Epistemically Different Epistemic Peers

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Introduction

For over a decade now epistemologists have been thinking about the peer disagreement problem of whether a person is reasonable in not lowering her confidence in her belief P when she comes to accept that she has an epistemic peer on P who disbelieves P. However, epistemologists have overlooked a key realistic way how epistemic peers can, or even have to, differ epistemically—a way that reveals the inadequacy of *both* conformist and non-conformist views on peer disagreement by uncovering how the causes of peer disagreement bear on the debate's core philosophical issue.

Part of our argument for this thesis will involve giving a thorough yet entirely informal presentation of mathematical theorems in economics by Robert Aumann (1976) and Polemarchakis & Geneakoplos (1982) which represent a formally precise description of how two rational agents must deal with disagreement under certain epistemically interesting circumstances.

1. The Set Up

Admitted peer disagreement in epistemology is often taken as evidence that at least one of the disagreeing parties is epistemically required to adjust her confidence in the proposition disagreed upon.

In a diachronic fashion, at t_1 the two agents who accept each other as being peers on a proposition P each have a credence in P. At this point in time, each does not know the other person's credence in P. By a later time t_2 the agents have discovered their different initial credences *and* they have shared any reasons or evidence they have regarding p: in other words, they have reached "full-disclosure" of the disagreement.[1]

[1] This term comes from Feldman 2006.

One of the primary normative questions at stake in the standard debate arises at t_2 and concerns how the admission of the disagreement should affect what the agents think of P: are the agents reasonable, at that later time, if they stick with their initial credences in P?

The philosophical literature offers two general answers:

- The Non-Conformist[2]: it sometimes happens that neither of the agents changes her initial credence and they are both rational in doing so.
- The Conformist: In every case, at least one of the agents is rationally required to change her initial credence in P.

But what – one might ask – does mean to be an epistemic peer regarding a proposition? The literature cashes out this notion in different ways, and some philosophers seem to operate under the assumption that the details do not matter. For the issues raised in this essay, which bear on both conformism and non-conformism, the details are crucial.

2. Epistemic Peerhood

While early uses of the term of art `peer' stress the equality of the agents in terms of epistemic virtues, such as intelligence, perspicacity, honesty, and thoroughness (Gutting 1982), a more common way to define the peers nowadays adds an evidential dimension:

> **Ideal Peerhood:** two agents are *ideal peers with regard to P* iff (a) they have the same evidence regarding P, (b) they are equally familiar with the arguments that bear on the question whether P, and (c) they are equally competent, intelligent, and fair-minded in their assessment of the evidence and arguments that bear on the question whether P.[3]

[2] We borrow these terms from Lackey 2010.

[3] Examples of condition (a) include Christensen 2009, Elgin 2010, Matheson 2009, King 2012, and Kelly 2010. Examples of condition (b) include Lackey 2010, Kelly 2005, and Kelly 2010. Examples of (c) include Christensen 2009, Elgin 2010, Matheson 2009, King 2012, Kelly 2005, Kelly 2010, and Goldberg 2013.

Regarding (a), theorists sometimes acknowledge that peers do not need the same bodies of evidence as long as those bodies have the same strength vis-à-vis P. Incorporating this insight in the definition of ideal peerhood or at other relevant points in this essay wouldn't affect our arguments or theses. In addition, if equal familiarity with the evidence is taken to imply equal evidence, satisfaction of (b) guarantees satisfaction of (a).

We have two theses regarding ideal peerhood. Thesis **T1**: *ideal peerhood is quite rare—and is virtually non-existent for any proposition we are actually interested in, whether it be from science, politics, philosophy, history, anthropology, ethics, religion, our personal lives, etc*. The reason for **T1** is that regarding virtually all propositions we care about, people are highly diverse when it comes to evidence, argument-familiarity, and cognitive assessment. To require that two people be equal in any one of those—let alone all three—is to guarantee little application. Please note that **T1** has nothing to do with disagreement; it has to do with diversity alone.

Thesis **T2**: *if two people disagree over P (one believes P while the other disbelieves P, or they have significantly different credences in P), then the odds are high that they are not ideal peers*.[4] The reason for **T2** is that if two people disagree over P, then the odds are high that the causes of the disagreement—the factors that led them to adopt differing views on p—involves them having different evidence, argument-familiarity, or cognitive assessments of the evidence or arguments.

The combination of **T1** and **T2** shows that ideal peerhood is inapplicable to virtually all disagreements over propositions we take interest in.[5]

With respect to the definition of ideal peerhood, one might replace 'the same' in clause (a) with 'approximately the same' and replace 'equally' in (b) and (c) with 'approximately equally'. Call the resulting notion *approximate peerhood.* The analogues of **T1** and **T2** are false for approximate peerhood; hence, those two bullets are dodged. However, now we have unfortunate thesis **T3**: *conformism is implausible if it concerns mere approximate peerhood*.[6] For instance, if we both discover that we disagree over P, and then we both come to think that the other person is only *approximately* our peer on P, then learning those two facts fails to supply either of us with good reason to think that we are the one who has erred on P's truth-value. After all, even if you admit that I am your approximate peer, you would hardly be unreasonable to think that I may well lack a key piece of evidence you have, or perhaps I made a mistake in assessment that you avoided. Because of this

[4] For the purposes of this article, 'disagree over p' is stipulated to have the meaning of the expression in the parenthetical clause.

