

A Bayesian solution to Hallsson's puzzle (penultimate draft)¹

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Bjørn Hallsson has recently (2019) raised an epistemological puzzle which is born out of real-world political disagreement. The puzzle, in a nutshell, is this: These days, when people form political beliefs they (unbeknownst to themselves) employ *motivated cognition*. This is 'cognition that aims at arriving at an interpretation of evidence that yields a desired conclusion . . . [rather than] accurate beliefs' (2019: 2190). Moreover, the greater a person's epistemic abilities (*e.g.* intelligence and familiarity with evidence), the more powerful his motivated cognition. That is, the greater a person's epistemic abilities, the more easily and convincingly he can justify his desired conclusion to himself and generate stories about why contrary evidence ought to be ignored.

What, then, to make of political disputes from the point-of-view of the epistemology of disagreement? On the one hand, we typically think that epistemic ability in an interlocutor gives us reason to downgrade our beliefs upon discovering that we disagree. On the other hand, if epistemic ability travels with motivated cognition—and

¹ I thank Bjørn Hallsson and Kirun Sankaran for helpful comments on this paper. I am also grateful to Desmos, Inc., which kindly granted permission to use Figure 1, which was generated with its graphing calculator (URL = <<https://www.desmos.com/calculator>>, retrieved 14 July 2019).

in the political domain, it does—then we have reason to discount that interlocutor’s opinion. How should we resolve this tension?

Hallsson leaves that question unanswered. He regards it as ‘a genuine puzzle with unwelcome consequences whichever route we go’ (2019: 2200). He is content to raise the worry and then, ably, turn aside objections (*e.g.* that political disagreement is not epistemologically significant in the first place).

I want to suggest a solution to Hallsson’s puzzle. Namely: The tension is resolved when we adopt a *Bayesian* approach to belief revision (as I discuss, more generally, in my Forthcoming). As we shall see, this falls on the side of ignoring interlocutors’ opinions when their motivated cognition is bad enough. No matter how epistemically able they be, their disagreement should not influence our beliefs. The reason this is so, I argue, is that these interlocutors provide us with *no new information on which to conditionalize*. Because of the extreme partisanship and motivated cognition which Hallsson cites, we implicitly and to high accuracy know partisans’ political beliefs before they are ever revealed to us. When we discover that we disagree, we learn nothing new.

1. Hallsson’s argument, in brief

Hallsson begins by distinguishing two ‘notions of epistemic peerhood’—that is, two methods of assessing a person’s epistemic credentials:²

ABILITY: An individual’s familiarity with the relevant evidence and arguments, and their epistemic virtues such as intelligence, thoughtfulness, and freedom from bias.

² On these two notions, see, respectively, Kelly 2005 and Elga 2007.

ACCURACY: The probability of an individual's belief about p being correct, conditional on their disagreement with another individual. (2019: 2190, my emphasis)

We normally think that these two go hand-in-hand. If not coextensive, we at least expect them to be highly correlated. But by surveying the empirical literature on political belief formation, Hallsson shows how the two may come apart not only in theory but in practice. That is, he shows how a high-ABILITY epistemic interlocutor may have low ACCURACY, and *vice versa*. Hallsson presents the following scenarios:

BRILLIANT PARTISAN: I belong firmly on one side of the political aisle. I have a doxastic attitude toward a politically disputed proposition p that is typical for those on my side of the aisle. I learn that BP is an extremely intelligent, highly educated and scientifically literate, open-minded, and reflective person on the other side of the political aisle, who is intimately familiar with the relevant evidence about p .

MEDIOCRE PARTISAN: I belong firmly on one side of the political aisle. I have a doxastic attitude toward a politically disputed proposition p that is typical for those on my side of the aisle. I learn that MP is a moderately intelligent, decently educated and scientifically literate, somewhat open-minded, and reasonably reflective person from the other side of the political aisle, who has some familiarity with the relevant evidence. (2019: 2191-2192, my emphasis)

BP is, *ex hypothesi*, high-ABILITY. But she is, Hallsson points out, low-ACCURACY—since no matter what the evidence about p actually entails, BP will construe it to support her desired conclusion, *via* motivated cognition.³ It is precisely BP's epistemic gifts that enable her to generate a justification for what she wants to believe politically—even in the face of shoddy or inconclusive evidence—and to generate clever reasons why contrary evidence should be ignored.

