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Good Reasoning on the Toulmin Model

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ABSTRACT: Some solo verbal reasoning serves the function of arriving at a correct answer to a question from information at the reasoner's disposal. Such reasoning is good if and only if its grounds are justified and adequate, its warrant is justified, and the reasoner is justified in assuming that no defeaters apply. I distinguish seven sources of justified grounds and state the conditions under which each source is trustworthy. Adequate grounds include all good relevant information practically obtainable by the reasoner. The claim must follow from the grounds in accordance with a justified general warrant. If this warrant is not universal, the reasoner must be justified in assuming that no exception-making circumstances hold in the particular case to which it is applied.

KEY WORDS: reasoning, Stephen E. Toulmin, good reasoning, justified conclusion, justified premiss, adequacy

INTRODUCTION

Stephen Toulmin (1958, 2003) advanced his model for the layout of arguments without providing criteria for evaluating arguments so laid out. Some criteria are given in his co-authored textbook based on this model (Toulmin, Rieke and Janik, 1978, 1984). For example, the authors prescribe (1984, p. 238) eight 'essential merits' of arguments: clarity on the kind of issues the argument is intended to raise, clarity on the underlying purpose of the argument, grounds relevant to the claim, grounds sufficient to support the claim, warrant applicable to the case under discussion, warrant based on solid backing, modality or strength of the resulting claim made explicit, possible rebuttals or exceptions well understood. But these conditions are underdeveloped. The textbook focuses rather on the structure of arguments and on the forms their components take in different fields.

Toulmin's model applies not only to arguments, whose authors address verbalized reasoning to someone else, but also to solo verbal reasoning, in which reasoners draw conclusions for themselves from information at their disposal. I shall propose evaluative criteria for such

reasoning. Solo verbal reasoning as I understand it must have some verbal components (merely thought, spoken aloud, written, signed, etc.) but can have non-verbal components. For example, its grounds can include non-verbal perceptual stimuli or non-verbal symbolic artefacts such as figures and drawings. In what follows, I shall use the unqualified term 'reasoning' as a convenient abbreviation for 'solo verbal reasoning' as just defined. I shall assume that the Toulmin model and its components (claim, grounds, warrant, qualifier, rebuttal, backing) are known, and shall propose criteria for good reasoning in terms of the components of this model. I shall use 'conclusion' as a synonym of 'claim' and 'premisses' as a synonym of 'data' or 'grounds'; the latter usage reflects my position (Hitchcock, 2003) that the warrant of an inference is not a premiss but an inference-license. I shall not discuss solo non-verbal reasoning.

Goodness of a kind is relative to function. A good eye is one that has characteristics that are sufficient for seeing well. A good bread knife is one that has characteristics that are sufficient for cutting bread well. Similarly, good reasoning is reasoning that has characteristics that are sufficient for accomplishing well the function of the reasoning. Reasoning in fact has many functions, for each of which there will be a correlative account of its goodness. I shall focus on one common function: to produce a correct answer to a question whose answer is not immediately obvious to the reasoner but may be inferred from information at the reasoner's disposal. Why did the aeroplane hijackers who attacked the World Trade Centre choose September 11 as the date of their attack? What possible difficulties do I need to be aware of before starting to install a central vacuum system in my house? How long will it take to get to a place I plan to go to tomorrow? What is the best way of handling my two-year-old's temper tantrums? Sometimes the answers to such questions are obvious, but when they are not, and we have or can get information from which to work out an answer, reasoning is appropriate. Naturally we want to arrive through this reasoning at a correct answer.

There is of course no litmus test or gold standard for correctness of conclusions. We cannot write the conclusion on a piece of paper, dip it in a liquid, and determine from the colour of the paper whether the conclusion is correct or incorrect. We are not infallible visionaries, but human beings, working with incomplete information of imperfect quality. Instead of correctness, we must make do with the second best: justification by the best practically obtainable evidence. That is why many warrants hold in most or some cases rather than in all cases, why we qualify our conclusions with such words as 'probably' or 'possibly', and why we acknowledge potential defeaters of our conclusions.