[5] This point has been made, among others, in Frances 2010 and King 2012. The latter notices how the conditions for epistemic peerhood are very seldom met in real life and that, if the debate focuses on the disagreement cases in which the agents have reasons for believing that they are epistemic peers, then the epistemic implications of the disagreement don't have an as wide scope as the literature usually takes them to. We agree with him and, in order to restore the wider scope that the peer disagreement is assumed to have, in what follows we endorse what King calls a `lenient, less draconian' standard of peerhood.

[6] King 2012 points out at how this is one of the main worries for any lenient, less draconian account of peerhood.

thought, you would be reasonable in sticking with your credence in P; and all this is true of my thoughts about you as well. This result is inconsistent with conformism. Therefore, because conformism is plausible (or so we assume here) but would not be if it employed approximate peerhood, conformism does not employ approximate peerhood.

Actually, matters are a bit more complicated than that. The preceding paragraph is true provided 'approximately equal' comes to *only very roughly equal*; but it is mistaken provided 'approximately equal' comes to something like *virtually equal*, where virtual equality is much closer to real equality than approximate equality is. Our thesis **T4** concerns a trade-off: *the more we let the agents differ when it comes to evidence, argument familiarity, or cognitive assessment, the better we avoid the analogues of **T1** and **T2** but then the analogue to **T3** becomes more pressing (that was the problem with approximate peerhood); on the other hand, the more we demand the agents are the same when it comes to evidence, argument familiarity, and cognitive assessment, the better we avoid the analogue of **T3** but then the analogues to **T1** and **T2** become more pressing (that was the problem with virtual peerhood)*.

We state without argument thesis **T5**: *there is a need for a notion of peerhood that has a wide range of application to actual cases of disagreement*. Thesis **T6** is a consequence of previous theses: *ideal and approximate peerhood are not adequate for such a notion of peerhood*. We are not saying, with **T6**, that all notions of peerhood need to have wide applicability to actual cases of disagreement. For instance, ideal peerhood can be useful in contexts that are more theoretical.

An even more serious problem with the two notions of peerhood concerns a key class of interesting disagreement cases, ones that will figure prominently in section 4 and which both the ideal and the ordinary peerhood are inadequate to capture. For instance, you and I might be equally likely to correctly judge p's truth-value even though you are significantly smarter than I am, provided I have put more productive thought into P than you have. Or, I may have spent much more time investigating P than you have but you have done so with far fewer major distractions. Or, your evidential support for P is considerably greater than mine but I have fewer or less disruptive major biases—and these differences cancel out leaving us equally likely to judge P correctly (we elaborate on such a case below). Or, you have better testimonial evidence but I have superior sensory evidence.

Regarding cases along these lines, two definitions are in order:

Equal-Position Peerhood: two agents are *equal-position peers with regard to P* iff they are virtually equally likely to correctly judge P's truth-value (cf. Frances and Matheson 2018).

Equal-Position Case: two agents are in an *equal-position case with respect to P* iff they are equal-position peers with regard to P even though they have significant differences in evidential strength, assessment of evidence, arguments, or assessment of arguments (regarding P).[7]

We have four theses regarding equal-position cases and equal-position peerhood:

Thesis **T7**: equal-position cases are common for the propositions we care about and disagree over; moreover, that means that equal-position peers are also common for those propositions. So, the analogues to theses **T1** and **T2** are false for equal-position peerhood.

Thesis **T8**: conformism and non-conformism are both plausible when concerning equal-position peerhood. So, the analogue of thesis **T3** is false for equal-position peerhood.

Thesis **T9**: equal-position peerhood satisfies the conditions for peerhood mentioned in **T5**.

Thesis **T10**: equal-position cases do not satisfy the conditions for either ideal peerhood or approximate peerhood.

As for **T7**, notice first that equal-position peerhood uses just one dimension—epistemic position—while the ideal and approximate notions of peerhood use five—evidential strength, argument familiarity, competence, intelligence, and fair-mindedness (the last three with respect to argument and evidence assessment). Hence, it is much easier for a disagreement case to involve equal-position peers than ideal or approximate peers: agents have to match on one dimension instead of five. This fact, plus the use of 'virtually' in the definition of 'equal-position peerhood'—so agents' epistemic positions vis-à-vis judging P do not have to match up perfectly—means that we have found a way around the previously noted trade-off problem facing approximate and ideal notions of peerhood (viz. the problem that avoiding **T3** often means falling prey to **T1** and **T2**, while avoiding **T1** and **T2** often means falling prey to **T3**).

