

# CIRCULAR ARGUMENTS, BEGGING THE QUESTION AND THE FORMALIZATION OF ARGUMENT STRENGTH

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## ABSTRACT

Recently Oaksford and Hahn (2004) proposed a Bayesian reconstruction of a classic argumentation fallacy - Locke's 'argument from ignorance.' Here this account is extended to what is probably the most well-known of all argumentation fallacies: circular reasoning or 'begging the question'. A Bayesian analysis is shown to clarify when and where circular reasoning is good or bad, and how seeming paradoxes about circular reasoning from the informal reasoning literature can be resolved with a more precise notion of argumentation and argument strength.

## 1. INTRODUCTION

Argumentation is fundamental to everyday life in complex societies and, as a result, has been a topic of interest across a wide range of disciplines, exercising philosophers, psychologists, as well as AI researchers. Even within a single discipline, interest in argumentation typically stems from numerous sources. In psychology, research is distributed across social psychology where researchers have been interested in 'persuasion' (see e.g., Johnson, Maio & Smith-MacLellan, 2005 for an overview), cognitive psychology (e.g., Rips, 2002; Oaksford & Hahn, 2004), and developmental psychology (e.g., Kuhn & Udell, 2003). In AI, research has focused on argumentation directly (e.g., Gordon, 1995), as well as within the context of developing computational logics (see e.g., Prakken & Vreeswijk, 2002), and in attempting to provide technical solutions to the thorny problem of non-monotonic and uncertain reasoning (see e.g., Fox, 2003). In philosophy, finally, the topic dates back to Plato and Aristotle, and has been sustained within the rhetorical, dialectical and logical traditions (for an overview see van Eemeren et al, 1996).

Despite this broad interest, it seems fair to say that comparatively little about argumentation has been resolved. Few researchers attempt to integrate work from more than one discipline (for notable exceptions see e.g., Walton, 1996). Key topics have been pursued literally for 2000 years without resolution. One central challenge is posed by the classical argumentation fallacies, that is arguments that seem convincing but shouldn't be (see e.g., Hamblin 1970, for an overview). The catalogue of fallacies found in most introductory logic or critical thinking

texts originates from Aristotle, though it has received additions through the ages. Despite long-standing interest, it has been difficult to provide an adequate explanation of *why* the fallacies are poor arguments. In particular, no formal treatment has been forthcoming. Logical treatments have struggled because some of the fallacies are actually logically valid, but nevertheless seem to be poor arguments. At the same time, arguments with the same logical structure seem to nevertheless differ in acceptability. An alternative approach to the fallacies has been suggested by pragma-dialectical theories of argumentation (for an overview see e.g., van Eemeren & Grootendorst, 2004). This approach seeks to explain the weakness of the fallacies by reference to normative rules of rational dialogue. Fallacies are portrayed as inappropriate moves in a given type of dialogue, seeking, for example, to unfairly shift the burden of proof. This approach suffers from a similar limitation as the logical approach with regards to 'exceptions'. For example, it can be shown that examples of so-called arguments from ignorance ("ghosts exist because nobody has proved that they don't") can be found which vary continuously in strength even though they are found in exactly the same dialogue, subject to exactly the same normative rules (see, Oaksford & Hahn, 2004; Hahn & Oaksford, *subm.*).

Recently, we have proposed an alternative treatment of the fallacies using a Bayesian framework (Oaksford & Hahn, 2004; Hahn & Oaksford, *subm.*). This account seeks to capture *argument strength* through the key quantities from Bayes' theorem for evaluating the evidence for a claim, i.e., the prior degree of belief in a claim and the relationship between the claim and evidence. Classic textbook examples of the fallacies are arguments in which the specific content dictates values of these quantities that make the argument weak. However, stronger alternatives with the same structure can typically be found. In other words, the classic fallacies are for the most part not structurally distinct argument forms that are collectively weak. Rather, they are collections of examples which occupy the weak end of a continuously varying spectrum of argument strength defined in Bayesian terms.

In this paper, we show how these ideas can be extended to what is possibly the most widely cited fallacy—

that of circular reasoning. Specifically, we outline why circular arguments are regarded as poor. We then develop the key aspects required of a theory of argument strength. In light of this, we seek to resolve the debate in the literature.