Our goal, then, is to reach the answer that the best relevant practically obtainable evidence justifies us in accepting. I propose four individually necessary and jointly sufficient conditions for reasoning that reaches this goal. First, we must be justified in accepting the ultimate grounds on which we base our reasoning. Second, our grounds must include all the relevant justified practically obtainable information. Third, the conclusion must follow in virtue of a justified warrant. Fourth, if the warrant is not universal, we must be justified in assuming that in the particular case there are no defeaters that rule out application of the warrant. I propose these conditions for reasoners to apply to their own reasoning, thus abstracting from the consideration of the audience and of the dialogical context that is required in the case of reasoning verbalized to others. Let us now consider each condition in detail.

1. JUSTIFIED GROUNDS

It is perhaps self-evident that good reasoning with a function of arriving at a previously unknown correct answer to a governing question must start from grounds that we are justified in accepting. Correct conclusions can follow from incorrect premisses, but it is an accident if they turn out to be correct. To have some assurance of reaching our goal, we need justification for our starting-points.

The most trustworthy sources of justified premisses appear to be direct observation, written records of direct observation, memory of what one has previously observed or experienced, personal testimony, previous good reasoning or argument, expert opinion, and appeal to an authoritative reference source. This list is open to emendation; further, none of these sources is infallible.

1.1. Direct observation

In general, the most basic source of justified premisses is direct observation. Seeing the thick black clouds getting ever larger in the western sky is good justification for believing that thick black clouds are forming in the western sky. Hearing the screaming of one's two-year-old rapidly diminish in loudness after he is put into his room alone is good justification for believing that the temper tantrum faded away after he was put in his room alone. The smell of smoke is good justification for believing that there is smoke in the air one is breathing in. Observation includes not only such witnessing by the human senses but also the reception of information by some sensory apparatus like a telescope; observation has been defined (Shapere, 1982) as reception by an appropriate receptor of information transmitted without interference from the observed entity. In general, an observation is justified to the extent that the following eight conditions are met:

1.1.1) Well-established background theories show that the receptor in the observational situation accurately receives information from the source under normal conditions.

1.1.2) The sense or sensory apparatus being used is in good condition and functioning properly.

1.1.3) The conditions for observation are adequate.

1.1.4) The information received is of a sort that the receptor generally detects accurately.

1.1.5) The observer takes care to notice accurately.

1.1.6) The observer, if human, is primed to observe accurately.

1.1.7) The observer has whatever expert knowledge is required to use any instruments involved and to interpret what is observed.

1.1.8) No other justified information contradicts the observation.

The conditions just mentioned synthesize similar lists proposed by Robert Ennis (1962, p. 90) and by Stephen Norris (1984) with the findings of psychological research (Loftus, 1979; Loftus and Doyle, 1992) and work in the philosophy of science (Shapere, 1982; Kosso, 1992). They are only a rough guide, and must be applied to particular cases with judgement. They exclude a foundationalist account, according to which observation sometimes provides indubitable starting-

points for the construction of human knowledge. In fact, things formerly taken to be observed can later be discounted as due to defects in sensory equipment or to mistakes in some theory used to interpret the equipment's output. Here, as elsewhere, what is justified may be false.

1.2. Written records of direct observation

Written records of direct observation make it possible to restore previous observations without depending on the vagaries of memory. They are important where the content of observations must be available and accurate long after the observation is made, such as in scientific research, police investigation and medical examination. Norris (1984, p. 136) proposes the following criteria:

- 1.2.1) The observation should be reported no more precisely than can be justified by the observational technique that was used.
- 1.2.2) The record should be made close to the time of observing.
- 1.2.3) The record should be made by the observer.
- 1.2.4) The record should be made in the same environment in which the observation was made.

1.3. Memory

Our memory of what we have previously observed or experienced is basically accurate, or we would not cope as well as we do. But distortions and failures occur not only at the initial acquisition stage (the observation) and at the later retrieval stage, but also during the intervening retention stage—human memory is plastic (Loftus, 1979). Empirical psychological research has discovered three main sources of distortion in what we remember (Schacter, 2001): (1) Misattribution assigns what is remembered to the wrong source, even to reality rather than fantasy. (2) Our suggestibility leads to the implantation of false information by leading questions, suggestions or comments at the time of retrieval. (3) Bias inclines us to edit our remembered past in the light of our current beliefs.

