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The Overall Evaluation of Arguments: How Probable/Acceptable is a Conclusion Given the Evaluation of the Truth and Support of its Reasons?

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ABSTRACT: I explore the logic of counterexamples by possible conjunction in order to extend their use to estimate the degree of support of premises; address some problems with my proposal; discuss some ways of teaching this extended use; and argue that conditional probability fails to express the degree of support of premises. The scant literature on this topic sometimes presents the degree of support of premises $P_1 \ldots P_n$ for conclusion C in terms of conditional probability, $Pr(C/ P_1 \ldots P_n)$. I will argue that the degree of support is better expressed by the probability of the conditional statement expressing the inference, Pr(If $P_1 \ldots P_n$, then C); and prove that $Pr(C/ P_1 \ldots P_n)$ is not equivalent to Pr(If $P_1 \ldots P_n$, then C).

KEY WORDS: counterexamples by possible conjunction, conditionalized inference, conditional probability, probability of conditionals

Textbooks in critical thinking focus much attention on the stages pertaining to the evaluation of the support and truth of reasons, but they provide little guidance in the final stage where we use the results of these evaluations to establish the probability or acceptability of the conclusion. The only exception to this claim that I am aware of is Wayne Grennan's *Argument Evaluation* (1984). In this paper I will describe what seems to contribute to some of the problems in completing effectively the overall evaluation of an argument, offer some suggestions for resolving them, and address some pedagogical consequences arising from my suggested resolution.

One obstacle to combining the evaluation of the support and truth of premises is that we evaluate the truth of premises in terms of probabilities, but we usually evaluate the support of premises for their conclusion in terms of the metaphor, 'strength'. (Even the use of 'support' in this context is metaphorical.) The strength of the support can vary from the strongest, which occurs whenever the premises guarantee the conclusion (i.e., when an argument is valid), to very strong, strong, moderate, weak, very weak, nil (i.e., when the premises are irrelevant). The difficulty is that this figurative description of the premise support in terms of *degrees of strength* prevents us from working effectively with the *probability* of premises to estimate the probability or acceptability of the conclusion.

We can easily address this problem. First, we can make use of the fact that given any argument, we can express the support of its premises in terms of a conditional statement in which all the premises are its antecedent, and the conclusion its consequent. For instance, given an argument, 'P, so C', the support for conclusion C is expressed by the conditional statement 'If P then C'. I will call such conditional statements, the 'conditionalized inference'. Once premise support is expressed in terms of a conditional statement, the *strength of* premise support can be expressed in terms of the *probability* of that statement: Pr(If P then C).

This probabilistic representation of premise support is quite consistent with our intuitions of the degrees of premise strength (from the strongest support of validity to the total absence of support when the premises are irrelevant). For when an argument is valid, its conditionalized inference is true, Pr(If P then C) = 1; when the premises are irrelevant, Pr(If P then C) = 0; and when the premises are neither sufficient nor irrelevant, then 1> Pr(If P then C)>0.

Given any argument, e.g., ‘P, so C’, the probability of the premise, Pr(P), and the probability of the conditionalized inference, Pr(If P then C), we can now combine them. We can bring them together either conjunctively or disjunctively. They *cannot* be combined disjunctively, Pr(C) ≠ Either Pr(P) OR Pr(If P then C), for that would make a conclusion true simply when the argument is valid, but valid arguments can have false conclusions; it would also make a conclusion true when its reasons are true, but arguments with true reasons can have a false conclusion. Thus, in the overall evaluation of the argument ‘P, so C’, they are joined conjunctively: Pr(C) = Pr(P) <u>AND</u> Pr(If P then C), which means mathematically, Pr(C) = Pr(P) x Pr(If P then C).

I need to clarify certain aspects of this formula. For according to probability theory, given any two statements, e.g., A and B, Pr(A&B) = Pr(A) x Pr(A/B), but Pr(A&B) = Pr(A) x Pr(B) when A and B are independent of each other. Statements, or events, are independent of each other when the probability of one does not affect the probability of the other, when either Pr(A/B) = Pr(A) or Pr(B/A) = Pr(B). The truth and support (represented by the conditionalized inference ‘If P then C’) are independent of each other because premises can be sufficient, i.e., the argument can be valid, even when they are all false; and they can all be true even when they provide no support, i.e., even when they are irrelevant. Consequently, there is no logical need to represent Pr(C) = Pr(P) <u>AND</u> Pr(If P then C) by the more complex Pr(C) = Pr(P) x Pr(C/If P then C).

