WHAT ARE EXPLANATORY VIRTUES INDICATIVE OF?

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ABSTRACT: This paper discusses an assumption on which explanationist accounts of the evidential support relation rely with a focus on McCain's recent account. Explanationist accounts define the relation of evidential support in terms of relations of best explanation that hold between the evidence a subject possesses and the propositions she believes. Such a definition presupposes that the explanatory virtues of what best explains a subject's body of evidence is indicative of its truth. Yet, recent cases offered in the literature against McCain's account show that there is no straightforward way of vindicating this assumption.

KEYWORDS: evidentialism, explanationism, explanatory virtues, evidential probability

Offering a satisfying account of the relation of evidential support is one of the main tasks that have to be carried out by philosophers who endorse an evidentialist conception of epistemic justification. This relation holds between a subject's body of evidence and the propositions that receive a certain degree of confirmation from this evidence, and its existence is generally taken, at least by evidentialists, to be a necessary condition for epistemic justification.[1] In other words, evidentialists generally agree on the fact that for someone to be justified in believing that P, P has to be supported by the evidence one has. Given this general agreement, a central question related to the elucidation of the notion of epistemic justification concerns the conditions under which a subject's evidence supports a given proposition.

This paper focuses on accounts of the evidential support relation that define it in terms of relations of best explanation that hold between a subject's evidence and the propositional content of her beliefs. More specifically, this paper offers a critical discussion of McCain's explanationist account of the evidential support

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[1] Evidentialists often distinguish doxastic justification from propositional justification. While the relation of evidential support that holds between a subject's evidence and a proposition P is necessary and sufficient for this subject to be propositionally justified in believing P, it is only a necessary condition for this subject to be doxastically justified in believing P. In addition of the relation of evidential support that holds between a subject's evidence and P, doxastic justification requires that a subject's belief that P be properly based on this subject's evidence.

relation.[2] McCain's account happens to have very satisfying results when applied to some problematic cases that have been offered against other explanationist accounts in the literature. Yet, this account, like any other explanationist account of the evidential support relation, relies on a crucial assumption whose plausibility needs to be assessed. This assumption relates to the relation between an explanation's explanatory virtues and its truth. If the relation of evidential support is to be defined in terms of relations of best explanation, then the explanatory virtues of what best explains a subject's evidence has to be indicative of its truth. However, cases offered in the recent literature show that there is no straightforward way of supporting this assumption.

In the first two sections of the present paper, McCain's account is introduced and the assumption concerning the relation between an explanation's explanatory virtues and the truth of this explanation on which it relies is spelled out. In the third section, the plausibility of this assumption is questioned on the basis of a case offered against McCain's account by Byerly and Martin.[3] The fourth section relies on an account of the evidential relevance of explanatory considerations that has been put forward by McCain and Poston[4] and on Leitgeb's[5] theory of rational belief to consider a more sophisticated way for explanationists to vindicate this assumption. In the last section of this paper, I discuss two cases which show that this way of supporting the assumption on which McCain's account relies is ultimately unsatisfactory.

1. Explanationist Accounts of the Evidential Support Relation

According to Evidentialism (*E*), the justification a subject has for believing that a given proposition is true is determined by the body of evidence she has at a certain time. In its strongest form,[6] this thesis can be formulated as follows:

> **E**: S is justified in believing P at *t* iff S's evidence *e* at *t* supports P.

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[2] See Kevin McCain, "Explanationist Evidentialism," *Episteme* 10 (2013): 299–315, Kevin McCain, *Evidentialism and Epistemic Justification* (New York: Routledge, 2014) and Kevin McCain, "Explanationism: Defended on all sides," *Logos & Episteme* 6 (2015): 61–73.

[3] T. Ryan Byerly and Kraig Martin, "Problems for Explanationism on Both Sides," *Erkenntnis* 80 (2014): 773–791.

[4] Kevin McCain and Ted Poston, "Why Explanatoriness Is Evidentially Irrelevant," *Thought* 3 (2014): 145–153.

[5] Hannes Leitgeb, "The Stability Theory of Belief," *Philosophical Review* 123 (2014): 131–171 and Hannes Leitgeb, "I—The Humean Thesis on Belief," *Aristotelian Society Supplementary* 89 (2015): 143–185.

[6] A weaker version of it would only define evidential support as a sufficient yet not necessary condition for propositional justification.