In general, the recollection of a previous observation or experience is justified to the extent that the following seven conditions are met:

- 1.3.1) The previous observation was justified.
- 1.3.2) Not much time has elapsed since the previous observation or experience (Loftus, 1979, pp. 53-54; Schacter, 1995, pp. 25-26).
- 1.3.3) The recollector has not received subsequent information (especially misinformation) about the observed episode or objects (Loftus, 1979, pp. 54-78; Loftus and Doyle, 1992, pp. 61-66, 68-70).
- 1.3.4) The recollector has not subsequently thought about the observed episode or objects. Labelling, guessing what was observed, or verbalizing the recollection can distort (Loftus, 1979, pp. 78-87).
- 1.3.5) The information recalled consists of emotionally salient and central facts rather than peripheral or unimportant details (Schacter, 1995, p. 16).
- 1.3.6) The information is not recalled in response to a leading question or under hypnosis (Schacter, 1995).
- 1.3.7) The retrieval environment is the same as that in which the original observation was made (Loftus, 1979, pp. 88-99).

1.4. Personal testimony

Personal testimony of what has been directly observed or experienced must be scrutinized in terms of the criteria for justified observation, written records, and memory (Ennis, 1962, p. 90; Norris, 1979, pp. 18-20; 1984, p. 137). For example, testimony based on distant memories is suspect if unsupported by written records made at or near the time of the observation.

It is particularly important in evaluating testimony to be on guard against secondhand, thirdhand, or more distant testimony. As the game of 'telephone' dramatically shows, the quality of messages passed from one person to another tends to deteriorate with each

transmission. One must also watch for distortion through a careless or intentionally deceptive formulation.

1.5. Previous reasoning or argument

The reasoner may already have reached a relevant conclusion by previous reasoning. Alternatively, the reasoner may have been convinced by someone else's argument to accept a relevant conclusion of that argument. If the relevant conclusion was justified by the earlier reasoning or argument, it becomes a justified premiss of the new reasoning.

1.6. Expert opinion

Reasoners sometimes can and should scrutinize the reasoning by which an expert arrives at an expert opinion. Sometimes, however, the reasoner must judge its acceptability indirectly. In such cases, an expert opinion justifies a claim to the extent that the opinion meets each of the following seven conditions (cf. Ennis, 1962, pp. 196-197):

1.6.1) The opinion in question must belong to some subject matter in which there is expertise. An opinion can belong to an area of expertise even if the expertise is not based on formal education; there are experts on baseball and on stamps, for example.

1.6.2) The author of the opinion must have the relevant expertise. It is important to be on guard against the fallacy of 'expert fixation', accepting someone's opinion because that person is an expert, when the expertise is irrelevant to the opinion expressed.

1.6.3) The author must use the expertise in arriving at the opinion. The relevant data must have been collected, interpreted, and processed using professional knowledge and skills.

1.6.4) The author must exercise care in applying the expertise and in formulating the expert opinion.

1.6.5) The author ideally should not have a conflict of interest that could influence, consciously or unconsciously, the formulated opinion. For example, the acceptance of gifts from the sales representative of a pharmaceutical company can make a physician's prescription of that company's drug more suspect.

1.6.6) The opinion should not conflict with the opinion of other qualified experts. If experts disagree, further probing is required.

1.6.7) The opinion should not conflict with other justified information. If an expert opinion does not fit with what the reasoner otherwise knows, one should scrutinize its credentials carefully and perhaps get a second opinion.

Sometimes we do not know directly whether these seven conditions are met, and we must judge by inference. The track record of an expert in the relevant field of expertise is good evidence, positive or negative, about the trustworthiness of that expert's new opinion.

1.7. Authoritative reference source

A seventh source is an authoritative reference source, such as an encyclopedia or the *Handbook of Chemistry and Physics*. Authoritative reference sources differ from expert opinions in that they contain generic information, whereas expert opinions apply expertise to a particular situation. Ideally, authoritative references embody the best available evidence at the time they are composed.