In order to use the formula Pr(C) = Pr(P) AND Pr(If P then C), I propose a numerical translation of expressions commonly used to describe different degrees of probability and strength.

(A)

Terms applied to statements	**Degree of Support**	**Numerical representation**
Extremely probable	extremely strong	0.9-0.99
Very probable	very strong	0.8-0.89
Probable	strong	0.7-0.79
Moderately probable	moderately strong	0.6-0.69
Slightly probable	slightly strong	0.51-0.59
		0.50
Slightly improbable	slightly weak	0.4-0.49
Moderately improbable	moderately weak	0.3-0.39
Improbable	weak	0.2-0.29
Very improbable	very weak	0.1-0.19
Extremely improbable	extremely weak	0.01-0.09

The formula gives results that are consistent with our intuitions: when premises are true, the probability of the conclusion equals the probability of the conditionalized inference; and when an argument is valid (i.e., when the probability of a conditionalized inference equals 1), the probability of the conclusion equals the probability of the premises. The formula also helps us to handle the cases where premises are neither true nor false (i.e., 1>Pr(P)>0), and where the support is neither valid nor nil (i.e., when the reasons are irrelevant): *the probability of a conclusion is always lower than the lowest probability of either the premise or the conditionalized inference*.

The formula Pr(C) = Pr(P) AND Pr(If P then C), however, does have some counterintuitive results. When either the premises of any argument are false or their support is nil (i.e., the premises are irrelevant, Pr(If P then C) = 0), the probability of the conclusion is zero, which means that the conclusion is false. But an argument can have a true conclusion even if its premises are false or irrelevant. At the moment I'm not sure how to resolve this problem except to say that this formula does not apply whenever either Pr(P) = 0 or Pr(If P then C) = 0.

There is another important objection to consider: What is the value of the formula Pr(C) = Pr(P) AND Pr(If P then C) if in most real-life arguments we will not be able to assign precise probabilities to either Pr(P) or Pr(If P then C)? Though we typically do not have precise numerical probabilities, we usually do have some rough non-numerical idea about the probability of the premises and the probability of the conditionalized inference, and so the formula provides some guidance regarding the use of those rough ideas to estimate the probability of the conclusion. For instance, if we suspect that that the premises are *very probable*, but that the conditionalized inference is only *probable*, then the formula tell us that the probability of the conclusion will be less than the probability of the conditionalized inference. More precisely (assuming Table (A)), the probability of the conclusion will vary between 0.56 and 0.70, which is a range resulting from the multiplication of (0.8-0.89) and (0.7-0.79). Since 0.70 is the stipulated number for the beginning of the range of statements that are probable (in table (A)), then this means that the probability of the conclusion can vary from slightly probable to moderately probable to probable (but probable only at the lowest number, 0.70). Even if we have no numerical probabilities, the formula still helps us to expect the probability of the conclusion to be lower than the lowest probability of either the reasons or the conditionalized inference when the premises are neither true nor false, and neither sufficient nor irrelevant, i.e., when 0<Pr(P)<1, and 0<Pr(If P then C)<1.

However, there is a limitation to the application of my approach for the overall evaluation of an argument. Some arguments use either value or moral claims, and probabilities are not easily applicable to them. This means that we will have to find a different way of combining the acceptability and support of premises to estimate the degree of probability or acceptability of a conclusion. I will address this issue in a future paper.

PROBABILITY OF A CONDITIONALIZED INFERENCE

Since the probability of a conclusion depends on the probability of a conditionalized inference, we must find a way to estimate the latter. Consider the following proof:
1. Pr(~P or P) = 1. The probability of a tautology.
2. Pr(~P) + Pr(P) = 1. The rule of addition when probabilities are independent.
We are looking for a substitution for '~P' and 'P' that will allow us to assess the degree of *support* of *any* argument, P_1&P_2….&P_n, so C. Replace both 'P's' in (2) by 'P_1&P_2….&P_n & ~C':
3. Pr(~(P_1&P_2….&P_n & ~C)) + Pr(P_1&P_2….&P_n & ~C) = 1.
Subtract Pr(P_1&P_2….&P_n & ~C) from both sides of the equation:
4. Pr(~(P_1&P_2….&P_n & ~C) = 1 – Pr(P_1&P_2….&P_n & ~C).