Several philosophers have endorsed Evidentialism and proposed different analyses of the notions involved within it. There is, for instance, no agreement among them concerning the nature of a subject's evidence. Likewise, not all evidentialists think that a subject's justification for believing P is determined by the totality of the evidence she has at t; some rather consider that justification is only determined by a properly restricted portion of a subject's evidence. Finally, and maybe most importantly, philosophers diverge in the way they conceive the relation of evidential support, central in E.

While many tend to conceive this relation within the framework of the Bayesian theory of confirmation – namely in terms of P's conditional probability on a subject's evidence – alternative explanationist accounts have recently emerged. According to Conee and Feldman,[7] the fundamental epistemic principles are those of best explanation, and the conditions under which a belief is propositionally justified by one's evidence are relative to the explanatory relation that holds between its content and one's evidence. The view they suggest, which is referred to by McCain as Best Explanation Evidentialism (*BEE*), has been synthetized by McCain in the following way:

> **BEE**: S, with evidence e, is justified in believing P at t iff P is part of the best explanation available to S at t for why S has e.[8,9]

BEE states that evidential support is a matter of explanatory coherence between a subject's evidence and the content of her beliefs and that explanatory coherence can be defined in terms of what best explains this evidence. The explanatory virtues which make an explanation better than another can remain broadly conceived in the context of the present discussion as being typically the explanatory power, the simplicity, the scope and the unificatory force of a potential explanation available to S for why S has e at t.

McCain offers an account of the evidential support relation which differs from *BEE* with respect to the role played by relations of logical consequence.[10] He believes that defining evidential support in terms of relations of best explanation alone is too restrictive. Cases proposed by Lehrer[11] and Goldman[12] show that S's

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[7] Earl Conee and Richard Feldman, "Evidence," in *Epistemology: New essays*, ed. Quentin Smith (Oxford: Oxford University Press 2008), 97–99.

[8] e should be understood as the subject's total evidence.

[9] See McCain, "Explanationist Evidentialism," 300.

[10] See McCain, "Explanationist Evidentialism," McCain, *Evidentialism and Epistemic Justification* and McCain, "Explanationism: Defended on all sides."

[11] Keith Lehrer, *Knowledge* (Oxford: Oxford University Press, 1974).

evidence *e* can support the belief that P without P making any contribution to the potential explanation of why S has *e*. In these cases, P is only entailed by other propositions that could contribute to explain why S has *e*.[13] To accommodate such cases, McCain suggests that a proposition P available as a logical consequence of the best explanation for why a subject has evidence *e* can be supported by *e* without making any contribution to the potential explanation of why this subject has *e*. He formulates his account, labelled Explanationist Evidentialism (*EE*), as follows:

> **EE**: S, with evidence *e* at *t* is justified in believing P at *t* iff at *t* S has considered P and either
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> (i)   P is part of the best explanation available to S at *t* for why S has *e;* or
> (ii)   P is available to S as a logical consequence of the best explanation available to S at *t* for why S has *e*.[14,15]

While *BEE* and *EE* both incorporate the explanationist idea that evidential support should be defined in terms of relations of best explanation that hold between the propositions believed by a subject and the evidence *e* this subject has at *t*, *EE* extends this support to any proposition entailed by the explanation that best explains why this subject has *e* and, because of this, is able to accommodate a larger range of cases.

2. What Is Assumed by Explanationist Evidentialism

Let me first emphasise why *EE* appears as a *prima facie* plausible account of the evidential support relation. Any satisfying account of the evidential support

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[12] Alvin I. Goldman, "Toward a Synthesis of Reliabilism and Evidentialism? Or: Evidentialism's Troubles, Reliabilism's Rescue Package," in *Evidentialism and Its Discontents*, ed. Trent Dougherty (New York: Oxford University Press, 2011), 254–280.

[13] See McCain, "Explanationist Evidentialism," 300–305 for complete discussion.

[14] In response to a problematic case put forward by Byerly and Martin in "Problems for Explanationism on Both Sides," McCain offers a new formulation of *EE* amended with respect to its second condition in "Explanationism: Defended on all sides," 339. In this new version, condition (ii) is spelled out in terms of the explanatory consequences of the best explanation for why S has *e* instead of the logical consequences of the best explanation for why S has *e*. According to McCain, P is an explanatory consequence of the best explanation for why S has *e* if and only if P would be better explained by this explanation than ¬P. As formulating condition (ii) of *EE* in terms of explanatory consequences instead of logical consequences has no incidence on the particular issue I will be raising here for *EE*, for the sake of simplicity, I will stick to the original formulation of *EE* in which condition (ii) is spelled out in terms of logical consequences of the best explanation for why S has *e*.