## 2. PAST EXPLANATIONS OF CIRCULAR ARGUMENTS

One of the most widely cited examples of the fallacy of circular reasoning, also known as 'petitio principii' or 'begging the question' is the following:

- (1) God exists because the Bible says so and the Bible is the word of God.

Researchers have struggled to explain the fallacies generally, but circular arguments have proved particularly troublesome. This is due, in considerable part, to their close connection with deductively valid inference:

- (2) God exists, because God exists.

This seems intuitively even worse as an argument, because the dependence of the conclusion on itself as a premise is even more transparent, yet it is also more clear that the argument is deductively valid. If logic is the normative standard by which arguments are to be judged, (2) would seem to have the ultimate seal of approval.

Accordingly, the literature on circular reasoning has generated widely diverging opinions which are more or less unreconciled. Some seem to have denied that circular arguments are fallacious precisely because they are deductively valid (Robinson, 1971). More widely shared, however, is the opposite perspective that they are always fallacious. For example, Copi maintains that for arguments generally,

“if the proposition is acceptable without argument, no argument is needed to establish it; and if the proposition is not acceptable without argument, no argument that requires its acceptance as a premise could possibly lead one to accept its conclusion.” (Copi, 1986, p. 101)

Yet other authors maintain that some, but not other, instances of circularity might be fallacious. Some authors, here, have stressed that a crucial factor is whether or not the claim in question is actually contested. Kahane (1986), for example, points out that a reference to Biblical statements that God exists might be perfectly acceptable at a revival meeting where God's existence was not questioned or at issue (see also Sanford, 1972). Colwell (1989) echoes this point by distinguishing between circular reasoning or exposition in general and circular argument specifically: a dialogue may serve other functions than to convince someone of a claim, and in these other dialogical contexts circularity might be benign. Furthermore, according to Colwell, even circular arguments

might be acceptable embedded in a larger dialogue as long as the overall argument 'moves on'.

Walton (1985, 1995) has also repeatedly maintained that not all circular arguments are fallacious. Differentiating between logical and pragmatic aspects of a dialog he has distinguished the logical, structural notion of circularity, from the pragmatic notion of 'begging the question'. Begging the question is 'an improper move in a reasoned dialogue'. A circular argument, then, is fallacious only when it begs the question in a given case (Walton, 1995). This might not be the case, where different claims are inextricably bound together, as in the case of a citizen's committee claiming that the number of people in a particular suburb who use the buses are so few because the buses are so poor, to which city hall is countering that the bus services have to be reduced because so few people are using these buses (example discussed by both Walton, 1985 and Colwell, 1986). Rips (2002) also follows a broadly pragma-dialectical framework. He attempts to capture non-vicious circles, in part through hierarchical representations of argument and the linguistic notion of c-command in order to distinguish 'harmless' repeats from circular dependence. Vicious circles, on this view, are ones that involve series of evidential justifications which start and end with the same claim. It can, however, be possible to use an assertion non-circularly as long as explanation and evidence are mixed within the argumentative chain. For example: (3)

- A: People mentally rotate the images of objects.
- B: What's the evidence?
- A: Reaction times for same/different judgements are linear in the angular displacement of the objects.
- B: What explains the linear reaction times?
- A: People mentally rotate the images of objects.  
(after Rips, 2002)

Truncalito (2004) draws a slightly different distinction between the 'wrong doings of arguments', that is logical fallacies, and the 'wrong doings of arguers', what he calls rhetorical fallacies:

“Sometimes arguments go wrong: their premises do not entail their conclusions. And sometimes arguers go wrong: they make dialectical moves that violate the spirit of the quest for truth; to put the point another way, they break the rules of a language game.” (Truncalito, 2004, p. 326)

This is close in spirit to Walton in that it is based on pragmatics, but differs in that Walton (and other pragma-dialectical theorists) view the pragmatic failure as leading to a deficit of the argument itself. Indeed, van Eemeren and Grootendorst (2004) seem to maintain the position that circular arguments and begging the question are the same thing, and are always fallacious, because they violate one of the normative rules of dialogue which stipulates that in order to resolve differences of opinion by

means of regulated discussion it is necessary for the discussants to adopt as starting points propositions accepted by both parties. Circular arguments at least, (though not every circularity in dialogue, cf. Colwell and Kahane above) always violate this rule, because the disputed claim cannot form part of an initial premise set, precisely because it is under dispute. In the following, we will seek to resolve this debate with a Bayesian account of argument strength.