If ~(P_1&P_2….&P_n & ~C), then P_1&P_2….&P_n are *sufficient* for C, so we can replace '~(P_1&P_2….&P_n & ~C)' in (4) by the logically equivalent expression 'If P_1&P_2….&P_n then C', which expresses the support that the premises bring to the conclusion in terms of the probability of the conditionalized inference:

5. Pr(If P_1&P_2….&P_n then C) = 1 – Pr(P_1&P_2….&P_n & ~C).

The expression 'Pr(P_1&P_2….&P_n & ~C)' stands for the probability of *all* the counterexamples by possible conjunction against the support of the premises in the argument P_1&P_2….&P_n, so C.

How do we construct such counterexamples? I discussed these counterexamples in great detail in *Teaching Philosophy* (2003), but it will suffice for this paper to invent a number of counterexamples against a simple argument:

There are now no cars coming on my right.

Therefore, it is now safe to cross the street where I am.

I will present the first counterexample in its entirety:

CE_1 *It is possible that*:

There are now no cars coming on my right. AND *There is a vehicle coming on my left*. AND *It is false that* it is now safe to cross the street where I am.

Such a counterexample consists of *a possible conjunction* of propositions, which is why I name this kind of counterexample, a '**counterexample by possible conjunction**'. It can prove that the given reasons of a specific argument are not sufficient for the argument's conclusion: it can show that the argument is invalid. (Counterexamples by possible conjunction are to be contrasted with counterexamples by analogy, which are supposed to be analogous *in form* to the argument against which they are advanced, and which can prove that any argument of that form is invalid.) In order to be effective, counterexamples by possible conjunction must satisfy two conditions: (a) They must have at least one proposition that makes us understand how it is possible for all the premises to be true and the conclusion false. In CE_1 I italicized that proposition. (b) The conjunction of all the propositions constituting the counterexample must be consistent. These counterexamples are typically presented in a condensed way simply by stating the proposition that is supposed to make us understand how it is possible for all the premises to be true and the conclusion false. Here are additional counterexamples in their more common condensed form against the premise's support for the conclusion:

CE_2 *It is possible that* there is a vehicle other than a car coming on my *right* (e.g., truck, van, motorcycle, bicycle, ship on wheels, etc.)

CE_3 *It is possible that* a helicopter is about to land on the street in front of me.

CE_4 *It is possible that* the street is not solid enough to cross (e.g., the soil under the street that supports the asphalt has caved in due to a recent earthquake).

CE_5 *It is possible that* there is a stampede of animals coming on either my right or left (e.g., animals released from the zoo, or a circus).

CE_6 *It is possible that* there is a very low flying object (e.g., small plane, helicopter, glider, UFO!) coming on either my right or my left.

CE_7 *It is possible that* the street has turned into a deep and wide crevasse caused by an earthquake.

CE_8 It is possible that there is a gang fight and shooting along the street where I am.

Each counterexample, no matter how unlikely, proves that the given reason is not sufficient for its conclusion: each one, no matter how farfetched, proves that the argument is invalid. But it is their estimated combined probability that (partly) gives us $Pr(P_1\&P_2….\&P_n \& {\sim}C)$, which is then used to estimate the probability of the conditionalized inference (i.e., the degree of support): $Pr(\text{If } P_1\&P_2….\&P_n \text{ then } C) = 1 – Pr(P_1\&P_2….\&P_n \& {\sim}C)$. Our estimation of $Pr(P_1\&P_2….\&P_n \& {\sim}C)$ is typically incomplete and imprecise for two reasons. First, we will usually *not* be able to identify *all* possible counterexamples against the support of reasons. For practical purposes, we can stop inventing counterexamples once we suspect that we can invent only unrealistic/unlikely ones, for such additional examples do not significantly affect our estimation of the *combined* probability of the counterexamples against the support of premises. I stopped at CE8, even though many more counterexamples could be invented, because from that point on I was able to construct only very unrealistic ones. It is important to bear in mind that wherever we stop constructing these counterexamples, we could be overlooking realistic ones. So if we are evaluating an argument that is important to us, it is usually advisable to persist beyond a few unrealistic counterexamples, for sometimes they will make us discover some realistic ones. We must also keep in mind that our final evaluation is always relative to our imagination and knowledge. Hence, if we are unimaginative or are not well informed about the issue discussed in an argument, then our counterexamples will likely not be very reliable to assess the support of the argument's premises.