[15] McCain, "Explanationism: Defended on All Sides," 334.

relation should aim at defining it in terms of a known kind of relation that hold between believed propositions and a subject's evidence and whose existence is indicative of the truth of these propositions. In addition, the kind of relations in terms of which evidential support is defined should be able to account for the deductive and the inductive support that propositions can receive from a subject's evidence. Given this aim, relations of best explanation appear as plausible candidates. Firstly, the ubiquity of abductive reasoning in our everyday lives and scientific practices shows that we often take the explanatory virtues possessed by the hypotheses we come to consider to be related to their truth.[16] Secondly, relations of best explanation between sets of propositions and a subject's evidence allows to account for the deductive and the inductive support that propositions can receive from a subject's evidence.

In addition to its *prima facie* plausibility, *EE* is an attractive account because it is potentially illuminating with respect to the aim of belief-attitudes. Truth is commonly regarded as being belief's regulative aim and therefore as being what epistemic justification tracks. Defining the relation of evidential support in terms of relations of best explanation can give us a deeper insight regarding this aim. If evidential support is to be defined as in *EE*, then epistemic justification can be conceived of as not merely tracking truths, but as tracking informative truths. More precisely, if a subject's evidence supports a proposition just in case this proposition is either part of or entailed by an available representation that best explains this evidence, then epistemic justification can be conceived of as tracking truths that are part of potentially informative representations. By potentially informative representations, I mean representations that can potentially provide some degree of understanding of the phenomena that constitute a subject's body of evidence. As the precise relation between firstly states of understanding, secondly belief's regulative aim and thirdly epistemic justification is of utmost epistemological interest and as *EE* appears to be able to provide some ground for its further investigation, there are independent reasons for regarding *EE* as being an attractive account of the evidential support relation.[17]

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[16] Note that I am not claiming here that the truth of *EE* depends on the validity of such abductive reasoning. I only take the ubiquity of this form of reasoning to explain, at least partly, the intuitive appeal of *EE*.

[17] Several authors have recently focused on the relation that may exist between the distinctive value of knowledge, which is of course related to truth and epistemic justification, and the epistemic value of states of understanding. See for instance Jonathan L. Kvanvig, *The Value of Knowledge and the Pursuit of Understanding* (Cambridge: Cambridge University Press, 2003) and Duncan Pritchard, "Knowledge, Understanding and Epistemic Value," *Royal Institute of Philosophy Supplement* 64 (2009): 19–44 and Duncan Pritchard, "Knowledge and

In the present paper, while acknowledging *EE*'s appeal, my aim is to outline a difficulty that is inherent to this account and, more generally, to any explanationist account of the evidential support relation, in order to emphasise the need for a proper response to it. This difficulty relates to the precise relation that exists between an explanation's explanatory virtues and its truth. *EE* relies on the assumption that an explanation's explanatory virtues are somehow indicative of its truth and are thereby indicative of the truth of the propositions that are part of it or entailed by it. This assumption allows *EE* to define the relation of evidential support in terms of relations of best explanation because an explanation's explanatory virtues are not, at least for most of them, intrinsic properties of an explanation but properties that are possessed by it in relation to a subject's body of evidence. Thus, under the assumption that an explanation's explanatory virtues are indicative of its truth, a subject's body of evidence in relation to which an explanation possesses these virtues can be regarded as indicating the truth of this explanation and thereby the truth of the propositions that are part of it or entailed by it. Yet, for *EE* to constitute a satisfying account of the evidential support relation, the plausibility of this assumption, crucial for *EE*, has to be established.

3. No Straightforward Way to Vindicate This Assumption

What I take to be a serious difficulty for supporting the assumption on which *EE* relies has been highlighted in the context of an exchange that took place recently between McCain, Byerly and Martin.[18] Byerly and Martin offered a case designed to show that P being part of the best explanation available to S at *t* for why S has evidence *e* is, in some cases, not sufficient for *e* to support believing that P. As I will argue, the strength of this case comes from the fact that it shows that, at least in some cases, an explanation's explanatory virtues and its evidential probability, namely its probability conditional on a subject's body of evidence, come apart:

> *Sally Case*: Imagine that Sally is the lead detective on an investigation of a burglary. She typically uses an eight-step investigative procedure for crimes of this sort and this procedure involves gathering and analyzing multiple kinds of

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understanding," in *Virtue Epistemology Naturalized: Bridges between Virtue Epistemology and Philosophy of Science*, ed. Abrol Fairweather (Dordrecht: Springer, 2014), 315–328.