³ This is the justification for BP's having low ACCURACY which Hallsson finally settles on (2019: 2194). He considers other possibilities earlier in the section.

MP is lower-ABILITY than BP but higher-ACCURACY. Why? Because, being less epistemically able than BP, MP is not as effective at interpreting the evidence in a way that confirms his existing beliefs. As a result, MP's 'belief about p is more constrained by what the evidence actually supports than BP's belief is' (2019: 2194, my emphasis).

2. The Bayesian response

Interesting in its own right, Hallsson's paper is valuable because it provides further reason to believe that a Bayesian approach to disagreement-based belief revision—which is a minority one, at least among epistemologists—is correct.⁴

I first summarize the Bayesian approach. We are interested in the truth or falsity of some proposition p :⁵ *abortion is morally impermissible; humans are causing climate change; that is the Dean walking on the quad* (Feldman 2007); and so on.

We have a *prior probability*, $\Pr(p) \in (0, 1)$, which is our degree of belief in p before discovering the existence of disagreement. This is also referred to as our 'credence' or our 'confidence' in p . Thus, if p is *humans are causing climate change*, $\Pr(p) = 0.8$ means that we believe, subjectively, that there is an 80% chance that humans are causing climate change. This is all intuitive, and standard in the disagreement literature.

The Bayesian approach to disagreement differs from its competitors, steadfast and conciliatory, in three ways:

⁴ See Easwaran *et al.* 2016, Isaacs 2019, Jehle and Fitelson 2009, Lasonen-Aarnio 2013, Levinstein 2015, Mulligan Forthcoming, and Shogenji Manuscript.

⁵ The Bayesian approach, in its full generality, allows for p to take on three, four, or more discrete values (rather than just true and false), or even be treated as continuous.

Bayesian Principle No. 1

When we Bayesians learn that someone disagrees with us about p , we treat that as just another datum on which we can update our beliefs. It is no different, as a category matter, from the data we obtain when we read some new empirical study. In contrast, the standard (if implicit) understanding in the epistemological literature is that there is something special about human judgment, such that dissent must be treated *via* a unique epistemic framework.

In particular, many ‘traditional’ (*i.e.* non-Bayesian) epistemologists of disagreement, like David Christensen (2007), regard disagreement as evidence that one has made a mistake. For these epistemologists, when we learn that an epistemic peer disagrees with us, we learn that we may have evaluated the evidence incorrectly, and, thus, that our existing credence is not the ideally rational one.

Although I do not wish to explore the differences between the traditional view of disagreement and the Bayesian view in detail, a few remarks are in order. First, for the traditionalists, disagreement implies that we *may* have evaluated the evidence incorrectly—not that we did. There are plenty of cases of disagreement in which we, and not our interlocutor, evaluated the evidence correctly yet belief revision is still rational.⁶

⁶ For example, in Christensen’s (2007) ‘Restaurant Tip’ case, two friends go out to dinner and calculate their shares of the bill. They are epistemic peers (*i.e.* equally good at math, they both took a careful look at the check, *etc.*), but they come to different conclusions about what their shares are. Suppose that EP1 is right and EP2 is wrong. The traditionalist surely holds that EP1 should lose confidence in his belief, despite, *ex hypothesi*, being right. (And I agree that he should.) It is the (internalist) *possibility* of error that demands epistemic compromise.

But this is hardly news. For every belief we have (at least as far as paradigmatic cases in the literature go) we know, or should know, that we could have erred. We all make mistakes, all the time.