### 3. WHAT MAKES AN ARGUMENT A GOOD ARGUMENT?

The key goal of an argument is to *convince* someone (possibly myself) of a claim. This is apparent, for example, in van Eemeren and Grootendorst's definition of argumentation:

“Argumentation is a verbal, social, and rational activity aimed at convincing a reasonable critic of the acceptability of a standpoint by putting forward a constellation of propositions justifying or refuting the proposition expressed in the standpoint.” (van Eemeren & Grootendorst's, 2004, p. 1)

Consequently, the first quantity of interest in evaluating an argument as good or bad is the ultimate degree of conviction it brings about with regards to the standpoint or claim in question. An argument is strong to the extent that it convinces us of the claim it seeks to support.

However, it seems at least as important to take into consideration the amount of *change* in the degree of conviction brought about by an argument, not just how convinced or not the addressee is in the end. This is because degree of conviction will typically be influenced by how convinced someone was of the claim in advance of the argument presented. Preaching to the converted is easier than swaying the sceptic. Yet it presumably takes a strong argument to turn a die-hard sceptic into someone of even moderate conviction. Such achievement must be taken into account when classifying an argument as good or bad. This dependence of arguments on the prior beliefs of the addressee is familiar from the rhetorical tradition under the header of the ‘audience dependence’ of argumentation (Perelman & Olbrechts-Tyteca, 1969). What is convincing for one audience will not be so for another. The degree of change brought about we will refer to as the *force of an argument*. Argument strength then is a function of both (ultimate) degree of conviction and degree of force.

#### 3.1. Formalization of argument strength

Our proposal is that the relevant factors that make an argument (rationally) compelling or not can be captured within a Bayesian framework. We mean by this the view that probabilities express subjective degrees of belief that can be updated using Bayes' theorem. In other words, my ultimate degree of conviction in a claim  $C$ , given a reason

$R$ , e.g., some data, is

$$P(C|R) = \frac{P(R|C)P(C)}{P(R)}$$

The quantities that make up the key ingredients of how good or bad an argument is, on this account are:

Convincingness	=	$P(C R)$
Prior conviction	=	$P(C)$
Force (change)	=	The discrepancy between $P(C R)$ and $P(C)$

This discrepancy could potentially be captured in several ways, e.g., as a difference  $P(C|R) - P(C)$  or a ratio  $P(C|R)/P(C)$  but neither of these quantities are normalized with respect to the amount of change that can still be brought about. That is, the degree of belief of someone of a prior of .9 can at most be altered by .1, even with the strongest argument. Consequently these measures only allow direct comparison of arguments pertaining to the same claim and associated degree of prior conviction, not across arguments on different issues.

Another possibility is the likelihood ratio:

$$L(R|C) = P(R|C)/P(R|\text{not} - C)$$

This measure has the advantage that it is normalized across changes in prior, and, in this sense, isolates the evidence. It is also widely used in Bayesian modelling, and some authors (e.g. Pearl, 1988) suggest that the quantities from which it derives, i.e., the conditional probabilities such as  $P(e|H)$  are the atomic relationships in Bayesian analysis. Conditional probabilities possess modularity features similar to logical production rules, which suggests that it is these relationships a reasoner would want to encode. We do not seek to resolve or discuss here which measure of change is ultimately preferable as it matters for the present context only that such measures can clearly be derived.

Finally, it is worth emphasising that Bayesian inference provides a *normative* framework. It allows audience dependence through priors and quantifies ‘degree of confidence in the conclusion generated by the premises’ as invoked by Sanford (1972) to explain begging the question. Yet it doesn't introduce what philosophers fear as ‘psychologism’ whereby anything goes, because it so happens that I believe it. Arguments, including fallacies, will not be rendered strong simply because the reasoner (psychologically) fails to spot their weakness (for more detailed discussion of these problems see Biro's, 1977, critique of Sanford).

We can contrast this Bayesian perspective with the view from classical logic, as this is the tool that has supported the above analyses of circular arguments. For one, the gradedness of probabilities becomes replaced with a Boolean function. The values available for ultimate conviction are now only true or false. Possibly more problematic, though, is the fact that an epistemic interpretation is required, i.e. an interpretation that views these values as

subjective degrees of belief, because an argument is always seeking to convince some particular agent. Because there is no value that directly represents ignorance, the expression of change is entirely binary as well. So,

- Ultimate degree of conviction corresponds to the truth value assigned to the claim or conclusion given the premises.
- Initial conviction corresponds to the truth value assigned to the claim without the reasons that constitute the premises of the argument- often this will simply be ‘undefined’.
- Change is the discrepancy between the truth values of ultimate and initial conviction.