[18] Originally, Byerly offered a case against *BEE* that involves beliefs about the future in T. Ryan Byerly, "Explanationism and Justified Beliefs about the Future," *Erkenntnis* 78 (2013): 229–243. Then, McCain offered a response to Byerly's case based on *EE* in Kevin McCain, "Evidentialism, Explanationism, and Beliefs about the Future," *Erkenntnis* 79 (2014): 99–109. Byerly and Martin later challenged McCain's response to Byerly's case and offered a new problematic case for *EE* in "Problems for Explanationism on Both Sides" and McCain offered an answer to Byerly and Martin's concerns and new case in "Explanationism: Defended on All Sides".

evidence – physical evidences, forensic evidences, testimonial evidences, psychological evidences, circumstantial evidences, and so on. Sally is now mid-way through her investigative procedure, having completed four of the eight steps. She has gathered and analyzed the appropriate evidence for these four steps, but has not yet gathered or analyzed evidence that may or may not arise during the final four steps. The list of suspects with which Sally began has been narrowed, and there is one very promising suspect in particular named Jeremy. In fact, the claim 'Jeremy committed the burglary' (call this the Jeremy hypothesis) is the best explanation available to Sally for all of the evidence she currently has obtained through the first four steps. There are multiple witnesses locating someone who fits Jeremy's description at the scene of the crime at the time at which it was committed. Some drug paraphernalia like that which Jeremy commonly uses to feed his drug habit was found at the scene of the crime. Jeremy seems to display a sense of satisfaction or gladness about the robbery. His bank account reflects a deposit shortly after the incident. Other current suspects, while not ruled out, do not fit the evidence Sally currently has anywhere nearly as well as Jeremy does. The Jeremy hypothesis is the best available explanation for the evidence Sally currently has and it is a very good explanation of that evidence.[19]

Byerly and Martin further specify that it often happened to Sally that, after completing the last steps of her eight-step investigation procedure, a new suspect emerged that better fitted the evidence she had gathered. Given this additional fact, they conclude, rightly it seems, that mid-way through her investigation procedure, Sally is not justified in believing that Jeremy committed the burglary, even though it is part of what best explains the evidence she has. Byerly and Martin also note that the Jeremy hypothesis qualifies as a good explanation in this case, namely as an explanation that is explanatory virtuous, and that the fact that Sally is not justified in believing that Jeremy committed the burglary cannot be accounted for on the basis of the poor quality of the Jeremy hypothesis *qua* explanation.

McCain's answer to Byerly and Martin relies on a possible solution that Byerly and Martin consider and ultimately dismiss. This solution consists in arguing that while the Jeremy hypothesis might be the best explanation available to Sally relative to a portion e of the evidence she currently has, it is not the best explanation relative to the totality of the evidence she has, written e^*, which includes her past experiences of investigations. The reason for which Byerly and Martin dismiss this solution is that they do not consider that there is an alternative explanation available to Sally that could explain better than the Jeremy hypothesis why Sally has e^* at t. Contrary to this, McCain argues that there is in fact an

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[19] Byerly and Martin, "Problems for Explanationism on Both Sides," 783.

explanation available to Sally that explains her total evidence e^* better than the Jeremy hypothesis.[20] According to what McCain suggests, this explanation consists of a general hypothesis of the form: 'somebody else than Jeremy committed the burglary,' which does not need to single out a particular suspect. In arguing for this, McCain emphasizes what is, in my view, the crucial aspect of the Sally Case:

> Since "It has not at all been uncommon that at these later stages in the process, an alternative suspect emerges who fits the data even better than previous suspects," presumably from Sally's perspective the odds of there being a rival to the Jeremy hypothesis that is as good, or better, of an explanation than the Jeremy hypothesis is at least .5. In light of this, it is plausible that the best explanation of Sally's data (or at least explanation that is equally as good as the Jeremy hypothesis) is that some currently unconceived hypothesis is correct.[21]