The second reason why our estimation of $Pr(P_1\&P_2….\&P_n \& {\sim}C)$ is typically incomplete and imprecise, is that we will usually have to appeal to a frequency sense of probability of counterexamples, and we will generally not be in an ideal position to determine how often a proposition has been true relative to all the time it could have been true. I will illustrate such estimations in the section of this paper that addresses some pedagogical consequences of my theory.

There are further challenges to reaching precision on $Pr(P_1\&P_2….\&P_n \& {\sim}C)$ when the context of an argument or explanation is not clear. For instance, in the above example about the safety of crossing a street, we are not informed of the location of this street, which is very important. If I am evaluating the safety of crossing a street when there are no cars coming on my right in a ghost town at three o'clock in the morning, then it is extremely unlikely that there will be a vehicle on coming on my left; but if I am on the Las Vegas Strip – where 'no one' sleeps – at three o'clock in the morning, it is likely that there is a vehicle coming from my left, even though there's no car coming on my right.

We must also be mindful of our life experiences, and how they can bias our estimations. For if I've lived mainly in large busy cities most of my life, those are the sort of images that will tend arise in my mind as I ponder the likelihood of the counterexample, but if I've always lived in small villages, images or memories of quiet streets will tend to dominate the kinds of examples that I will entertain.

The problems of estimating the probability of counterexamples are not unique to counterexamples: they occur with most reasons of arguments and explanations, and most claims. So, it is inescapable that they would arise as soon as we inquire into the probability of counterexamples. Thus these problems by themselves do not indicate a weakness in the approach I am proposing for the overall evaluation of most arguments.

HOW TO ADD THE PROBABILITIES OF COUNTEREXAMPLES

When we construct a number of counterexamples (CE_1 or CE_2 or CE_3 or…) against the support of premises, we must estimate their combined probability. According to probability theory, when two statements A and B are independent, that is, when the probability of one does not affect the probability of the other, then Pr(A or B) = Pr(A) + Pr(B); but when they are dependent, Pr(A or B) = Pr(A) + Pr(B) – Pr(A&B).

There are obvious problems if we generally treat counterexamples as independent: Pr(CE_1 or CE_2 or CE_3 or…) = Pr(CE_1) + Pr(CE_2) + Pr(CE_3) +…. For their individual probabilities will often add up to something greater than 1.0, which is by definition impossible. One could therefore be tempted to use the formula Pr(A or B) = Pr(A) + Pr(B) – Pr(A&B) every time we need to combine the probability of counterexamples, for Pr(A&B) = 0 when the counterexamples are independent, and the formula would work for all the counterexamples that are dependent (assuming we could estimate Pr(A&B)).

Unfortunately, this formula will also sometimes lead to results that exceed 1.0. I will illustrate this with a simple example. Let's assume that we have CE_1 and CE_2, and that we have estimated their respective probabilities to be 0.8 and 0.7. Let's also assume that they are dependent. Two statements are dependent whenever the conditional probability of one given the other is greater than zero. So, for the purpose of illustration, let's assume that Pr(CE_1/CE_2) = 0.2. According to probability theory, the way to estimate the combined probability of CE1 and CE2 is:

1. Pr(CE_1 + CE_2) = Pr(CE_1) + Pr(CE_2) – Pr(CE_1 & CE_2).
2. Let us recall that Pr(CE_1/CE_2) = Pr(CE_1 & CE_2) / Pr(CE_2).
3. Since we have assumed for the purpose of illustration that Pr(CE_1/CE_2) = 0.2, then
4. Pr(CE_1 & CE_2) / Pr(CE_2) = 0.2.
5. So, Pr(CE_1 & CE_2) = Pr(CE_2) x 0.2, by multiplying both sides of (4) by Pr(CE_2).
6. So, Pr(CE_1 + CE_2) = Pr(CE_1) + Pr(CE_2) – Pr(CE_2) x 0.2,
   by replacing in (1) Pr(CE_1 & CE_2) by Pr(CE_2) x 0.2 from (5).
7. So, Pr(CE_1 + CE_2) = Pr(CE_1) + Pr(CE_2)(1.0 – 0.2), by factoring out Pr(CE_2).
8. So, Pr(CE_1 + CE_2) = Pr(CE_1) + Pr(CE_2)(0.8).
9. Since we have assumed that Pr(CE_1) = 0.8, and Pr(CE_2) = 0.7,
10. Pr(CE_1 + CE_2) = 0.8 + (0.7)(0.8) = 0.8 + 0.56 = 1.36, which is by definition impossible.