Perhaps disagreement indicates that it's *more likely* that we erred than we suspected pre-disagreement. That raises the question, 'what's so special about disagreement?' There are many ways we might learn that it's more likely that we made an error than we thought. Suppose, for example, that we think that a tax cut is good for the general welfare. One way we could learn that we may have evaluated the evidence relevant to this claim incorrectly is *via* disagreement. Another way is by learning a new piece of microeconomic theory. It is unclear why the former must be treated in a special way, as the traditionalists desire.

Second, relatedly, the Bayesian approach handles this dynamic of possible prior mistake. Yes, we might update our beliefs after reading a new empirical study because that study provides us with new evidence. But the study might just as easily suggest to us that we made an error in our reasoning. (The study might, *e.g.*, claim that an inference from x to y is invalid, while our current belief is based in part on $x \rightarrow y$.)

Third, there are many cases of actual disagreement in which we should revise our beliefs because our interlocutor is bringing us new first-order evidence. Suppose I think it's going to rain because I see that the barometer is falling. My neighbor tells me that he thinks it's not going to rain, because he just looked at the weather radar and saw no precipitation. We disagree about the proposition *it's going to rain* and I so revise my

belief accordingly. In this case, the reason why I revise my belief is because disagreement provided me with new evidence relevant to the proposition.

Now here the traditionalist objects: This is not a genuine case of disagreement, because there is no epistemic peerhood relation. After all, my neighbor and I do not share the same evidence.

And that's true. And perhaps, for that reason, the case is not philosophically interesting. But it illuminates a critical advantage of the Bayesian approach: its generality. Whether some disagreement provides us with new first-order evidence, or suggests that we made a mistake in reasoning somewhere along the way, or raises the possibility that we are biased, is not the important thing. What is important is our assessment of our interlocutor(s) by specifying appropriate likelihood functions (see below).

Along similar lines, Bayesianism does not limit itself to special cases of disagreement, whereas traditionalists almost always consider disagreement with *one* epistemic *peer*. Multiple interlocutors (see n. 12) and epistemic superiors/inferiors are naturally accommodated by Bayesian belief revision.

Real-world disagreement is so rich and complicated. I believe that Bayesianism captures that richness and the traditional approach does not.

Bayesian Principle No. 2

We treat our interlocutor's opinion about p —let's call it q —as a random variable, the value of which she reveals to us (generally, in conversation).

Bayesian Principle No. 3

When we learn this value, we modify our belief in accordance with Bayes's Law:⁷

$$\Pr(p|q) = \frac{\Pr(p) \times \Pr(q|p)}{\Pr(p) \times \Pr(q|p) + \Pr(\sim p) \times \Pr(q|\sim p)} \quad (2.1)$$

Because $\Pr(p)$ is known, and $\Pr(\sim p) = 1 - \Pr(p)$, the 'only' hurdle to arriving at a rigorous *posterior probability* $\Pr(p|q)$ is specification of the *likelihoods* $\Pr(q|p)$ and $\Pr(q|\sim p)$. That is, we must specify the probabilities that our interlocutor would have the opinion that she does, q , given that p and given that $\sim p$, respectively.

Let us apply the Bayesian approach to Hallsson's puzzle. For the moment we consider the simplified case in which q is binary; the interlocutor thinks that humans are causing climate change, or she does not. (That is, our interlocutor does not provide a credence in p , but only 'yes; p ' or 'no, it's not the case that p '.) Suppose $\Pr(p) = 0.8$, as above, and my interlocutor, a BRILLIANT PARTISAN (who is a conservative, let's say), tells me, 'I believe that humans are not causing climate change'.

By design of Hallsson's thought experiment, BP's view is unconnected to the evidence. Because of her political beliefs and her powerful motivated cognition, BP is going to believe that humans are not causing climate change no matter the evidence. 'BP's brilliance means that, more or less regardless of what the evidence really supports about p , he or she would be able [to] construe the evidence as supportive, and to conjure

⁷ I am going to abuse notation a little from here on out, using q to refer to both a random variable and its realization.

up reasons to be supremely confident that his or her desired conclusion about p is correct.’ (2019: 2194, my emphasis).