The fundamental problem in the Sally Case is indeed that, given Sally's total evidence, the probability of there being a rival hypothesis which is the correct one is relatively high and, therefore, the probability of Jeremy being the burglar is relatively low. In other words, the evidential probability of the Jeremy hypothesis does not appear to be high enough for Sally to be justified in believing it to be true.[22] However, I disagree with McCain on the fact that this shows that the Jeremy hypothesis is not the best explanation available to Sally mid-way through her investigation procedure. A hypothesis of the form 'somebody else than Jeremy committed the burglary' is not better, *qua* explanation, than the Jeremy hypothesis, when we consider Sally's total evidence e^*; given e^*, it is only as probable, possibly more probable, as the Jeremy hypothesis. The fact that somebody else committed the burglary can neither explain Sally's past experiences of investigations nor the portion of her evidence that could be explained by the

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[20] See McCain "Explanationism: Defended on All Sides," 347–348.

[21] McCain "Explanationism: Defended on All Sides," 347.

[22] The notion of evidential probability invoked here relates to the conditional probability of a proposition on a subject's total evidence. There is an ongoing debate concerning this notion among Bayesians relative to the rational constraints on a proposition's evidential probability. While everybody agrees about the fact that the probability of P conditional on e is the probability a subject S who has e should assign to P, according to some, few rational constraints exist on P's unconditional probability and, therefore, P's probability conditional on e strongly depends on S's actual doxastic perspective, namely on the way P's unconditional probability is determined in S's actual perspective. According to others, P's unconditional probability is constrained in such a way that P's probability conditional on e tends to be independent on S's actual doxastic perspective. However, this debate is somehow orthogonal to the point I am discussing here. I will only assume that the evidential probability of P can be defined given S's total evidence and that this probability is the probability S should assign to P given S's total evidence e.

Jeremy hypothesis. Let us suppose that Sally comes to believe that somebody else than Jeremy committed the burglary; would we consider that she gains any understanding of her past experiences of investigation from this? Would we consider that she gains any understanding of the evidence collected on the crime scene? It does not seem to be the case, the reason being that the hypothesis that somebody else than Jeremy committed the burglary cannot, as such, explain these facts and therefore has little explanatory virtues given Sally's total evidence e^* compared to the Jeremy hypothesis.

The Sally Case shows that an explanation's explanatory virtues and its evidential probability can come apart and that therefore, explanatory virtues cannot be taken to be indicative of the truth of an explanation in the sense of supporting assigning a high probability to it. The Jeremy hypothesis is the most explanatorily virtuous hypothesis available to Sally mid-way through her investigation procedure but, given Sally's total evidence, its probability is relatively low.

4. Relations of Best Explanation and the Stability Condition on Rational Belief

The fact that an explanation's explanatory virtues and its evidential probability can come apart entails that, for *EE* to be able to accommodate cases such as the Sally Case, *EE* needs to be amended with the requirement that the evidential probability of a proposition P be sufficiently high when P is part of or entailed by the best explanation for why S has e at t.[23] The issue with the Sally Case is indeed that, given Sally's total evidence, the probability of the proposition 'Jeremy committed the burglary' is too low for Sally to be justified in believing that Jeremy committed the burglary. Consider the following amended version of *EE* which includes a condition relative to P's evidential probability, written $P_r(P \mid e)$:

> **EE***: S, with evidence e at t is justified in believing P at t iff at t S has considered P, $P_r(P \mid e) > x$ where $.5 \leq x < 1$ and either

> (i)   P is part of the best explanation available to S at t for why S has e.; or
> (ii) P is available to S as a logical consequence of the best explanation available to S at t for why S has e.

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[23] McCain himself, in "Evidentialism, Explanationism, and Beliefs about the Future," 106–107, relative to a possible answer he considers to another problematic case offered by Byerly in "Explanationism and Justified Beliefs about the Future" involving justified beliefs about the future, suggests that P's evidential probability plausibly reflects the extent to which e supports P.

Miloud Belkoniene

The Sally Case no longer constitutes a problem for *EE**. However, one might ask whether relations of best explanation are still required to define the relation of evidential support in *EE** and, more specifically, what an explanation's explanatory virtues are related to if not to its evidential probability. After all, proponents of the Lockean view of rational belief typically hold that it is sufficient, for S to be justified in believing P, that P's probability conditional on S's evidence be higher that a threshold x such as $.5 \leq x < 1$.[24] Thus, one might argue that conditions (i) and (ii) are no longer needed for *EE** to constitute a proper account of the evidential support relation and that the Sally Case actually shows that an explanation's explanatory virtues are not evidentially relevant in the sense that relations of best explanation are not required for belief justification.