1.8. General remarks

Being justified is not the same as being correct. A premiss justified by direct observation, or by a written record of a direct observation, or by an authoritative reference source, may later turn out to be false. The friend one 'sees' across the road may turn out on closer inspection to be someone else who looks like one's friend. An entry in a reputable encyclopedia, general or specialized, can be superseded by subsequent research or world events. One should always be prepared to revise one's belief in light of compelling new evidence to the contrary.

2. ADEQUATE INFORMATION

If one is trying to answer a question correctly on the basis of obtainable information, one needs to take into account all the good relevant information that is practically obtainable.

The information must be *good*, in terms of the conditions previously mentioned for justified premisses. There is no point in taking bad information into account, still less in devoting time and effort to acquiring it.

It must be *relevant*, in the sense that it could make a difference to the answer one reaches. That is, a justified warrant links it, perhaps in combination with other already obtained information, to an answer to the question that could be different than the one justified by the information already obtained. In many types of inquiry, different pieces of information point to different answers to a given question; examples are medical diagnosis, police investigation, military and other intelligence work, scientific research, adjudication, consumer choice, and interpretation of such symbolic artefacts as written texts or works of art or musical compositions. Hence, if in such a context one considers only information that supports one answer, and ignores information that points to a different answer, one is more likely to reach an incorrect conclusion than if one considers everything. A common human failing is to close prematurely on a particular answer, then seek supporting evidence for this answer, while failing to seek (or even ignoring) evidence that points in a different direction. Indeed, high school English teachers often teach their students to write essays this way: Adopt a thesis, then assemble evidence to support it. This is a fallacy of empirical investigation known to psychologists as 'confirmation bias' (Klayman, 1995). Both experimental-critical and historical-textual empirical investigators of human reasoning have concluded that the most common flaw of informal reasoning is the failure to consider lines of argument supporting conclusions contrary to the one reached (Finocchiaro, 1994). The mass media occasionally report examples of such failures in detective and intelligence work: convictions for murder are sometimes reversed on the basis of DNA evidence, and intelligence estimates of a foreign country's military preparations sometimes prove wildly inaccurate. Confirmation bias occurs in a subtle way in the publication in scientific journals of experimental results that are tested for their statistical significance. Since the best journals are distinguished by the strictness of their criterion, accepting only results that are significant at the .01 level (as opposed to the .05 level or .10 elsewhere), the evidence published in the best journals can be a biased sample of the evidence actually obtained by researchers.

Relevance is a function of context. Suppose the question is whether all swans are white. We have a justified assumption, well supported by direct and reported observation of birds of both sexes in many species, that birds of a single sex in a single species have uniform colouring; for example, all male cardinals have the same bright red

colouring. Suppose that we are aware of observations of swans of both sexes in each of many species: mute swans, trumpeter swans, whistling swans, and whooper swans. Suppose that all observed swans of these species were seen to be white. Then observing more swans of any one of those species, of either sex, is irrelevant; we have strong reason to believe that no such additional observation will produce a different answer to our question. But then we hear reports that there are different species of swans in the southern hemisphere. Observing swans of those species is relevant. Once we become aware of observations of the 'black swans' of Australia and New Zealand, which are as black as their name implies, then no further observations of swans is relevant; we have conclusive proof in the last observations of a negative answer to our question: not all swans are white. In general, if the justified premisses at one's disposal support an answer to one's question that no additional evidence can overturn, then no such further additional evidence is relevant. Of course, if further information casts doubt on one or more of those justified premisses, then the situation can change.

Finally, one needs to take into account only *practically obtainable* information. The word 'practically' implies multiple relativity: to the time and effort required to obtain the information, to the importance that one answer the question correctly, and to the urgency of arriving at an answer. If it will take a two-minute Internet search to get relevant information of good quality, and one has the two minutes to spare, and it is important that the answer be correct, and one can wait two minutes before closing in on an answer, then one ought to do the Internet search. If the question is whether to quarantine a patient with symptoms like those of sudden acute respiratory syndrome (SARS), a contagious viral infection with a 15% mortality rate, and it takes a week to get the result of a 'gold standard' test of the patient's blood sample, then one quarantines the patient first (unless one can immediately exclude a diagnosis of SARS) and reviews the quarantine decision after receiving the result of the blood test. There is of course no general algorithm for balancing considerations of time, effort, urgency and importance of correctness in deciding whether it is practical to obtain a certain piece of good relevant information. Judgement is required.

