the inquiry, including whether the theory or technique in question can be (or has been) tested, whether it has been subjected to peer review and publication, its known or potential error rate, and the existence and maintenance of standards controlling its operation, and whether it has attracted widespread acceptance within a relevant scientific community" [*Daubert v. Merrel Dow Pharmaceuticals*, 509 U. S. 579, 1993].

probability that *this particular* witness is *veracious* and, therefore, he's telling the truth, and that *this particular* agent is *rational* and that, in *those* circumstances, wanted *A*.

The second understanding of 'if *A* then usually *B*' statements is that they bear an unstated *ceteris paribus* clause excluding a (potentially endless) list of conditions: saying that 'if *A* then usually *B*' would not be different in meaning from a universal statement with an 'other things equal' clause: '(*ceteris parbus*) if *A* then *B*'. Starting from Hempel's paper on *provisos* and Nancy Cartwright's provocative theses [Hempel 1988; Cartwright 1983], the nature of *ceteris paribus* laws has been an important issue in philosophy of science and in the philosophy of special sciences. Many authors have reached the conclusion that 'bad news, good news' (for social sciences generalizations): "*Ceteris paribus* clauses surely do plague the social sciences. That, however, does not separate them from the natural sciences, for *ceteris paribus* clauses are endemic even in our best physics" [Kinkaid, 1996, p. 64].[7]

Common sense generalizations of the form 'if *A* then usually *B*' are not cp generalizations. There are two readings for cp generalizations: either they can be reduced to probabilistic laws, or they are *incomplete* generalizations. I don't consider here the traditional distinction between 'lawlike generalizations' and 'contingent generalizations' because the consideratons that follow apply to both, and, according to my "modest relativist" view of explanatory relevance, warranted contingent generalizations can be used in evidential reasoning. If cp generalizations can be reduced to probabilistic laws, then the above made remarks will hold. If they are *incomplete* generalizations, then common sense generalizations are *not* cp general statements.

The only non trivial way of completing a cp generalization would be to formulate some conditions in the language of a more basic scientific theory, what Jerry Fodor has called *completers* [Fodor, 1991]. Let's take the generalization that a veracious eye-witness usually tell the truth. Being 'a veracious eye-witness' is a mental state, and it means having the intention to tell what one believes. This generalization is always implicitly used in the inference from the event that *X* says that *H* occurred to the event *H*. Actually, it is a kind of *prima facie* generalization that can be further analyzed in terms of the "leading principle": 'if *X* wants to be cooperative, and if *X* believes that *H* occurred and that saying that *H* is a means to be cooperative under the circumstances, then *X* says that *H* occurred'. Let suppose we are able to give completers for such a generalization, so that a complete scientific answer to the question 'why does *X* say that *H*?' will be: because *H* and (a long conjuncton of universal and/or statistical laws *plus* statements of antecedent conditions). Would such a kind of answer be more satisfactory than the answer: because *H*, and *X* is a veracious eye-witness? The second answer seems to be a *good* explanation,

[7] For a different view see [Earman, Roberts, 1999].

in a context where it is a fact finder who is asking the question, and given that the truth conditions of the two answers would be the same.

There is a third possibile interpretation of common sense generalizations which it is helpful for understanding the role they play in evidential reasoning. Some authors have put forward the idea that intentional psychology is a family of *models*, following Ronald Giere's model-based approach to understanding scientific theories and scientific 'laws' [Maibom, 2003; Godfrey-Smith, 2005; Menzies, forthcoming; Giere, 1988, 1999; Teller, 2001]. In this view, scientific laws are neither exceptionless nor *ceteris paribus* generalizations, but are *stipulative definitions of idealising models* that provide simplified representations of, and are *similar* to, actual complex systems.

Peter Menzies shows as these models, which contain *a priori* definitions, can be used to make *empirical* predictions and explanations. He gives the example of the folk psychology model of rational agency. The generalization "if any agent *X* wants *A*, and if *X* believes that *B* is a means to attain *A* under the circumstances, then *X* does *A*" is a *definitional truth*, but we can apply it to a real-world situation because we made what Giere calls a "*theoretical hypothesis*", which specify the relevant aspects under which the model of rational agency is similar to the intended real-world situation, and the degrees of similarity. In this case, the theoretical hypothesis would be Peter "is a rational agent, or is close to being one in respect of basic deliberative psychology" [quoted with the author's permission from Menzies, forthcoming]. This is an empirical hypothesis that licenses the empirical conclusion that, if Peter wants *A*, and if Peter believes that *B* is a means to attain *A* under the circumstances, then Peter does *A*.