We can give an illustration of a typical equal-position case. Suppose Jo and Mo are trying to determine whether P is true. Jo has evidence E_J while Mo has evidence E_M. As a matter of fact, P is true and E_J

[7] Notice that neither of these definitions say the agents disagree on p: equal-position peers can have the same credence in P and the agents in an equal-position case can have the same credence in P.

supports P significantly better than E_M does. So, Jo has an advantage in epistemic position when it comes to getting the right answer. If Jo and Mo are otherwise equivalent (in particular, they assess their respective bodies of evidence equally well), then Jo is more likely than Mo to get the right answer to 'Is P true?'

But suppose things are not otherwise equivalent. In particular, suppose that Jo but not Mo has a bias against P's being true. Perhaps P is a hypothesis about sex and Jo thinks that P's truth would reflect badly on herself. Now Mo has an advantage in epistemic position when it comes to getting the right answer.

It seems to us that these two advantages could cancel each other out in the sense that Jo and Mo are in equally good epistemic positions to get the right answer to 'Is P true?' Now, it might happen that one of them misjudges her evidence (a kind of "performance error"). Or, Jo lets her bias ruin her correct assessment of her evidence. Or something else happens that results in their coming to opposite conclusions regarding P. Despite ending up with opposing beliefs, the epistemic positions they were in were equally good when it comes to the task of judging P's truth-value. Hence, they are equal-position peers *who disagree*. This fact will be important below.

As for **T8**, we take it as obvious that if you come to accept that someone is virtually equally likely to figure out P's truth-value (so you are equal-position peers with respect to P), and then you discover that she disbelieves P while you believe P, it is *plausible*—but hardly perfectly obvious—that you should, epistemically, adjust your position on P. Hence, **T8** is true.

Thesis **T9** is true: (a) it is an intuitive notion of peerhood and (b) it has a wide range of application to actual cases of disagreement that we care about.

Thesis **T10** is true because the relevant differences in the agents in equal-position cases are often large, but they balance each other so that they do not fall within approximate peerhood. Because of **T10** we have another reason for **T6**. In what follows, we will employ the equal-position notion of peerhood.

3. An Answer from Economics

In order to see what economics has to offer the debate over conformism, we need to work through an illustrative story in some detail.

Ann and Belle are jointly told that there is colored shape drawn on a piece of paper they have yet to examine. They are informed that it is either blue or red, and either circular or square. Let 'B' indicate 'it is blue', 'R' indicate 'it is red, 'C' indicate 'it is circular' and 'S' indicate 'it is square'. They are also jointly told that there are three possibilities regarding the drawing's color and shape, with the following subjective probabilities: (B & C), 0.45; (B & S), 0.3; and (R & S), 0.25.[8]

Hence, at this time t_0, before examining the drawing, they commonly know four things: the three probabilities plus the fact that each agent knows the three probabilities. More precisely, and in the jargon of the literature: they have "equal priors" (i.e., they assign the same initial and exhaustive probabilities to the only three options), and they have "common knowledge of the equal priors" (i.e., Ann knows her priors and that they are equal to Belle's, Belle knows her priors and that they are equal to Ann's, Ann knows that Belle knows her priors and that they are equal to hers, Belle knows that Ann knows her priors and that they are equal to hers, etc.).[9]

Next, they examine the drawing. Ann and Belle have relevantly different epistemic capacities, however: roughly put, Ann is color-blind and Belle is shape-blind (whether their perceptual oddities are temporary or permanent will not matter). More exactly, Ann is excellent at distinguishing circles from squares but utterly hopeless at distinguishing red from blue, and Belle is excellent at distinguishing red from blue but utterly hopeless at distinguishing circles from squares. One might think that these differences immediately preclude their being peers in any sense of 'epistemic peer'; we address this pivotal issue in the next section.

As it happens, the drawing is blue and square, so (B & S) is true. After they have examined the drawing and updated their credences based on what they experienced—so now we are at time t_1—what will their updated credences be?

[8] In the theorem, there is nothing that would prevent the prior distribution from being an objective distribution to which the agents conform via, for example, the Principal Principle. In other words, nothing in the theorem prevents the priors from indeed being objective probabilities. Yet, even upon the assumption that such an objective probability distribution exists, it is implausible to stipulate that the agents get access to it. On these grounds, in our story we will be content with considering the priors a subjective probability distribution whose common source is, for example, reliable.

[9] Common knowledge of equal priors is not explicitly listed among the requirements with which the agents have to comply, but it is essential for the dynamic version of the result (Polemarchakis & Geneakoplos 1982) to hold.

Color-blind but not shape-blind Ann will see that it is not circular but square—but she will not know its color. Since she knows it is not circular, she will, if she is being rational and puts any thought into the matter, immediately rule out option (B & C), which has the drawing circular. So she knows there are two options left: (R & S) and (B & S). Since she cannot distinguish red from blue, she is unable to determine which of the remaining two options is the right one. But since she knows that the initial probabilities for (R & S) and (B & S) were 0.25 and 0.30 respectively, and those are the only two options remaining, she will, if she is being rational and puts thought into the matter, update her credences so she thinks the new probabilities are 0.25/0.55 for (R & S) and 0.30/0.55 for (B & S).