To address this worry, one needs to show that relations of best explanation play a particular evidential role that accounts for a crucial aspect of justified belief which cannot be accounted for by the magnitude of the evidential probability of its content alone. A promising first line of argument consists in taking into account an important weakness of Lockean views of rational belief. Consider a fair lottery involving 1000 tickets. A lottery participant who learns that there is a total of 1000 tickets should assign a high probability to the proposition 'ticket *m* is losing,' where $1 \leq m \leq 1000$, as the evidential probability of the proposition 'ticket *m* is losing' is high in this case. Now, if this lottery is known to be fair, this lottery participant should also assign a high probability to the proposition 'one ticket is winning.' But if P's evidential probability being higher than a threshold is sufficient for someone to be justified in believing that P, then any lottery participant is justified in believing that each of the lottery ticket is losing and that one of these tickets is winning. Hence, any lottery participant would be justified in holding logically inconsistent beliefs, which in fact appears to be irrational.

According to Leitgeb, the crucial aspect of rational belief that is left aside in Lockean views of rational belief is the stability of the evidential probability of the belief's content.[25] Once this aspect is taken into account, the paradoxical situation which arises when we consider beliefs in lottery propositions can be avoided. In Leitgeb's view, S is justified in believing that P just in case S is justified, given her evidence, in assigning a stably high probability to P. In other words, S is justified in believing that P just in case $\Pr(P \mid e)$ is stably high. The notion of stability

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24 See Richard Foley, "The Epistemology of Belief and the Epistemology of Degrees of Belief," *American Philosophical Quarterly* 29 (1992): 111–121 and Richard Foley, "Belief, Degrees of Belief, and the Lockean Thesis," in *Degrees of Belief*, eds. Franz Huber and Christoph Schmidt-Petri (Dordrecht: Springer, 2009), 37–47 for such a view of rational belief.
25 Leitgeb, "The Stability Theory of Belief" and Leitgeb, "I—The Humean Thesis on Belief."

188

invoked by Leitgeb has been put forward by Skyrms[26] and relates to the stability of P's probability under conditionalization on new evidence. P's probability is said to be stably high under conditionalization if and only if, when conditionalized on new evidence, P's probability remains high. For his part, Leitgeb proposes to restrict the class of evidential propositions on which P's probability ought to remain stable to the propositions compatible with P's truth.[27] According to him, S, holding evidence e, is justified in believing that P just in case the probability S is justified in assigning to P given e is higher than a given threshold and remains higher than this threshold when conditionalized on new evidence compatible with its truth.

Leitgeb's account of rational belief constitutes a solution to the lottery paradox. While the probability that a lottery participant is justified to assign to the proposition 'ticket m is losing' is high, it is not stably high when conditionalized on new evidence compatible with its truth. If, for instance, a lottery participant learns that all tickets lost except ticket m and one other ticket, namely if she learns that only ticket m and one other ticket could be winning tickets, which is compatible with the truth of 'ticket m is losing,' the probability she should assign to the proposition 'ticket m is losing' is .5. Hence, the probability that a lottery participant is justified to assign to the proposition 'ticket m is losing' given her current evidence is not stably high. Leitgeb's account shows that Lockean views of rational belief run into paradoxical situations such as cases of fair lotteries because they fail to take into account a crucial aspect of rational belief, namely the stability of the probability one is justified to assign to its content given one's evidence.

If we accept Leitgeb's diagnosis concerning lottery cases and the stability requirement on rational belief he put forward, a plausible way of defending conditions (i) and (ii) of EE^* consists of showing that relations of best explanation that hold between believed propositions and a subject's body of evidence are necessary and sufficient for this subject to be justified in assigning a probability to these proposition that remains stable under conditionalization on new evidence. This is exactly the line of argument taken by McCain and Poston[28] in their

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[26] Brian Skyrms, *Causal Necessity: A Pragmatic Investigation of the Necessity of Laws* (New Haven: Yale University Press, 1980).

[27] See Leitgeb, "I—The Humean Thesis on Belief," 163 for a detailed version of his thesis where the class of propositions on which S's probability assignment ought to be stable is defined in terms of the propositions which are possible from the doxastic perspective of the subject, namely propositions that are not believed to be false.