I think that Menzies' proposal is plausible provided that 'models' are intended in a broad sense as 'schemas' or 'scripts'. There is empirical evidence that jurors reasoning can be arranged in the form of 'stories' that very often fit standard schemas or models that represents what 'typically' happens in the world according to their knowledge [Hastie, 1993; MacCrimmon, 2001]. Sometimes the 'schema' of a story can be summarized in a single sentence that can be generalized under the form of a general normative proposition [Twining, 2007, p.175]. Although folk 'models' are not explicitly stated in propositional form, educated people like historians, judges and scientists (and philosophers), who have to perform inferential tasks, must give to these models a linguistic disguise. In evidential reasoning this 'rationalization' of common sense knowledge takes the form of the development of a chain of reasoning *H*, *A*, …, *F*, *E*, linking evidence with the hypothesis to be proved, where each step of reasoning is supported by one or more generalizations that provide an appropriate *relevance relation* between two reasoning stages: "We assert a generalization *G* which we believe links *E* and *F*, and then we put this generalization to the test by collecting *n*

items of ancillary evidence […] This ancillary evidence together with the generalization being tested forms the basis of our epistemic assessments of likelihoods" [Kadane, Schum, 1996, p. 268-9].

Common sense generalizations "if *A* then usually *B*" must be intended as generalizations which are true in idealised models that are applied to the particular situation at hand. "Testing" a generalization in this context plays the role of positing Giere's theoretical hypotheses which state the similarity of the model to the real system. "*Ancillary evidence*" mentioned by Kadane and Schum is evidence that bears upon the truth of theoretical hypotheses. In the example of the veracious eye-witness, the idealised model of a veracious eye-witness is a person who says what she believes. In such a model, the following generalization is *a priori* true: 'if *X* is a veracious eye-witness that believes that *H*, then *X* says that *H*'. Peter is a veracious eye-witness, and Peter believes that *H*: thus, he says that *H*.

We have an answer to the why-question: Why Peter says that *H*? (the contrast-class is says that not-*H*, says nothing), that is a *potential* explanation (Because he believes that *H* is true), and where the relevance relation is warranted by the appropriate generalisation.

How does this reading of common sense generalizations take into account the fact that their scope is reduced by a '*usually*' quantifier? A judgment of 'similarity' is a *subjective* judgment: one judges that a model is 'similar' to the real system *X* if one's *subjective probability* that Peter is a veracious eye-witness is high.

4. A paradigmatic case: testimony

An explicit statement of the fact that evaluation of the probatory value of testimony is based on IBE can be found in Wigmore: "A testimonial assertion comes, as evidence, in the same logical form as a circumstancial evidential fact; i. e., the form of proposed inference is: *A* asserts the existence of fact *X*; therefore, fact *X* exists. Hence, the problem of the cogency of this inference involves (as do all other judicial inferences) the question, How many and what other hypotheses there are which *explain away* the evidential fact of *A*'s assertion as due to some other causes than the existence of fact *X*? The evidential fact is simply that *A* makes the assertion; the problem is, Can it be explained away (e. g. by witness' bias), so that we need not accept fact *X* as the conclusion? Thus, the whole process of Impeachment or Discrediting of a witness, as known to practitioners, is nothing but the general logical process of Explanation. So, too, the process of Corroboration or support of a witness, is the logical process of closing up the possible avenues of Explanation, and thus making the proposed inference more and more necessary and unavoidable." [Wigmore, 1937, p. 310]. Gilbert Harman himself uses testimony as an example of IBE: "(i) we

infer that he says what he does because he believes it; (ii) we infer that he believes what he does because he actually did witness the situation which he describes. That is, our confidence in his testimony is based on our conclusions about the most plausible explanation for that testimony. Our confidence fails if we come to think that there is some other possible explanation for his testimony (if, for example, that he stands to gain a great deal from our believing him)." [Harman, 1965, p. 89].

The most sophisticated common-sense analysis of testimony has been provided by David Schum who has identified three basic attributes of the credibility of human witnesses: *observational sensitivity* or *accuracy*, *objectivity*, and *veracity* [Schum, 1994, p. 101-114]. An eyewitness *X* is accurate if her senses gave evidence of an event that actually occurred, and *X* is objective if she believes the evidence of her senses. According to this analysis, the chain of reasoning between the evidence and the hypothesis can be decomposed into three steps, and it can be represented by a *directed acyclic graph* (*DAG*) whose nodes are the hypothesis *H* that the event occurred, the hypothesis *S* that *X*'s senses gave evidence of *H*, the hypothesis *B* that *X* believes that the event occurred, and the observed event *E* that *X* says that *H* occurred.

FIGURE 1

The generalization supporting the explanation of *E* is formulated by Schum as follows: "any person who is an accurate eyewitness and who is objective and who is veracious will usually tell the truth" [Schum, 1994, p. 102]. According to the above proposed interpretation, this *prima facie* generalization can be divided into three more basic common sense generalizations which are true by definition in the idealised models of an "accurate", an "objective", and a "veracious" person:

(i) if *X* is an accurate person, then her senses gave evidence of what she sees;

(ii) if *X* is an objective person, then she believes the evidence of her senses;

(iii) if *X* is a veracious person, then she says what she believes.

The first attribute has to do with the physical state of the person at the time the event occurred and with the physical circumstances of its occurrence. The second attribute has to do with the psychophysical states of the person at times later than the occurrence of the event. The third attribute has to do with the intentional state of the person at the time she gave her testimony. Each

step of the inference chain in (Figure 1) is, therefore, a complex web of relations for which it would be very difficult to provide a complete explanation in Fodor's sense.