This intuitively rational updating of credences for Ann occurs via the process of *conditionalizing*, captured by the (slightly simplified) formulas:

P(B & S) given that (B & C) is ruled out = P(B & S) divided by the sum of P(R & S) and P(B & S)
P(B & S) given that (B & C) is ruled out = 0.3/(0.3 + 0.25) = 0.3/0.55 = 6/11

Here is the actual formula for Ann's credence:

$$p((B\&S)|\neg(B\&C)) = \frac{p((B\&S)\&\neg(B\&C))}{p(\neg(B\&C))} = \frac{0.3}{0.55} = \frac{6}{11}$$

Shape-blind but not color-blind Belle will see that it is not red but blue—but she will not know its shape. Since she knows it is not red, she will, if she is being rational and puts any thought into the matter, immediately rule out option (R & S), which has the drawing red. So she knows there are two options left: (B & S) and (B & C). Since she cannot distinguish circularity from squarehood, she is unable to determine which of the two remaining options is the right one. But since she knows that the initial probabilities for (B & C) and (B & S) were 0.45 and 0.3 respectively, and those are the only two options remaining, she will, if she is being rational and puts thought into the matter, update her credences so she thinks the new probability is 0.45/0.75 for (B & C) and 0.3/0.75 for (B & S). So her credence for (B & S) is 2/5 whereas Ann's is 6/11.

More specifically, Ann and Belle's epistemic abilities and states are such that the following hold of them:

THE AGENTS' EPISTEMIC STATES	
Color-blind Ann	Shape-blind Belle
At t_0 Ann and Belle (commonly) know that there is a 0.45 probability of (B & C), there is a 0.30 probability of (B & S), and there is a 0.25 probability of (R & S).	
If either (R & S) or (B & S) were true, then all the following would hold at t_1, after Ann had examined the drawing and updated her credences rationally: Ann knows/has learned/has learned with certainty[10] that [(B & S) or (R & S)] Ann knows that ~(B & C) ~Ann knows that ~(B & S) ~Ann knows that ~(R & S) Ann rationally believes that there is a 6/11 probability of (B & S) Ann rationally believes that there is a 5/11 probability of (R & S).	If either (B & C) or (B & S) were true, then all the following would hold at t_1, after Belle had examined the drawing and updated her credences rationally: Belle knows that [(B & C) or (B & S)] ~ Belle knows that ~(B & C) ~ Belle knows that ~(B & S) Belle knows that ~(R & S) Belle rationally believes that there is a 2/5 probability of (B & S) Belle rationally believes that there is a 3/5 probability of (B & C).
4) If (B & C) were true, then at t_1, after Ann had examined the drawing and updated her credences rationally, • Ann would know that (B & C) • Ann would know that ~(B & S) • Ann would know that ~(R & S)	5) If (R & S) were true, then at t_1, after Belle had examined the drawing and updated her credences rationally, • Belle would know that (R & S), • Belle would know that ~(B & S) • Belle would know that ~(B & C)

Table 1: The agents' epistemic states

[10] Instead of 'knows' in (2) one can use 'has learned' or 'has learned with certainty' or various other locutions (this would hold for (3)-(5) as well). We do not take a position in that debate.

In sum, by time t_1 (after examining the drawing and updating rationally based on what they perceived) they have assigned different probabilities to (B & S): Ann thinks there is a 6/11 probability whereas Belle thinks there is a 2/5 probability. Hence, at t_1 they "disagree" on (B & S) in the exact sense that they have different credences for it. With Feldman (2006), we call this stage of the disagreement arising at t_1 *disagreement in isolation*.

Next, they tell one another their differing credences in (B & S). They also tell each other how they updated their beliefs upon examining the drawing. More exactly, and in the jargon of the theorems, they acquire "common knowledge of posteriors" (the updated and differing credences at t_1 in (B & S), 6/11 vs. 2/5) and "common knowledge of conditionalization" (each knows how the other person followed Bayesian conditionalization after examining the drawing, each knows that the other person knows how she herself followed Bayesian conditonalization, etc.). After this sharing of knowledge, it is time t_2.

Again with Feldman, we call this stage of the disagreement at t_2 *disagreement after full disclosure*. In this stage, Anne and Belle have finished sharing each other's reasons and arguments, and the fact that the other person has come to a different credence after examining the same drawing.

Now, finally, we have the result of the two relevant theorems (we omit the proofs):

> **The Result**: *at time t_3, by which time they both have sufficiently exercised opportunities to update their credences based on the common knowledge they acquired by t_2, (a) if they do not have the same final credence, then at least one of them is irrational (Aumann 1976), and (b) if both of them update their credences by conditionalization on what they learned by t_2, then they will have reached the same final credence on (B & S) (Polemarchakis & Geneakoplos 1982).*[11]

The theorems do not say anything about times. They ignore factors such as the need for the agents to use time and an opportunity to update credences based on their new knowledge acquired by t_2. The theorems are about "ideal rational agents" with their knowledge and credences at t_2. Hence, we had to translate, so to speak, the theorems into a result that applies to real-life, non-ideal cases.