[28] McCain and Poston, "Why Explanatoriness Is Evidentially Irrelevant."

response to Roche and Sober[29] who raise a concern similar to the one just raised regarding *EE**. Roche and Sober argue that if the explanatory virtues of an explanation are evidentially relevant, then the probability of an explanation H conditional on some observation e and on the fact that H best explains e – written $P_r (H \mid e\&E)$ – should be higher that H's probability conditional on e alone – written $P_r (H \mid e\&E)$. On the basis of the cases they consider, Roche and Sober argue that this is ultimately not the case and that the fact that H best explains e adds nothing, in terms of evidential support, to the extent to which e makes H more probable independently of H's explanatory virtues.

In their response to Roche and Sober, McCain and Poston argue that while it is true that $P_r (H \mid e\&E)$ is not higher than $P_r (H \mid e)$, the probability that S is justified in assigning to H given $e\&E$ is more stable than the probability that S is justified in assigning to H given e alone. They follow Joyce[30] who considers that the stability of a probability assignment is a property of it which reflects the *weight* of a subject's total evidence and argue that the relations of best explanation that hold between the propositions a subject believes and this subject's total evidence reflect the weight of this evidence which is distinct from the probabilistic support that these propositions receive from this subject's evidence. Hence, they conclude, the fact that H best explains e makes a substantial difference in the doxastic attitude that S is justified to adopt toward H.

Given Leitgeb's theory of rational belief and McCain and Poston's answer to Roche and Sober's concern, an argument can be made for the assumption on which McCain's account of the evidential support relation relies and for conditions (i) and (ii) of *EE**. Firstly, an explanation's explanatory virtues that are possessed, at least partly, in relation to a subject's body of evidence are not indicative of the truth of this explanation in the sense of being indicative of its high evidential probability; this explains why an explanation's explanatory virtues and its evidential probability can come apart. Instead, they are indicative of the weight of the body of evidence that probabilistically supports the propositions that are part of or entailed by the explanation that possesses these virtues. Secondly, the relation of evidential support cannot only be defined in terms of the probabilistic support that propositions can receive from a subject's body of evidence as the stability of the probability that this subject is justified to assign to these propositions is an essential aspect of rational belief. Since the stability of the

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[29] William Roche and Elliott Sober, "Explanatoriness Is Evidentially Irrelevant, or Inference to the Best Explanation Meets Bayesian Confirmation Theory," *Analysis* 73 (2013): 659–668.

[30] James M. Joyce, "How Probabilities Reflect Evidence," *Philosophical Perspectives* 19 (2005): 153–178.

probability that a subject is justified to assign to a proposition depends on the weight of the evidence that probabilistically support this proposition, the relation of evidential support has to be defined in terms of relations of best explanation that hold between a subject's body of evidence and the propositions believed by this subject.

5. Relations of Best Explanations Are Neither Necessary Nor Sufficient for Stability

The argument that can be made for the assumption on which relies McCain's account and for conditions (i) and (ii) of *EE** heavily depends on the fact that relations of best explanation are necessary and sufficient for a subject to be justified in assigning a stable probability to a proposition. Yet, as it will be shown in this section, there are good reasons to consider that relations of best explanation are neither necessary nor sufficient for a subject to be justified in assigning a stable probability to a proposition.

Roche and Sober,[31] in a response to McCain and Poston, point out that relations of best explanation might not be necessary for $\mathrm{Pr}\,(P \mid e)$ to be stable under conditionalization. They discuss the following case offered by McCain and Poston, which they initially used to show that explanatory considerations affect the stability of a proposition's evidential probability:

> *Exploding Urn Case*: Sally and Tom have been informed that there are 1,000 x-spheres in an opaque urn. Sally and Tom have the same background evidence except for this difference: Sally knows that blue and red x-spheres must be stored in exactly equal numbers because the atomic structure of x-spheres is such that if there are more (or less) blue x-spheres than red, the atoms of all of the x-spheres will spontaneously decay resulting in an enormous explosion. Sally and Tom observe a random drawing often x-spheres without replacement, five blue and five red. The x-spheres are replaced in the urn.[32]

Given the data both Tom and Sally have, they should assign a probability of .5 to the proposition 'the next x-sphere will be blue.' In addition, Sally, contrary to Tom, has a very good explanation for why she observed a drawing of five red x-spheres and five blue. McCain and Poston argue that given the explanation Sally has, the probability she is justified to assign to the proposition 'the next x-sphere will be blue' will remain stable if, say, she observes ten successive drawing of blue x-spheres, while the probability Tom would be justified to assign to this proposition is considerably higher.