Assuming that these attributes can be considered as independent properties, then the following *DAG* can be drawn with binomial nodes *A*, *O*, and *V* representing the three "theoretical hypotheses" (Accuracy, Objectivity, Veracity) which need to be true in order to apply the models.

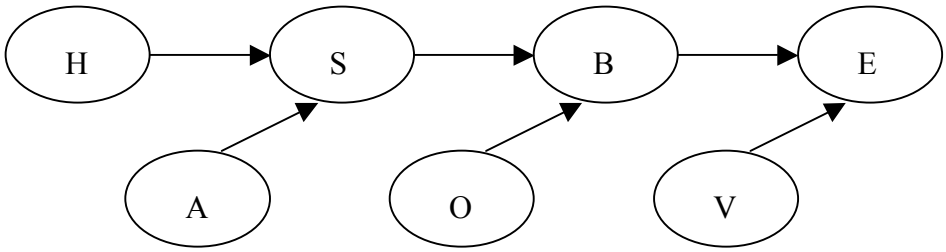

FIGURE 2

The *DAG* in (Figure 2) is a *Bayesian network* that allows to calculate a *posterior* probability for the node *H*, given that the node *E* is instantiated, provided the required probabilities are assessed. The initial probability of node *H* is the *prior* probability of event *H*; the initial probabilities of nodes *A*, *O*, and *V* will be based upon "ancillary evidence". Common sense generalizations (i) – (iii) give some of the required conditional probabilities:

(I) $p(S|H \,\&\, A) = p(\text{not-}S|\text{not-}H \,\&\, A) = 1$;

(II) $p(B|S \,\&\, O) = p(\text{not-}B|\text{not-}S \,\&\, O) = 1$;

(III) $p(E|B \,\&\, V) = p(\text{not-}E|\text{not-}B \,\&\, V) = 1$;

The real problem is to assess the probabilities of the "theoretical hypotheses" and the conditional probabilities in case the witness is not accurate, or not objective. The fact that it is difficult to assess these subjective probablities is the reason why we say that generalizations (i) – (iii) are *usually* true. One might use a kind of 'default assumption', as it has been made by the so called *Evidentiary Value Theory* [Gärdenfors, Hansson, N. E. Sahlin, 1983] and by other authors [Olsson, 2002; Bovens, Fitelson, Hartmann, Snyder, 2002]. If the witness is not accurate, or objective, then her answer might be considered, in a certain sense, a random answer, so that:

(IV) $p(S|H \,\&\, \text{not-}A) = p(S|\text{not-}H \,\&\, \text{not-}A) = 0.5$;

(V) $p(B|S \,\&\, \text{not-}O) = p(B|\text{not-}S \,\&\, \text{not-}O) = 0.5$.[8]

[8] If we use the values (I) – (V), and put $p(V) = 1$, what happens is that $p(H|E) = p(H)$. Therefore, the *rationale* behind the random answer assumption is that it agrees with common understanding: if a witness is not reliable for psychophysical causes, we wish to say that her testimony is not relevant. Bovens, Fitelson, Hartmann, and Snyder use

The analysis of the veracity attribute can be refined. Given that in *Bayes Nets* one can use multi-valued discrete nodes, node V might take, for example, three possible mutually exclusive states: V_1 = "X is disinterested", V_2 = "X is interested in affirming that H", and V_3 = "X is interested in negating that H". Then, particular instances of the "leading principle" would again yield some deterministic functions:

(VI) $p(E|B \,\&\, V_1) = p(\text{not-}E|\text{not-}B \,\&\, V_1) = 1$;

(VII) $p(E|\, V_2) = 1$;

(VIII) $p(\text{not-}E|\, V_3) = 1$.

What the exact values of these conditional probabilities are is not important for my point that the *Bayes Net* in (Figure 2) is an adequate representation of the common sense generalization that "any person who is an accurate eyewitness and who is objective and who is veracious will *usually* tell the truth". Indeed, without assuming that the generalizations involved are probabilistic laws, the likelihood $p(E|H)$ will be less than 1, provided that the probability of at least one of the states A, O and V_1 is less than 1. The adverb "usually" stands for a set of subjective probability judgments which it is difficult to make explicit.[9]

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a simple Bayes Net where there is only one node, say R, representing the reliability of the witness and a converging connetion $\{H \rightarrow E \leftarrow R\}$, but they are not concerned with the analysis of the reliability of witnesses.

[9] David Schum's original graphs were not *DAG*s and they did not allow to represent ancillary evidence within the usual *Bayes Nets* framework. On occasion he charted ancillary evidence on the same network, but he expressed scepticism about the feasibility of such an attempt [Kadane, Schum, 1996; p. 215-35; 270-1]. Recently, he has been following a different approach, evaluating separately the three attributes of human credibility, and then using that evaluation to estimate interval-valued likelihoods for the Bayes net in (Figure 1) [Schum, Morris, 2007]. Ancillary evidence can be further analysed using the technology of 'object-oriented Bayes Nets': nodes A, O and V can be, in turn, the root-nodes of other networks, which allow to calculate their posterior probabilities on the basis of evidence, and whose details are hidden from view until information on their structure is desired [Hepler, Dawid, Leucari, 2007].

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