Many more similar examples could be constructed, and each one would show that the rule Pr(A or B) = Pr(A) + Pr(B) – Pr(A&B) cannot be used to add up the probability of each counterexample by possible conjunction advanced against the support of premises. I *suspect* that such possibilities do not occur in mathematical problems partly because the values assigned to statements or events exhaust all possibilities, but this is *generally* not possible with counterexamples used against real-life arguments or explanations.

This kind of problem does not occur with the following kind of approach, which I name the 'Method of Diminishing Addition' (MDA):

1. Assume again that Pr(CE1) = 0.8, and Pr(CE_2) = 0.7.
2. Pr(CE_1 + CE_2) = Pr(CE_1) + ((1.0 – Pr(CE_1)) x PrCE_2)
   = 0.8 + (1.0 – 0.8)(0.7) = 0.8 + (0.2)(0.7) = 0.8 + 0.14 = 0.94.

What motivates these calculations? Keep in mind the formula: Pr(If P_1&P_2….&P_n then C) = 1 – Pr(P_1&P_2….&P_n & ~C). Pr(CE_1) tells us that the conditionalized inference is false 80% of the time, which means that it is true 20% of the time. PrCE_2 tells us that 70% *of that remaining* 20% is false, which means the conditionalized inference is true only 6% of the time. And so on.

3. Assume Pr(CE_3) = 0.9, using the same approach:

4. Pr(CE_1 + CE_2 + CE_3) = Pr(CE_1) + [1.0 – Pr(CE_1)] x (PrCE_2) + [(1.0 – {Pr(CE_1)) + (1.0 – Pr(CE_1)) x PrCE_2)}] x (CE_3)
= 0.94 + (1.0 – 0.94) x 0.9 = 0.94 + (0.06) x 0.9 = 0.94 + 0.054 = 0.994.

5. Assume Pr(CE4) = 0.9, using the same approach:

6. So, Pr(CE_1 + CE_2 + CE_3 + CE_4) = 0.994 + (1.0 – 0.994) x 0.9 = 0.994 + 0.006 x 0.9
= 0.994 + 0.0054 = 0.9994, and so on if the probability of each additional counterexample is 0.9. With this kind of approach, the total combined probabilities of counterexamples will *never* exceed 1, even if all the counterexamples are extremely probable. Therefore, the application of the MDA to the probabilities of counterexamples avoids the serious problem encountered when using the rule of addition of probabilities, Pr(A or B) = Pr(A) + Pr(B) – Pr(A&B).

It might be objected that the MDA has its own problems. One could argue as follows: Given a fair die and a fair throw etc., what is the probability of getting either even or 2?
According to probability theory:
Pr(E or T) = Pr(E) + Pr(T) – Pr(E&T) = 3/6 + 1/6 – 1/6 = 3/6 = 18/36.
According to the MDA:
Pr(E + T) = Pr(E) + (1.0 – Pr(E)) x Pr(T)
= 3/6 + (1.0 – 3/6) x 1/6 = 3/6 + 3/6 x 1/6 = 3/6 + 3/36 = 21/36.
So this second approach exceeds the correct amount by 3/36. Many similar examples could be constructed, and each one would show that this second approach leads to a higher total, even though it will never exceed 1.0.

I have two responses to this objection. First, the calculations in such mathematical examples exhaust all possibilities, but in most real-life arguments, there are usually additional counterexamples that are overlooked, which would affect one's combined probability of counterexamples and which would lower our estimation of the premise support. So the objection is based on the MDA's failure to get similar results to a probabilistic approach that does not *normally* apply to counterexamples advanced against real-life arguments. The comparison is thus inappropriate. Secondly, I have proven that the rule Pr(A or B) = Pr(A) + Pr(B) – Pr(A&B) is not a reliable way of adding the probabilities of counterexamples by possible conjunction, yet this objection is based on the use of this formula. Hence, the results obtained from that rule cannot be legitimately used to test the results obtained from the MDA. Failure to conform to what is irrelevant is not a weakness. However, the objection does show that the MDA does not apply to the kinds of problems to which standard probability formulas are applied

Until we can find a better way of adding the probability of counterexamples by possible conjunction, it seems that we have good reasons to use the MDA.