Of course, there is a wealth of non-classical logics that could be considered as alternative formalization tools here (for an overview see Prakken & Vreeswijk 2002). Examining these is beyond the scope of this paper; however, the following more detailed examination of circular arguments should nevertheless make clear how they would have to differ from classical logic in order to provide an appropriate framework.

#### 4. APPLICATION TO CIRCULAR ARGUMENTS

With these general considerations in hand, we return to analyse circular arguments in more detail. This discussion will distinguish two forms of the circular arguments. The first of these are:

##### 4.1. Circular arguments with direct premise restatement

God exists, therefore God exists

These have probably formed the main focus of the debate. Straightforwardly, any argument ‘that  $p$  therefore  $p$ ’ is deductively valid, so (as seen above) seems to carry a logical seal of approval, leading many authors to attribute its weakness to an alternative source ‘pragmatic failure’.

However, the question of whether or not deductive validity is the only criterion an argument has to meet is distinct from the use of logic as an analytical tool. Hence we pursue a logical analysis in light of our above discussion of argument strength in order to determine the extent to which the specific criteria established there are met. In circular arguments of this kind, the ‘convincingness’ of the claim ‘ $p$ ’ (as opposed to the premise ‘ $p$ ’) is dependent entirely on the truth value the addressed agent gives ‘ $p$ ’ as a premise. Where this is not given or not defined the argument has *no definite degree of ultimate conviction assigned to it*. By contrast, wherever a definite truth value is associated with the premise ‘ $p$ ’, the argument cannot bring about any change, regardless of which truth value this actually is.

In other words, greater attention to the quantities relevant for argument evaluation suggests that a classical logical analysis renders the argument a maximally poor one. And this is not simply because the somewhat crude machinery of classical logic renders all logical inferences

poor in this sense: I can have no initial truth value assigned to  $q$  but believe that ‘ $p$  implies  $q$ ’. If I am then told that  $p$  is true, I will come to the conclusion that  $q$  must also be true. In this case, the argument seems completely fine and the logical analysis would seem to concur (though the position that all deductively valid arguments commit the fallacy of circular reasoning has also been maintained, see e.g., Mackie, 1966, and Hamblin’s, 1970, or Biro’s, 1977 discussion of J.S. Mill).

On the Bayesian account the analysis of ‘ $p$  therefore  $p$ ’ runs like this. Here one has to distinguish (from the pragmatics of the utterance) between whether the ‘argument’ just involves two statements of the same claim or whether one (the first  $p$ ) is an evidence statement. If the first  $p$  is not an evidence statement, then I have no reason to use Bayes’ theorem to update in the first place, so no *change* is brought about. If however the first  $p$  corresponds to an observation (‘God exists’) then my conviction (that God exists) trivially goes to 1 whatever my priors were.

What will not always be pragmatically clear in real arguments is what the status of the first  $p$  actually is. One can imagine, for example, the following exchange:

A: God exists  
 B: why?  
 C: because God exists

Is A’s second line, here, a claim that has the status of an observation statement or is A simply refusing to engage and ‘closing the argument’ by reiterating his claim (for example, because he thinks there’s no real scope for debate for one reason or another?). Take another example:

C: the ball in the box is white  
 B: why?  
 C: because it’s white

which can be contrasted with,

C: the ball in the box is white  
 B: why?  
 C: because I lifted the lid and the ball is white

The lifting of the lid, in an of itself, is presumably irrelevant to the color, so all its addition is doing is making clear that the second occurrence of ‘the ball is white’ is an observation statement. But clearly this second version is fine as an argument and does not seem circular.

So a further reason the literature has been confused about circularity is that the translation from natural language statement to formalism necessary here is not necessarily straightforward. Similarly, the above examples suggest that the putatively circular claims themselves presumably have an influence on the interpretation assigned. Given general world knowledge, it seems unlikely that “God exists” is meant to express a direct observation, and as result it is assumed by readers of this example that

it does not, thus rendering the argument a circular, and hence, poor one.

In summary, both a logical and a Bayesian analysis actually render circular arguments involving direct restatements as poor, so that there is no need to resort to a pragma-dialectical explanation.