As a result, specification of the likelihoods is easy. The probability that q , given that humans are not causing climate change, is 1. If we are not causing climate change, BP is certainly going to say that we are not causing climate change. But the probability that q , given that humans *are* causing climate change, is also 1! BP’s motivated cognition ensures this. When it comes to climate change, the state of the world is just not relevant to BP’s belief.

Substituting these values into equation (2.1), we have:

$$\Pr(p|q) = \frac{0.8 \times 1}{0.8 \times 1 + 0.2 \times 1} = 0.8 \quad (2.2)$$

We see that BP’s opinion should not sway us. To use Hallsson’s term, ACCURACY is what matters.

What about MEDIOCRE PARTISAN? Here it is less certain that q is divorced from the evidence: ‘MP does not have the ABILITY necessary to escape from the conclusion that the evidence really warrants decreasing his or her confidence in his or her favored conclusion about p .’ (2019: 2194, my emphasis).

Therefore, we specify likelihoods that accommodate the potential ‘failure’ of MP’s motivated cognition. If the evidence supports human impact on the climate, MP might not reach his desired, conservative conclusion. Unlike BP, MP cannot wholly wriggle his way free from the facts.

So while $\Pr(q|\sim p)$ might remain 1, if humans *are* causing climate change there is a possibility that MP will believe that it is happening. That is, $\Pr(q|p) \neq 1$.

Suppose that $\Pr(q|p) = 0.7$. Now we have:

$$\Pr(p|q) = \frac{0.8 \times 0.7}{0.8 \times 0.7 + 0.2 \times 1} = 0.74 \quad (2.3)$$

With MP, we do not maintain our original belief in p , as was the case for our interaction with BP. Here, we mitigate our belief slightly. The reason is that MP's dissent is informative. He is more sensitive to the evidence than BP is (BP is not sensitive at all), and so his negative judgment about human-created climate change is epistemically useful to us. Now, $\Pr(q|p) = 0.7$ was chosen arbitrarily. The important point is that the more sensitive an interlocutor gets, the more we ought to reduce our confidence in p upon learning that we disagree.

Note that here, too, ACCURACY controls. MP's ABILITY is only relevant insofar as it improves or degrades the precision of his judgments.

There is another way to interpret these results from the Bayesian point-of-view. Notice that, perhaps counterintuitively, we do not gain new information when we learn that we disagree with BP about p . We knew prior to learning that fact that BP was, well, a brilliant partisan. And we also knew what that entailed: that her motivated cognition would cause her to settle on a certain belief no matter the evidence. We thus were able to predict, if implicitly, what BP's opinion about p was before she revealed it.

As Hallsson himself points out, ‘the greater a person’s ABILITY, the more predictive that person’s political ideology is of their beliefs about politically charged propositions’ and ‘beliefs [are] polarized along political fault lines, such that political ideology is highly predictive of one’s belief about these propositions’ (2019: 2191). Put differently, BP’s views on climate change were already fully baked into our prior, $\Pr(p)$, and so her disagreement was not informative.⁸

We have, then, a preliminary resolution to Hallsson’s puzzle. A proper application of Bayes’s Law aligns with revising our beliefs in accordance with our interlocutors’ ACCURACY—not their ABILITY. Indeed, it is precisely that ABILITY, and its bad effect on our interlocutors’ sensitivity to the evidence, that should cause us to ignore their opinions. Of course, this is perfectly compatible with ABILITY being a virtue in most circumstances. In any real-world scenario, motivated cognition would not be the sole modelling consideration. But it is, *ceteris paribus*, a bad thing.

There is a technical issue to address. It is standard in the epistemological literature, and for good reason, that our interlocutor report not a binary judgment about p (*i.e.* as true or false), but a continuous credence $q \in (0, 1)$. That is, our interlocutors report a probability for the uncertain event p .