[11] More precisely, the theorem to which we refer here (Polemarchakis & Geneakoplos 1982) proves that the convergence to a common credence will be reached in a finite number of steps, if the agents keep sharing back and forth their posteriors. That Ann and Belle will reach the agreement upon sharing their posteriors only once is only a particular instance of the theorem. Thank you to Reviewer 1 for this comment.

The Ann/Belle case is not one of peer disagreement—at least, it is not yet, since we have not had them acknowledge one another as peers on (B & S). Once we transform it into one, we can see what the Result's epistemic lessons are.

4. Why the Economics Case Can be One of Peer Disagreement

In the epistemology literature all the following are true for full-disclosure peer disagreement cases:

	PEER DISAGREEMENT CASES
DISAGREEMENT IN ISOLATION	a. By time t_1 the agents have reached differing credences in P but know nothing of the other person's position on P.
ACKNOWLEDGED PEER	b. By time t_1 the agents accept that they are peers on P.
FULL DISCLOSURE	c. By time t_2 the agents have shared their opinions, evidence and reasoning regarding P whereby obtaining knowledge of their different credences in P.
UPDATING	d. Then the agents update their beliefs based on what they learned in (c).
CREDENCES UPON DISCLOSURE	e. By time t_3 this updating results in their final credences in P.

Table 2: Description of the peer disagreement case

For the economics theorems all the following are true:

	THE ECONOMICS CASE
EQUAL PRIORS	f. At a certain time t_0 the agents have identical priors regarding P and common knowledge regarding their identical priors.

DISAGREEMENT IN ISOLATION	g. By time t_1 the agents have reached differing credences in P, via conditionalization.
FULL DISCLOSURE	h. By time t_2 the agents have shared their opinions, evidence and reasoning regarding P whereby obtaining (i) common knowledge of their credences in P and (ii) common knowledge that they reached those credences via conditionalization.
UPDATING	i. Then the agents update their beliefs based on what they learned in (h).
CREDENCES UPON DISCLOSURE	j. By time t_3 this updating results in their final credences in P.

Table 3: Description of the economics case

In this section, we will be arguing that the economics case can be developed so that it becomes one of full-disclosure peer disagreement. There are two main issues to examine: the Full-Disclosure condition and the Acknowledged Peer condition.

First issue. The Full Disclosure condition says that the agents share their evidence and reasoning between times t_1 and t_2. As an objection to its fulfillment in Ann/Belle story, one might claim that Ann and Belle *cannot* really share their evidence and reasoning regarding (B & S). After all, Ann and Belle obtained radically different *sensory* evidence when examining the drawing. They cannot share *that* evidence, and this is true in two different ways. First, it is obvious that they cannot share their *token* sensory experiences, any more than they can share their spines or livers. Second, and more to the point, their token sensory experiences were radically different qualitatively, and due to their respective kinds of blindness they cannot get one another to have sensory experiences with the differing qualities. So, in one sense—tied to sensory experiences themselves, and not propositions learned from those experiences—they cannot share their evidence and satisfy the Full Disclosure condition.

However, this fact is irrelevant. Not-color-blind Belle can tell Ann, “The drawing is definitely blue. I can see color fine”. Not-shape-blind Ann can tell Belle, “The drawing is definitely square. I can see shapes fine”. In this sense, they can “share their evidence and reasoning” as well as one could wish. In real life, sharing evidence often proceeds in just this fashion. For instance, suppose you and I are debating some proposition in politics. Part of my evidence for my political belief is my knowledge that a certain

politician voted nay on some relevant bit of legislation. When I share this bit of knowledge with you in order to reach full disclosure, I will probably not tell you precisely how I obtained that knowledge. If I had obtained it via a website or watched the politician on television casting her vote will not matter to my ability to share my evidence. Hence, Ann and Belle can reach full disclosure by t_2. Therefore, the Full Disclosure condition is fulfilled in Ann and Belle's case together with the conditions of Disagreement in Isolation, Updating and Credences Upon Disclosure.

When it comes to the Acknowledged Peer condition matters are more complicated.

On the one hand, it is easy to see that the condition is satisfied as stated. Clearly, Ann and Belle can *take each other* to be peers on (B & S). For one thing, Ann and Belle could just be told by some appropriately respected and reliable authorities that they are such peers. Or, they can be told that they have different perceptual abilities but also told that those differences cancel out and that, in the end, their epistemic positions are equally good. If you prefer it, you can think of Ann and Belle as being perceptually the same, never perceiving the drawing, but receiving appropriately different private testimony regarding the drawing. Belle comes to know by testimony its color; Ann comes to know by testimony its shape. They still could be told that their differing testimonies make them equally likely to correctly (B & S)'s truth-value.