#### 4.2. Circular arguments without premise/claim restatement

Under this header we consider circular arguments such as:

God exists, because bible says so and bible is the word of God

Arguments of this kind, in which the claim is not used directly as a premise, but rather is implicitly drawn on in the evaluation of the evidence, are much more frequent in real life and do not seem to be necessarily viciously circular:

- (4) Electrons exist, because we can see 3 cm tracks in a cloud chamber, and 3 cm tracks in cloud chambers are signatures of electrons.

In fact, such arguments are prevalent in scientific reasoning wherever unobservable entities whose existence can be inferred only indirectly are concerned (see, Hahn & Oaksford [subm.] for further discussion; also see Brown, 1994 for real-world examples). In the first instance, at surface level, classical logic has nothing to say about these arguments, because the conclusion is not logically entailed by the premises.

For classical logical inference to be brought to bear on such examples, the ‘presuppositions’ of the claim underlying the reason must be spelled out, i.e., the Bible can be the word of God if and only if God exists. But this also means that the conclusion can follow only if the implicit premise/presupposed claim is actually true. Though ‘ultimate conviction’ will be high (i.e., ‘true’) in this case, the argument has failed to bring about any *change*, and, hence, is weak.

Typically more appropriate, however, will be to regard the presupposed claim/hidden premise as ‘undefined’ with regards to its truth value, in which case nothing at all can be inferred, and, again, trivially, there is no change in conviction. Consequently a (classical) logical analysis seems to necessarily render arguments of this kind as poor, so poor as to be ‘non-arguments’. This is disturbing with regards to examples such as (4).

Before much of current scientific practice with regards to unobservables is abandoned, however, a Bayesian account paints a different picture. Shogenji (2001) has demonstrated how such arguments *can* legitimately increase posterior degrees of belief. In the interest of space, we refer the interested reader directly to this paper for technical detail.

A Bayesian account further allows one to capture variations that make circular arguments of this latter kind more or less compelling. Consider, for example, another

everyday case involving uncertain data: on a page, one encounters what looks like three letters, though the middle letter is smudged and only partially visible, i.e., one sees something like:

(5) C - T

It seems entirely reasonable in these circumstances to infer that the word in question is “CAT,” though this inference rests on the assumption that the partially obscured middle letter is an “A.” This is an assumption which itself is supported by the fact that, if this were indeed the case, the sequence would spell the familiar word CAT (for a Bayesian analysis of word recognition models operating on such principles, see McClelland 1998; see also, Hahn and Oaksford, subm. for further discussion of this example). At the same time, one would be *more* convinced that one was dealing with “A” and “CAT”, if the preceding text up to these letters read “the big furry . . .” than if the sequence was preceded by nonsense letters. The difference between these cases is naturally captured in terms of differences in the prior  $P(\text{CAT})$ . Likewise, a Bayesian analysis can capture differences in the amount of smudging to the middle letter.

The previous examples resonate with the views of Colwell, Kahane and van Eemeren and Grootendorst introduced in section 2 above, in that they demonstrate that assent with the claim matters with regards to the circular arguments. By contrast, however, the examples make clear that one requires more than a binary notion of agree/disagree here. Degree of (prior) agreement with a claim makes circular arguments more or less acceptable, and it does so in a graded fashion, not in a binary transition from ‘non-argumentative,’ and hence non-fallacious, use to argumentative and hence fallacious use. In line with this perspective are the experimental findings of Rips (2002). Rips found graded effects of participants’ judgments of the ‘reasonableness’ of circular arguments given a manipulation of consent, though not on judgements of ‘circularity’ or ‘question begging’ as he had expected from a pragma-dialectical perspective. This fits exactly with the Bayesian perspective. The Bayesian analysis also clarifies Rips’ intuition that restatement of a hypothesis as an ‘explanation’ can be acceptable (see example 3 above), while making clear that this restatement can very well have evidential ramifications as well.