⁸ These considerations are related to Hallsson’s discussion of ‘clustering’ on pp. 2197–2198 (see also Elga 2007). But here we are not denying that political disagreements are epistemically significant. Nor are we begging the question by claiming that because some interlocutor is wrong about related disagreements, she is wrong about this one, too. What matters is the predictive nature of political partisanship—what an interlocutor’s opinions about related issues suggest for her opinion about this one.

In principle nothing changes from the approach just described—we simply model q as a continuous random variable (probably but not necessarily distributed Normal truncated to $(0, 1)$) and specify appropriate likelihoods.

In practice, though, this can be onerous. The likelihoods must incorporate ABILITY—no easy thing to reckon on its own, especially when we include the motivated cognition dynamic—plus bias in its various forms, the possibility of interdependence between our judgment and our interlocutor’s judgment, and myriad other epistemic considerations. (Plus we may struggle, conceptually, to specify distributions which are conditioned on an event which has not and may never occur.)

In order to operationalize this Bayesian approach, decision theorists have introduced a variety of models, each of which seeks to simplify the likelihood specification problem without losing necessary generality.⁹ Here I wish to apply my favorite, which is due to Christian Genest and Mark Schervish (1985), to Hallsson’s puzzle. I shall first give the model and then discuss the assumptions and philosophy behind it:

$$\Pr(p|q) = \Pr(p) + \lambda(q - \mu) \quad (2.4)$$

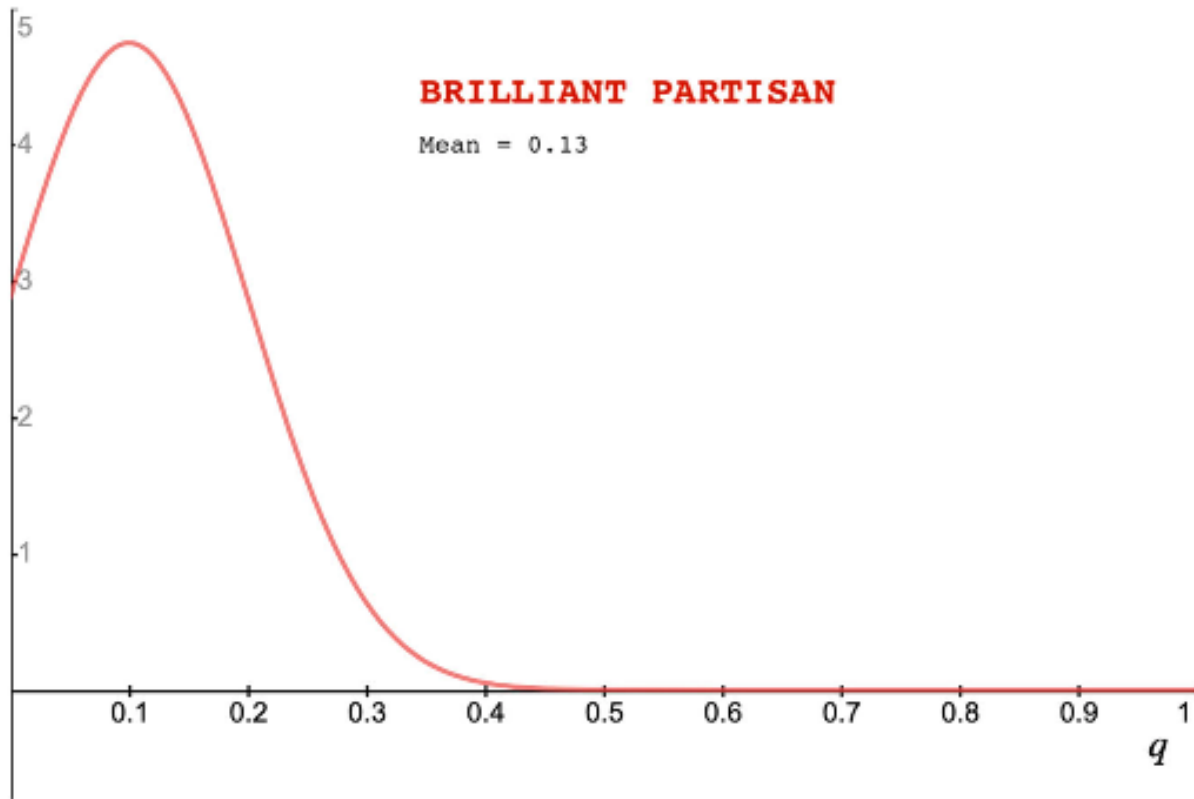
The prior probability $\Pr(p)$ is, again, our pre-disagreement belief in $p = \textit{humans are causing climate change}$. Now, however, q is a credence—it is our interlocutor’s expressed belief about the probability that p . So we are now in the case commonly considered in