PROBABILITY OF CONDITIONALS AND CONDITIONAL PROBABILITY

Up to this point I have expressed the support of premises in terms of a conditionalized inference. I will next address some problems in an alternative way of expressing support. Since a conditional statement, 'If P, then C', can also be expressed as 'C given P', it can appear at first sight plausible to interpret Pr(If P then C) as equivalent to Pr(C/P), which is read, 'The probability of C given P'. There is a certain ambiguity in the expression, 'The probability C given P'. For it can mean either 'Given P, Pr(C)' or 'Pr(Given P, C)'. It is only in the latter case that the probability operator actually expresses the strength of the relation of support that P brings to C.

Some philosophers believe that the probability of conditionals, Pr(If P then C), is equivalent to conditional probability, Pr(C/P) (Adams (1975); Grennan (1997)). If these expressions are equivalent, then given the argument, 'P, so C', the strength of the support that P provides to C can be expressed as Pr(C/P), and since Pr(C/P) = Pr(P&C)/ Pr(P), then the strength of the support can be expressed by Pr(P&C)/ Pr(P).

The first major problem with this interpretation of premise support, is that it is not clear how one would find values for Pr(P&C)/ Pr(P) when dealing with real-life arguments. Consider the following example: (C) I should be careful not to accept any gifts from them in the future because (P) they will think they have bought my respect. The Pr(C) would be Pr**(**I should be careful not to accept any gifts from them in the future **AND** They will think they have bought my respect**) divided by** Pr(They will think they have bought my respect). Except for the mathematical examples where we can identify all possibilities, we cannot estimate the probability of the numerator when we are trying to determine the probability of C.

The second major problem is that Pr(If P then C) and Pr(C/P) are not equivalent. Proof:

1. If two expressions are equivalent, then they should logically lead to identical probabilistic results in identical contexts. For the purpose of this proof, I will use as the context the formula for the overall evaluation of an argument: Pr(C) = Pr(P) x Pr(If P then C). Thus,
2. The formulas Pr(C) = Pr(P) x Pr(If P then C), and Pr(C) = Pr(P) x Pr(C/P) should lead to identical probabilistic results.
3. By definition, Pr(C/P) = Pr(P&C)/ Pr(P). Hence, Pr(C) = Pr(P) x Pr(C/P) becomes
4. Pr(C) = Pr(P) x Pr(P&C)/ Pr(P). But 'Pr(P)' cancels itself out on the right side. Consequently,
5. Pr(C) = Pr(P&C), but this formula is true in the cases where either the Pr(C) = Pr(P) = 0, or Pr(C) = Pr(P) = 1, but *false in all other cases*.
6. No such absurdities result in expressing the strength of the support by Pr(If P then C) in the formula Pr(C) = Pr(P) x Pr(If P then C).
7. Since the two formulas logically lead to different probabilistic results in identical contexts, they are not equivalent.

Conclusion (5) also proves that conditional probability should not be used to represent the support of premises. It should now be clear why I do not propose to express the support of premises by means of conditional probability.

PEDAGOGICAL CONSEQUENCES

Though it would not be reasonable to expect students or even most adults to grasp the details of the preceding theoretical investigation, it has significant pedagogical consequences. It is very important to note that Pr(If P_1&P_2….&P_n, then C) = 1 – Pr(P_1&P_2….&P_n & ~C) represents an *inverse relation*: the *greater* the probability of the combined counterexamples, the *lower* the probability of the conditionalized inference, that is, the weaker the support; and the *lower* the probability of the combined counterexamples, the *higher* (assuming that there are no overlooked likely counterexamples) Though children and most adults will not grasp the proofs in the preceding sections, they will understand the *image* that represents this inverse relation: a teeter-totter, a sea saw. We can use this image to guide their thinking when they are playing with counterexamples to estimate the degree of support of premises.