The example of (5) and its variations also makes clear where exactly the limitations of using classical logic lie. The first is the ‘ceiling effect’ introduced by the binary nature of evaluation. Conviction is either maximal or zero. Because of this, conviction cannot change from the (implicit) statement of the claim in the premise to that in the conclusion. The moment the statement is endorsed, as is necessary for an inference to go through, its endorsement can no longer increase. At the same time, the actual ‘data’ or ‘evidence’ given in the reason (e.g., that the Bible says that God exists, that one saw what looks like part of a letter) is inferentially entirely inefficacious (see also Colwell,

1986). There is no logical connection between the evidence itself and the conclusion. The only logical connection between premise and conclusion is the restatement from presupposition to conclusion. Hence a logical analysis cannot distinguish between the offering of ambiguous data or weak data and absolutely no data at all. This is just another example of the way that logical consequence seems unsuited to the concept of relevance required by a theory of informal argument (similar arguments have been made with respect to relevance logics, Anderson & Belnap, 1975). Logical consequence not only fails to provide a sufficient criterion for argument strength, as already evidenced by the need to supplement deductive validity with some other standard in order to deal with circular arguments. Logical consequence does not provide a necessary criterion either.

In short, for circular arguments without direct restatement an analysis in terms of classical logic and the Bayesian approach diverge. The logical analysis renders the argument poor, whereas the Bayesian analysis allows some arguments of this structure to be acceptable, and some to be poor - as seems to accord with intuition.

## 5. CONCLUSION

In conclusion, we think the Bayesian account captures well the two kinds of circular argument that have figured in discussions of classical reasoning fallacies. In capturing circular arguments, the Bayesian account proves superior to both classical logic and pragma-dialectical explanations. Logical analysis fails to capture appropriately the variation in strength found with non-viciously circular arguments without explicit premise restatement, and incorrectly labels all such arguments as 'bad'. Likewise, the pragma-dialectical perspective fails to capture circularity without explicit premise restatement. Though the notion that a poor argument is pragmatically 'question begging' precisely *labels* the limitations of such arguments, highlighting the consequences of their use in dialog, the pragmatic notion of 'question begging' itself fails to *explain* why poor arguments are poor in the first place. Given that non-viciously circular arguments without direct premise restatement can vary in strength, and can vary to the extent that some such arguments seem both acceptable and possibly the best kind of argument available for that particular claim (as in example 4 above), some additional explanation of why some circular arguments are good and some are bad is required. 'Begging the question' itself simply labels the distinction between the two. This problem is the same for Truncalito's attempt to explain circularity as a rhetorical failure of the arguer. The arguer too, presumably fails only because his or her argument is poor.

In explaining, why a particular example fallacy is weak, not strong, the Bayesian account, we think, recommends itself as a general account of argument strength. Furthermore, in this regard it is clearly superior to the alternatives considered here, though there may be other formalisms, in particular non-classical logics and alternative approaches to dealing with uncertainty (see e.g., Parsons,

2001) that might also turn out able to fulfil this role. That the Bayesian approach, in our view, provides a better explanation of argument strength, should not, however, be taken to mean that classical logic or pragma-dialectical theory have no contribution to make to the study of argumentation. With regards to the pragma-dialectical approach, we agree with these authors in that considerations about the function of dialogue are necessary for elucidation of what argument strength is about. We do not, however, think that the social norms governing discourse (in the form of van Eemeren and Grootendorst' rules, for example) help further in actually measuring argument strength, and hence, in explaining the fallacies. Rather, they are part of what is a largely orthogonal but nevertheless fundamental project. The social norms governing discourse, and the variations in these norms across different kinds of discourse, are clearly a fundamental of how arguments are conducted, and are a necessary ingredient of any wider theory of argumentation. Likewise, logic will always have a part to play in determining the logical structure between statements which in turn affect their probabilistic relationships. Structure is clearly essential to the way human beings represent and use knowledge. Given that we typically do not possess fully specified joint distribution functions, structure is needed to capture probabilistic relationships in cognitively plausible way (see e.g., Pearl, 1988). We suspect, however, that the actual strength of an argument will just depend on the probabilities themselves, and that the relevant quantities are well-captured on a Bayesian account. This is, of course, at this point in time mere conjecture and will depend crucially on the extent to which the notion of informational relevance can be captured in a probabilistic way as posited, for example, by Pearl. All we have shown at this point is that Bayesian inference provides a framework which can resolve some longstanding puzzles in informal reasoning, by providing an explanation of a key fallacy. Elsewhere, we have also started to collect experimental evidence that people presented with everyday arguments are indeed sensitive to the quantities postulated on the Bayesian account (e.g., Oaksford & Hahn, 2004; Hahn, Oaksford & Bayindir, 2005). These are, however, just first steps toward a both normatively and descriptively adequate theory of argument strength.

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