⁹ Summaries of these models may be found in Clemen and Winkler 1990 and 1999, and in French 1985.

the epistemological literature, in which we are trying to decide whether to modify our confidence (and if so, how much) upon learning an interlocutor's confidence. The parameter λ I shall describe shortly.

The parameter μ is the mean of the distribution of q , as we see it. That is, we think about our interlocutor, and what she might say about p , and build up a probability density in our own mind (although this is not strictly necessary—see below). This could happen before learning q (ideally) or after. For example, in the case of BP, we will say that low values of q are more likely than high values. We are quite sure that BP, being a committed conservative, will assign a low probability to the event p (*i.e.* that humans are causing climate change). Perhaps we also think that q should be distributed normally. Those are modelling choices; what is important is that the distribution integrate to 1 and have support $(0, 1)$.

For example, we might model q thus:



To reiterate, this distribution represents our judgment about what BP thinks about p . We are almost certain that she will say that humans are not causing climate change (*i.e.* $q < 0.5$). Indeed, we are quite sure that will she report a confidence close to $q = 0.1$ (‘there is a 10% chance that humans are causing climate change’), which is the modal value of our chosen distribution.¹⁰

Here is the key point: When BP (or anyone else, for that matter) reports what we expect her to—that is, when $\mu = q$ —equation (2.4) reduces to $\Pr(p|q) = \Pr(p)$. In such

¹⁰ Because the support of this distribution is $(0, 1)$, is no longer technically Normal. Therefore, its mean is no longer (generally) equal to its mode. Figure 1 is, rather, a Truncated Normal distribution, with parent parameters $\mu = 0.1$ and $\sigma = 0.1$. Its mean is $\mu + \sigma \frac{\varphi(\frac{0-\mu}{\sigma}) - \varphi(\frac{1-\mu}{\sigma})}{\Phi(\frac{1-\mu}{\sigma}) - \Phi(\frac{0-\mu}{\sigma})} = 0.13$, where $\varphi(x)$ is the probability density function of the Standard Normal distribution, and $\Phi(x)$ its cumulative distribution function.

cases, we do not change our belief in p as a result of disagreement, *no matter our interlocutor's ABILITY*. Again, this is the Bayesian intuition: If we don't gain new data as a result of an interaction, we ought not change our beliefs. Similarly, when our vegan organic farmer friend tells us that he believes that humans *are* causing climate change, that should not affect us.

Suppose, however, that BP surprises us. Suppose that this conservative, small government, free market supporter says, 'I've taken a look at the evidence, and I think that there is a 60% chance that humans are causing climate change' (*i.e.* $q = 0.6$). Now this is interesting. The fact that someone with conservative commitments has reached such a conclusion, perhaps overcoming powerful motivated cognition along the way, provides us reason to increase our confidence in p . (Here's another intuition: If and when conservatives come *en masse* to believe that humans are causing climate change, we can be pretty sure it's happening.)

Plugging those values into equation (2.4), we get:

$$\Pr(p|q) = 0.8 + \lambda(0.6 - 0.13) \quad (2.5)$$

To reach a final, revised belief, we must address the parameter λ . Although a technical discussion of this is outside of the scope of this paper (see Genest and Schervish 1985 and West and Crosse 1992), a few useful things can be said.