I will illustrate this with the evaluation of the argument: *As I'm not speeding, I'm not going to get a ticket.* Given the way the conclusion is stated, this argument is vulnerable to the following counterexamples: What if I'm speeding but I get a different kind of traffic ticket, e.g. an improper turn, passing a red light, not stopping at a stop sign, not yielding the right of way, unsafe car, polluting car, unnecessary noise, driving too slowly, parking in a wrong place, drinking and driving. The presenter of this argument would easily block all these counterexamples simply by eliminating some of the vagueness in 'ticket' in the conclusion. (It is sometimes by means of the CE's against the support (or truth) of reasons that we discover what needs to be clarified.) The author probably intended his/her conclusion to be about a speeding ticket, and *not* about any other ticket. So, a charitable interpretation of the conclusion is 'I'm not going to have a *speeding* ticket'.

There is still some vagueness in the conclusion that allows for the possibility of constructing new counterexamples: what if I have a speeding ticket in a year from now; in a year and a day from now; in a year and two days from now, etc. The author probably intended something equivalent to the following argument: As I'm not speeding *at this time*, I won't have a speeding ticket *at this time*.

Now that I have reconstructed the argument into its likely intended presentation, I can proceed again with the assessment of the support. Despite my charitable interpretations of the argument, it is still subject to CE's:

(1) It's possible that a speed radar is malfunctioning and falsely indicates that I'm speeding, and a police officer gives me a ticket.

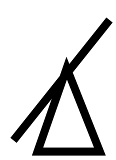
(2) It's possible that a police officer is in a very bad mood and gives me a speeding ticket.

How do I *estimate* the probability of CE1? Here is an illustration of a *frequency approach*. What is the *ratio of* the number of defective speed radars used at any moment in this region *to* the total number speed radars used at any moment in this region? Again, relative to my very limited knowledge (and maybe some wishful thinking), the number of defective radars *in use* would appear to be extremely small relative to the total number of well functioning speed radars in use. So, I very roughly estimate the probability of CE1 to be extremely small.

How do I estimate the probability of CE2? How many police officers on duty are there at any moment in this part of the country who are in such a bad mood that they would randomly give a speeding ticket to someone who is not speeding? How many police officers are there on duty at this time of day in this part of the country? Again, relative to my very limited knowledge, and my assumptions about the police, the *ratio of* such unfair police on duty *to* the total number of police on duty would be extremely small.

What is my estimation of the probability of either CE1 or CE2, in other words, Pr(CE1 or CE2)? It would still be *extremely low*. Using the seesaw/teeter totter model, the probability of the conditionalized inference, is *very high*.

Probability of counterexamples:
Pr(CE1 or CE2) = Pr(P & not-C)
Pr~(If P then C) =
<u>extremely low</u> probability



Strength of support:
Pr(If P then C) = 1 - Pr(CE1 or CE2)
= **<u>extremely high</u> probability**
= extremely strong support

Since I'm in no position to estimate the probability of the premise, the probability of the conclusion, relative to my imagination and knowledge, is:

Pr(C) = Pr(P) **X** Pr(If P then C)
= **?** **X** extremely high = **?**.

However, if the premise were true, if Pr(P) = 1, then the probability of the conclusion would be very high. Since I do not know the actual likelihood of the premise, the probability of the conclusion is *at most* very high.

We must bear in mind that any probability ascribed to a conclusion by using my approach is typically not the absolute and final probability of that conclusion. For one's estimation could change with the addition of new and relevant premises, or more relevant knowledge or greater imagination in the construction of additional counterexamples.

In this paper I have described one way of addressing the typically overlooked final stage of argument evaluation where one uses the evaluation of both the truth and the support of reasons to estimate the likelihood or degree of acceptability of their conclusion. In order to facilitate the proper combination of these two evaluations, I described the support of reasons in terms of a conditionalized inference, thereby making it possible to translate the degree of support of reasons into the degree of probability of the conditionalized inference. It was then easy to show that the probability of a conclusion equals the product of the probability of its premises and the probability of the conditionalized inference. I described how to construct counterexamples by possible conjunction against the support of premises in an argument; pointed out some difficulties in estimating their individual probabilities; described how their individual probabilities are 'added' together; and showed how to use their combined estimated probability to estimate the probability of the conditionalized inference of that argument. I proved that, despite the initial plausibility, the support of reasons cannot be expressed in terms of conditional probability. And finally, I illustrated how this theory could be applied in the evaluation of arguments in our courses.

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