On the other hand, one might want to strengthen the Acknowledged Peer condition so that the protagonists have to be *correct* in thinking that they are peers. Regarding that issue, there are two arguments that conclude that the Ann/Belle case is *incompatible* with peer disagreement because Ann and Belle cannot be peers. Argument **A1** is an elaboration of Kelly (2005):

a. Assume the Ann/Belle story is a case of peer disagreement regarding (B & S).

b. In any case of peer disagreement, the agents in the story are peers.

c. If two agents are peers on P, then they obtain the same evidence regarding P.[12]

d. Hence, by (a)-(c), Ann and Belle obtain the same evidence regarding (B & S).

e. Ann and Belle have the same priors, by stipulation.

[12] As mentioned earlier, we might well replace the same-evidence condition with a same-degree-of-support condition, by claiming that peers do not have to obtain literally the same evidence as long as their differing bodies of evidence support P to the same degree. Our argument wouldn't be affected by any change of this kind.

f. Ann and Belle update via Bayesian conditionalization upon just their bodies of evidence, by stipulation.

g. If Ann and Belle have the same priors, obtain the same evidence regarding (B & S), and update via conditionalization upon just those bodies of evidence, then they will update to the same credence for (B & S).

h. If Ann and Belle update to the same credence for (B & S), then they do not disagree on (B & S).

i. Hence, by (d)-(h) Ann and Belle do not disagree on (B & S).

j. If the Ann/Belle story is a case of peer disagreement regarding (B & S), then Ann and Belle disagree on (B & S).

k. Hence, by (a) and (j), Ann and Belle disagree on (B & S).

The assumption in (a) has led to the contradictory conjunction of (i) and (k). Hence, our critic concludes that (a) is false: the Ann/Belle story is not a case of peer disagreement. Argument **A2** overlaps **A1** in all but the last line:

a. Assume the Ann/Belle story is a case of peer disagreement regarding (B & S).

b. In any case of peer disagreement, the agents in the story are peers.

c. If two agents are peers on P, then they obtain the same evidence regarding P.

d. Hence, by (a)-(c), Ann and Belle obtain the same evidence regarding (B & S).

l. But Ann and Belle do not obtain the same evidence regarding (B & S) (since their radically different perceptual experiences of the drawing do not generate the same evidence regarding (B & S)).

Again, the assumption of peer disagreement had led to a contradiction, this time in the conjunction of (d) and (l). As before, it is thought that (a) is the false assumption. That would mean the strengthened Acknowledged Peer condition, which requires genuine peerhood, is not met in the economics case.

We have two main theses regarding the strengthened Acknowledged Peer condition, **A1**, and **A2**.

To see the first, we start by noticing that the mere fact that an agent A has learned that agent B disagrees with her on P is a poor reason for thinking that A is unreasonable if she does not subsequently adjust her initial credence in P. For instance, A might be fully convinced, and amply justified, in the falsehood that B is by a large margin her epistemic *inferior* on P (and if A has such a false belief in B's large-degree inferiority, then A is reasonable in not modifying her initial credence in P). Hence, mere peerhood does not generate the primary question addressed in the literature (viz. conformism vs. non-conformism). Instead, the conformism issue demands that the agents *accept* each other as peers with respect to P. So much is obvious.

However, what is less obvious is thesis **T11**: *the agents' acceptances of peerhood do not have to be true in order for their case to be one of peer disagreement* (e.g., Frances 2010; Matheson, personal communication). The primary intuition behind conformism is that each agent should, when reacting to the discovery of disagreement, think something along the lines of, "Wait a minute. I just admitted that she is as likely as I am to judge P correctly. Now that I have learned that she thinks it is false whereas I decided it was true, how can I trust my judgment over hers?" In order for this conformist thought to be plausible, the agent does not have to be *right* that the other person is her peer: it is the mere justified belief in peerhood that makes the debate over conformism interesting. In addition, part of the interest in steadfast views is the counterintuitive idea that one can rationally not adjust one's credence in P even though one *admits* that the person one disagrees with is a peer over P: again, there is no need for the admission to be true.

Moreover, the fact that the intuitions that make the debate over conformism interesting are fully engaged even when the agents' judgment of peerhood is mistaken shows the truth of thesis **T12**: *it would be obtuse to restrict the "peer cases" to those in which the agents were correct in their judgment of peerhood*.[13] The Acknowledged Peer condition should not be strengthened. Conformists and non-conformists cannot attempt to protect their views by claiming that their theses are meant to apply to cases of genuine peers alone.

Hence, although the debate over conformism employs peer disagreement cases, those cases do not always involve *genuine* peers. Hence, we have thesis **T13**: *premise (b) from both **A1** and **A2** is false*.

[13] One might go so far as to say that if X has excellent overall evidence that Y is her disagreeing peer on P, then even if X thinks that Y isn't her peer but inferior on P, the intuitions that make the debate over conformism interesting are fully engaged. We need not take a stand on that issue.