3. JUSTIFIED APPLICABLE WARRANT

If one's reasoning is to justify one's conclusion, that conclusion must follow from one's premisses in accordance with a justified general warrant.

The phrase '*in accordance with*' means that the warrant actually applies to the inference. In other words, the warrant is semantically equivalent to some generalization of the reasoning's associated conditional 'if p_1 and ... and p_n , then c ', where p_1, \dots, p_n stand for the premisses and c for the conclusion (with qualifiers and defeaters removed). The requirement that the warrant actually apply to the inference is self-evident; obviously the warrant that argon is an inert gas has nothing to do with the quality of an inference from the speed clocked on a radar device to the conclusion that the car was speeding. A subtle danger in reasoning, which reasoners may not notice, is the use of a generalization of the converse of the associated conditional. For example, one may reason from hearing a train-like whistle that a train is in the vicinity. Reflecting on why one thinks this follows, one might propose the generalized warrant: If a train is in the vicinity, then I hear a whistle like the one I just heard. But this is the converse of the required warrant, which is rather: If I hear a whistle like the one I just heard, then a train is in the vicinity. This warrant may not be justified;

for example, one may be aware that there are no train tracks in one's vicinity, and that one's neighbour is a train aficionado who habitually plays recordings of trains at high volume.¹

In addition to being applicable, the warrant must be *general*. No conclusion follows in just one particular case; if it follows in one case, it follows in parallel cases. An applicable warrant picks out a class of such cases. It is important to realize that there may be several ways of doing so. In general, warrants generalize over the repeated content expressions of one's reasoning, and they must generalize over at least one content expression that occurs both in a premiss and in the conclusion (Hitchcock, 1985). If more than one content expression is repeated, then the reasoning has several potential warrants for the inference. Furthermore, the extent to which one generalizes over a given content expression is variable. In the whistle example, generalizing over the implicit time constant 'now' to all times produces the warrant: Whenever I hear a whistle here that sounds like this, a train is in the vicinity. Generalizing to a given time of day produces the warrant: Whenever at about 7 p.m. I hear a whistle here that sounds like this, a train is in the vicinity. Generalizing to a given time interval like the calendar year produces the warrant: Whenever in the current calendar year I hear a whistle here that sounds like this, a train is in the vicinity. And so on.

The requirement that the warrant be general is not a requirement that it be universal. Warrants, as Toulmin pointed out, can be modally qualified, as holding for the most part, or *ceteris paribus*, or even just sometimes. Such qualifications, along with qualifications of the epistemic status of the warrant, imply imperfect support for the conclusion, which may or may not be explicitly marked in one's reasoning.

Finally, the warrant must be *justified*. It is neither necessary nor sufficient that the warrant actually hold, i.e. that the generalization is correct (whether universally, for the most part, *ceteris paribus*, or just sometimes). Correctness is not sufficient, because reasoners need to draw inferences in accordance with warrants of which they are actually aware. Thus, for example, a logic student in the 1920s who was thinking about axiomatized Peano arithmetic could not use the correct generalization that no consistent axiomatization of arithmetic is complete to draw the conclusion that axiomatized Peano arithmetic is incomplete, because this generalization had not yet been shown to be true. Nor is correctness necessary. Fallible human reasoners with limited resources have no direct access to truth, or more broadly to correctness. They must make do with what at any given time they are justified in accepting. Hence good reasoners must be ready to revise their cognitive commitments, including the warrants in accordance with which they reason, in the light of new good evidence.

In Toulmin's model, warrants are justified by backing. His conception of backing, and his distinction between warrant-using and warrant-establishing arguments, is linked to his strong field-dependency thesis, about which many reservations have been expressed, for example in several chapters of Norris (1992). In fact, there seems no reason to postulate a sharp difference in kind between warrant-using reasoning and warrant-establishing reasoning. If one is reasoning to a conclusion that will later serve as a warrant for further reasoning, the conclusion is one's claim and the 'backing' for that claim constitutes one's grounds; the inference from grounds to claim will have its own warrant. In good medical reasoning, for example, conclusions about individual patients are reached using so-called 'evidence-based' generalizations about risk factors, diagnosis, prognosis or treatment. The evidence that justifies such generalizations

tends to take the form of clinical trials and other analytical studies, the conclusions from which are incorporated through meta-analysis and systematic review into authoritative clinical guidelines and references. Reasoning from the results synthesized in a systematic review to a clinical guideline is, in Toulmin's terminology, another instance of reasoning from grounds to a claim, only at a higher level than reasoning that applies a clinical guideline to the observed circumstances of a particular patient.