First, λ must comport with consistency conditions which ensure, *inter alia*, that $0 \leq \Pr(p|q) \leq 1$. The conditions are:

$$\max \left\{ \frac{\Pr(p)}{\mu - 1}, \frac{\Pr(p) - 1}{\mu} \right\} \leq \lambda \leq \min \left\{ \frac{\Pr(p)}{\mu}, \frac{1 - \Pr(p)}{1 - \mu} \right\} \quad (2.6)$$

For the values under discussion, $\Pr(p) = 0.8$ and $\mu = 0.13$, we have $-0.92 \leq \lambda \leq 0.23$.

Second, many relevant epistemic considerations can be incorporated into our belief revision through careful selection of λ . These include ABILITY *per se* (which increases λ), motivated cognition (which decreases λ), other forms of bias (which decrease λ), and, in the case of multiple interlocutors, dependence between them (which decreases the λ s).

Third, the consistency conditions maintain coherence between our reckoning of our interlocutor's reliability, λ ; what we expect her to say, μ ; and our prior probability of p . It would not make sense, for example, to believe both that (i) some event k is highly improbable and (ii) this person who has great insight into k is going to say that k is highly probable. The consistency conditions prohibit such oddities.

Suppose that we select $\lambda = 0.15$,¹¹ which comports with the consistency conditions. Then, by equation (2.5), we can compute our updated confidence in p when our BRILLIANT PARTISAN surprises us with a confidence $q = 0.6$. Namely, $\Pr(p|q) = 0.87$. When we find out that a committed conservative believes, if only modestly, that humans are causing climate change, we increase our confidence that it is the case.

¹¹ Here is how I selected this value. Observe that we can use equation (2.4) to work backwards, computing λ by specifying a posterior probability for some given value of q . I might think, thus, that my posterior probability of p ought to be 0.9 in the event that my interlocutor ends up agreeing with me, $\Pr(p) = q = 0.8$. That yields $\lambda = 0.15$. In many cases, it may be easiest to compute λ by choosing a value for q very close to 0 or 1.

In the case of a MEDIOCRE PARTISAN who reports $q = 0.6$, we might expect a more modest increase in confidence, given MP's lesser ABILITY and our expectation, pre-disagreement, that he will have a view on climate change closer to our own. We can see that if we take $\lambda = 0.1$ and $\mu = 0.2$, we increase our confidence to $\Pr(p|q) = 0.84$ upon interacting with him.

We ought to give careful thought to the unique epistemic features of any given case of disagreement and incorporate them into a Bayesian updating procedure. Note that in the above analysis we did more than was necessary. There was no need to specify the whole distribution of q , as we did in Figure 1. All that we must do is answer, 'what do I expect my interlocutor to say?' (i.e. 'what is μ ?')

I shall leave things there, since I think these considerations suffice to solve Hallsson's puzzle. If any interlocutor—brilliant, mediocre; liberal, conservative—reports exactly what we expect them to—that is, if $q = \mu$ —we ought not modify our confidence in the proposition at issue. When this is not the case—and it often is not—we ought to use Bayes's Law, with situation-appropriate likelihood functions, to determine our new confidence. When equation (2.4) is appropriate, we think about the epistemic features of the case at hand—ABILITY, motivated cognition, bias, dependence, and all the rest—select values for μ and λ , and arrive at our posterior. Although I do not have the space to explore things here, I note that this approach has the benefit of incorporating further

generality. For example, and as alluded to above, the Bayesian approach can easily accommodate disagreement with multiple interlocutors.¹²

Hallsson's paper commends, if indirectly, a Bayesian approach to disagreement. Hallsson is right to worry that standard approaches to disagreement in the epistemological literature, steadfast and conciliatory, are unable to cope with scenarios like those he gives. The lesson is not to give up hope, but to look elsewhere for our solution.

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¹² A possibility discussed in Gardiner 2014 and Mulligan 2015. For n interlocutors, equation (2.4) becomes $\Pr(p|q) = \Pr(p) + \sum_{i=1}^n \lambda_i (q_i - \mu_i)$. The consistency conditions change accordingly.

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