That is the first point we wanted to make regarding **A1** and **A2**. Our thesis **T14** expresses our second point: *there are positional peers on P who obtain different evidence on P.* This result is interesting for three reasons.

First, it is surprising that there can be peers on P who have different (strengths of) evidence regarding P. This point is not to be found in the literature. Second, it entails that premise (c) of both **A1** and **A2** is false. (To be sure, (c) is true for ideal peerhood and approximate peerhood (setting aside the contrast between 'the same evidence' and 'virtually the same evidence', which is irrelevant here), but for reasons given in section 2 those notions of peerhood are inferior to the positional notion.) Third, it entails that even if one wants to use the strengthened Acknowledged Peer condition, the economics case satisfies the conditions for peer disagreement.

We will prove **T14** by proving **T15**: *Although (i) Ann and Belle obtain different evidence regarding (B & S), (ii) Ann and Belle are positional peers with regard to (B & S) (that is, they are (at least) virtually equally likely to correctly judge (B & S)'s truth-value).*

The claim that Ann and Belle have different evidence is intuitive and accepted in premise (l) of argument **A2**. So we are happy to accept (i) as true, at least for the sake of meeting our critic half way. The hard part is proving (ii), which we attempt now.

In determining whether Ann and Belle are equally likely to correctly judge (B & S)'s truth-value, we need to look at their performance across the relevant possible worlds: for each one we ask what the person in question would think about (B & S) and then we figure out if they would be right in their judgment. We will consider two ways of evaluating their performance.

First, recall that Ann and Belle were given (via testimony) subjective probabilities over each of the possible states of the world: there is a 0.45 probability of (B & C), there is a 0.30 probability of (B & S), and there is a 0.25 probability of (R & S). Let us further assume that those are the only three outcomes that have non-zero objective probability. Hence, there are just three classes of possibilities for the drawing: those in which (B & C) is true, those in which (B & S) is true, and those in which (R & S) is true. Here are Ann's and Belle's credences in (B & S) for each of the classes of possibilities:[14]

[14] The agents come to entertain thee credences by conditionalizing on the different information that they gather in each of the possible states of the world and that we listed in Table 1.

Possible state of the world	Ann's credence in (B & S)	Belle's credence in (B & S)
The drawing is (B & C)	0	0.4
The drawing is (B & S)	0.55	0.4
The drawing is (R & S)	0.55	0

Next, we assume that a person believes a proposition if her credence in it is over 0.5, and she disbelieves it if her credence is less than 0.5 (there is no need to address the case of exactly 0.5). So in the (B & S) and (R & S) worlds Ann believes (B & S) is true while in the (B & C) worlds she thinks it is false; and in all worlds Belle thinks (B & S) is false. Let '✓' stand for 'correctly judges the truth-value of the proposition (B & S)' and '✗' for 'incorrectly judges the truth-value of (B & S)'. Then we have the following:

Possible state of the world	Ann's evaluation of (B & S)	Belle's evaluation of (B & S)
The drawing is (B & C)	✓	✓
The drawing is (B & S)	✓	✗
The drawing is (R & S)	✗	✓

Hence, it follows logically that they each get (B & S) right in two out of the three classes of possible worlds. So, going by that measure of relative likelihood, *they are equally likely to correctly judge (B & S)'s truth-value*.

Second, we can offer another measure of the relative likelihood that they correctly judge (B & S), one that includes the specific objective probabilities. For the sake of simplicity, assume that we are dealing with a finite set of possible worlds—let us say 100—and that in 50 of them (B & C) is true, in 25 (B & S) is true, and in 25 (R & S) is true. Here we are assuming the objective probabilities are different from the subjective probabilities Ann and Belle had (one's subjective probabilities can be inaccurate). It follows logically from our assumptions that Ann will be right about (B & S) in the 50 (B & C) worlds and the 25 (B & S) worlds—viz. in 75% of the worlds. It also follows that Belle will be right in the 50 (B & C) worlds and the 25 (R & S) worlds—viz. in 75% of the worlds. So, once again *they are equally likely to correctly judge (B & S)'s truth-value*.

We take it that these calculations suggest that **T15** is true. And **T14** follows from **T15**. As far as we have determined, there is just one questionable premise in the argument for **T15**: the premise that at least one of the two measures of relative likelihood correctly measures Ann's and Belle's relative likelihood

in correctly judging (B & S)'s truth-value. Since we do not have an airtight argument for that premise, we have to be cautious in endorsing **T14** and **T15**.

However, that issue does not matter to our thesis **T16** which follows logically from *either* **T13** *or* **T15**: *both **A1** and **A2** are unsound*. Our defense of the claim that the economics case satisfies the conditions for being a case of peer disagreement requires the truth of just one of **T13** and **T15**.