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[31] William Roche and Elliott Sober, "Explanatoriness and Evidence: A Reply to McCain and Poston," *Thought* 3 (2014): 193–199.

[32] McCain and Poston, "Why Explanatoriness Is Evidentially Irrelevant," 149.

Miloud Belkoniene

As Roche and Sober note,[33] regarding this case, we need to pay attention to what constitutes the explanans and what constitutes the explanandum. The explanation H Sally possesses is relative to what she knows concerning the atomic structure of the x-spheres. In addition, what is explained by H is the random drawing of ten x-spheres she observed. However, the proposition 'the next x-sphere will be blue' to which Sally is justified in assigning a stable probability is neither part of nor entailed by the explanation H that best explains her evidence. What explains the drawing Sally observed surely does not include the proposition 'the next x-sphere will be blue' and does not entail it neither as the atomic structure of the x-spheres does not entail that the next x-sphere will be blue; the next draw will be random. But if the proposition to which Sally is justified in assigning a stable probability is neither part of or entailed by what best explains her evidence, then it is not necessary for P to be either part of or entailed by what best explains a subject's evidence for this subject to be justified in assigning a stable probability to P.

Let me now consider a second case which shows that P being part of or being entailed by what best explains the evidence that a subject has at *t* might not even be sufficient for this subject being justified in assigning a stable probability to P. Consider the following modified version of the Sally Case:

> *Sally Case*: Sally investigates a burglary based on the same procedure as in the original case. During the burglary, a safe has been opened by someone who knew the safe's code. A very promising suspect is Sam who is an employee of the company where the burglary took place and who potentially had access to the safe's code. As in the original case, the Sam hypothesis can explain other pieces of evidence that Sally gathered during her investigation and hence is the best explanation available to Sally as to why she has the evidence she does mid-way through her investigation procedure. However, unlike the original case, it is Sally's first ever investigation and therefore, given her total evidence, the probability of the Sam hypothesis is quite high as Sally has no reason to suspect that a better explanation for her evidence is yet unavailable to her.

Let us assume that, in the Sally Case*, the probability Sally is justified to assign to the proposition 'Sam committed the burglary,' given her evidence, is .8. The question is now to determine if this probability remains high under conditionalization on evidence compatible with its truth, which would be the case if P being part of or being entailed by what best explains the evidence S has at *t* was sufficient for P's evidential probability to be stable. Let us suppose that, mid-way through her investigation procedure, Sally learns that the company's

[33] See William Roche and Elliott Sober, "Explanatoriness and Evidence: A Reply to McCain and Poston," 196–197.

manager's computer was hacked and that 100 other people potentially had access to the safe's code. At this time, Sally knows nothing about these people; they are simply new suspects who have not yet been ruled out. In addition, what she learns is compatible with the truth of the Sam hypothesis as even though these 100 people had access to the safe's code, Sam still could be the burglar. In fact, it is plausible that the Sam hypothesis is still the best explanation available to Sally once she learns this new information given that she knows nothing about the 100 new suspects. Yet, the probability that Sally is justified to assign to the proposition 'Sam committed the burglary' once she has learnt the new hacking information is considerably lower that it was before. This shows that despite the fact that the Sam hypothesis is the best explanation available to Sally, its evidential probability is not stable under conditionalization on propositions compatible with its truth.

Conclusion

When cases such as the Exploding Urn Case and the Sally Case* are considered, the claim according to which relations of best explanations are necessary and sufficient for a proposition's evidential probability to be stable appears to be doubtful. Consequently, the possible argument for the assumption on which McCain's account relies that has been put forward in the fourth section of this paper does not appear as a viable strategy for explanationists.

To overcome the challenge arising from the fact that an explanation's explanatory virtues and its evidential probability can come apart, explanationists should therefore either look for a property of explanations related to their truth that is always possessed by explanatory virtuous explanations, or they should identify another aspect of rational belief that can be accounted for only in terms of relations of best explanation. Both of these options should be thoroughly investigated as *EE* has many theoretical advantages to offer once the crucial assumption on which it relies is properly vindicated.[34]