4. JUSTIFIED IN ASSUMING THAT NO DEFEATERS APPLY

A well-known feature of Toulmin's model is that many warrants come with rebuttals, or exceptional conditions under which the conclusion is incorrect. If the warrant that justifies one's inference is not universal, one must be justified in assuming that no exceptional condition in the particular case rules out application of the warrant. Such exceptional circumstances include not only circumstances that show that the conclusion is incorrect but also circumstances that show that the warrant is inapplicable to a particular situation, even though the conclusion may be correct. There may be other types of defeaters. The type of exceptional circumstance that shows the conclusion to be incorrect may be said to *override* (Pinto, 1999) or *rebut* (Pollock, 1970) the warrant; a standard example is the circumstance that a bird is a penguin, which overrides the warrant that birds fly (since penguins do not fly). The type of exceptional circumstance that shows the warrant to be inapplicable even though the conclusion may nevertheless be correct, may be said to *undermine* (Pinto, 1999) or *undercut* (Pollock, 1970) the warrant; a standard example due to Pollock (1995) is the undermining of the warrant that things that look red are red by the circumstance that the object one is looking at is illuminated by a red light. If one is not justified in assuming that a warrant lacks defeaters in a particular case, then one's conclusion about that case is obviously unjustified.

The condition that one is justified in *assuming* that no defeaters apply is weaker than the condition that one has a *justification* or *proof* that no defeaters apply. To require a reasoner using a non-universal warrant to have a justification that no defeaters apply is to impose too great a burden of proof. The non-existence of a defeater is not a ground from which the reasoner arrives at a given conclusion. Rather, defeaters are something to be aware of as a possibility. In many cases, there are indefinitely many possible defeaters, and it would paralyse reasoning to require a reasoner to have a justification for excluding each and every one of them.

What does it take to be justified in assuming that no exception to a warrant applies to the particular case about which one is reasoning? *First*, one must know of no such exception. *Second*, if an exceptional condition has serious consequences and one can find out without too much difficulty whether it is present in the particular case, one must find out whether the exceptional condition is present. For example, in general it is safe to start across an intersection when the light turns green. But it is dangerous to do so if a vehicle on the cross street is running a red light. Since it takes only a brief look in each direction to determine if this exceptional condition is present, an appropriately careful driver will look in each direction as the light turns green, to make sure that no vehicle is going to run the newly red light on the cross street. The example is a bit artificial, since the behaviour of experienced drivers in such routine situations is a matter of habit, but reasoning can be used in forming such habits, for example, when one is receiving driving instruction. The more serious the consequences of an

exception, the more effort one should be prepared to put into finding out if it is present. It is a matter of judgement where to draw the line. *Third*, if the previous two conditions have been met, one can draw one's conclusion as if there is no exception, but one should be alert to the possibility of discovering at a later time some exceptional circumstance pertaining to the particular case. If one's observation of a clock leads one to conclude that the time is 10:15, and shortly after making that observation one sees another clock which reads 11:20, then one should suspend judgement about what time it is until one finds out which of the two clocks is correct.

SUMMARY

The four conditions—justified premisses, adequate information, justified applicable warrant, justified assumption that no exceptions apply—are individually necessary and jointly sufficient for good solo reasoning aimed at working out a correct answer to a question.

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¹A generalization of the converse may be said to warrant an abductive inference to a possible explanatory hypothesis, in this case that there *may be* a train in the vicinity. But the generalization of the converse seems to be backing for the warrant, rather than the warrant itself. The qualified warrant is: whenever someone hears a whistle like the one I heard, it may be produced by a nearby train. Its backing is: If the driver blows the whistle of a nearby train, it makes a sound like the sound I just heard.