As pointed out previously, if you still do not like the idea that the agents are positional peers, given their difference in perceptual abilities, you can think of them as being perceptually the same, never perceiving the drawing, but receiving appropriately different private testimony regarding the drawing. Belle comes to know by testimony its color; Ann comes to know by testimony its shape. This would mean they have different bodies of evidence (so (i) from **T15** is true as before), but they are still equally likely to judge (B & S)'s truth-value correctly. Hence, (ii) from **T15** is true in this variant of the story.

5. The Epistemic Significance of the Result

As noted earlier, by time t_2 Ann and Belle have shared their opinions, evidence and reasoning regarding P whereby obtaining common knowledge of their credences in (B & S) and common knowledge that they reached those credences via Bayesian conditionalization. So color-blind Ann will learn that color-reliable Belle puts a 1.0 credence in B's being true; since Ann has credence 1.0 in S's being true, she will conclude with 1.0 credence in (B & S). For analogous reasons, Belle will also reach that high credence in (B & S). Of course, that is what the Result says will happen on the assumption of perfectly updating via Bayesian conditionalization.

Hence, we have thesis **T17**: *Ann starts with credence 6/11, Belle starts with credence 2/5, and rationality requires them to end up with credence of 1*. Rationality demands adjustment of credences from both agents; so we have thesis **T18:** *non-conformist views which say that both agents are not rationally required to adjust credences, are wrong about many of the cases the Result applies to*. Moreover, rationality does not permit splitting the difference between credences (i.e., averaging 6/11 and 2/5) after full disclosure either; so, we have thesis **T19**: *the split-the-difference kind of conformism is wrong about many of the cases the Result applies to*.[15]

[15] The question whether the theorem can be interpreted as vindicating or supporting the right reasons view rather than the conciliatory view as a paradigm of the conformist reply in some case doesn't fall within the purpose of the present paper.

The reason Ann and Belle become so confident in (B & S) after full disclosure is that they share with one another more than their respective credences in (B & S): in order to reach full disclosure Ann and Belle must share their reasons for (B & S), and that involves Ann saying to Belle, "I know the drawing is square; so one half of (B & S) is definitely true" and Belle saying to Ann, "I know the drawing is blue; so one half of (B & S) is definitely true". That is what changes everything: if their respective credences in (B & S) were *all and only* what the peers shared, then maybe splitting the difference would be rationally permitted or even required. For all we have argued here, the splitting-the-difference view may be correct *prior to full disclosure*.

But it is not after it, because full disclosure leads the agents to uncovering the cause of their disagreement—in this case, the difference in their abilities, i.e. Ann's color-blindness and Belle's shape-blindness. Once the cause of the disagreement is spotted, any rational response to it will obviously require the agents to take it into account, as even the strongest steadfaster might be willing to concede.

The split-the-difference kind of conformism apparently fails for the same reasons: if full disclosure can lead to uncovering why the disagreement arose in the first place, this needs to be factored in in any rational reply to the disagreement, as any conformist might be willing to concede.

More generally, this leads us to two theses concerning the methodological fruitfulness of the economics example in the epistemology of disagreement.

> **T20:** *The formally tidy structure/scaffolding on which the story of the Ann/Belle disagreement relies sheds light on the possible causes of the disagreement.*
>
> **T21:** *Further constraints on this formal structure, such as equal priors and perfect conditionalization, are useful for modelling the different possible causes of a disagreement.*

Firstly, there are benefits to the formal structure of the economics framework in which the agents have degrees of belief, form their posteriors by conditionalizing on their priors, and are to some extent skilled. The differing factors—priors, degrees of skill, strengths of evidence, methods of updating—can lead to disagreement. Further, even if they both conditionalize in the same way, if they are taken to be ordinary agents and not idealized ones—so we drop the assumption that they are perfectly rational—they might make calculation mistakes in the process of conditionalization. These

disagreement factors become apparent once one turns the mushy story of the disagreement into a precise narrative.

By putting different constraints on the formal structure, one might develop a taxonomy of peer disagreement cases according to their cause. Modelling disagreements that arise because the agents assess the evidence differently, for example, can be achieved by letting the agents' priors differ and by holding equal all the other factors, such as conditionalization, skills, and so on. Given such a taxonomy then, one might want to test whether the intuition behind the conformist and non-conformist replies are cause-specific or they apply to all the peer disagreements, independently of their causes.

The Ann and Belle case seems to be evidence for the former: it is unequivocal that their disagreement is caused by a difference in the agents' abilities, because all the other possible causes of disagreement are neutralized by means of formal assumptions. In particular, the equal priors assumption rules out the possibility that the disagreement is caused by a different assessment of the evidence—a difference in priors—and the fact that both agents always correctly conditionalize in a Bayesian way rules out different conditionalizations and calculation mistakes as further causes. A plausible explanation for the fact that in the Ann and Belle case the most rational way to handle the disagreement surprisingly differs from the standard replies then might be that it represents a type of peer disagreement—the one caused by a difference in the agents' abilities—that has not been addressed in the literature so far and that is worth further investigation.

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