Counterfactual Triviality: A Lewis-impossibility argument for counterfactuals

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Last revised: 6th January 2011

Abstract

I formulate a counterfactual version of the notorious 'Ramsey Test'. Whereas the Ramsey Test for indicative conditionals links credence in indicatives to conditional credences, the counterfactual version links credence in counterfactuals to expected conditional chance. I outline two forms: a Ramsey Identity on which the probability of the conditional should be identical to the corresponding conditional probability/expectation of chance; and a Ramsey Bound on which credence in the conditional should never exceed the latter.

Even in the weaker, bound, form, the counterfactual Ramsey Test makes counterfactuals subject to the very argument that Lewis used to argue against the indicative version of the Ramsey Test. I compare the assumptions needed to run each, pointing to assumptions about the time-evolution of chances that can replace the appeal to Bayesian assumptions about credence update in motivating the assumptions of the argument.

I finish by outlining two reactions to the discussion: to indicativize the debate on counterfactuals; or to counterfactualize the debate on indicatives.

*My interest in the theses explored in this paper was sparked after reading an early version of Moss (manuscript). Moss cites a range of interesting evidence in favour of a connection between credence and chances—of which the generalizations below are in the spirit (though the reader should read Moss's paper to determine exactly how her position relates to the thesis I explore). I'd like to thank Rachael Briggs, Ross Cameron, Ant Eagle, Brandon Fitelson, Daniel Elstein, David Etlin, Al Hájek, Barry Loewer, Sarah Moss, Jason Turner, Rich Woodward, an anonymous reviewer, and all others with whom I've discussed this material. Versions were presented at departmental seminars at Rutgers and Maryland. The work in this paper was supported by a British Academy Research Development Award (BARDA: 53286).

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Introduction

To what degree should we believe a counterfactual conditional? Here is one proposal: one *counterfactually supposes* the antecedent, and sees *under that supposition* what credence is appropriate to the consequent. One then invests *that* degree of belief in the counterfactual. Thus we suppose that *Oswald had not shot Kennedy*, and under this supposition, we note that Kennedy probably would not have been assassinated; accordingly we are confident that had Oswald not shot Kennedy, noone else would have.

This is a 'Ramsey Test' for counterfactuals. We formulate it as an identity, writing $P^A(B)$ for the probability one attaches to B under the supposition-as-counterfactual that A:

$$P^A(B) = P(A \mathrel{\Box\!\!\rightarrow} B)$$

A more familiar Ramsey Test concerns *indicative* conditionals. We make the *indicative* supposition (or 'supposition-as-actual') that *Oswald didn't kill Kennedy*; and figure out our credence under that supposition for Kennedy surviving (pretty low). When $P_A(B)$ picks out the probability one attaches to B on the supposition-as-actual that A, this can be written:

$$P_A(B) = P(A \rightarrow B)$$

The indicative form of the Ramsey Identity has been subject to intense discussion. The counterfactual version has received far less attention. I will argue we distort debate over conditionals unless we appreciate the parallels.

The Ramsey Identities state a connection between 'beliefs under a supposition', and beliefs in an associated conditional. Supposition is a kind of mental activity familiar to all of us. We might suppose that our train won't arrive in order to form a contingency plan for that eventuality, and believe-under-that-supposition that the best thing to do is to take a cab. What a Ramsey Identity asserts is an normative connection between two distinct mental states: for fully rational agents, the degree of suppositional belief in B on A and the corresponding categorical credence in 'if A then B' (/'if were A then B') should coincide. I take it's perfectly possible for agents to have degrees of belief in conditionals that diverge from the corresponding suppositional credences—but if the Ramsey Identities are correct, this is a form of irrationality.[1]

It's worth pointing out a couple of features of the theoretical representation of supposition used here. Whereas categorical belief is a propositional attitude with a 'slot' for a single proposition, I represent suppositional states as having two 'slots' for propositions: one for the content initially supposed to be the case; and a second for the content believed-under-that-supposition. (Either slot can be filled, in principle, with any proposition. So if there are conditional propositions, they can figure as things supposed, or as things believed-under-a supposition. The Ramsey Identities, as formulated, can be applied to conditionals with conditionals embedded.) I will remain neutral on the finer-grained analysis of supposition. For all I say it could be a not-further-decomposable dyadic propositional attitude; equally, it might admit of analysis into more basic forms of thinking.[2]

Less familiar than supposition itself is the claim that there are *two subkinds* of this activity; that we can engage with a scenario suppositionally either in indicative or counterfactual mode. I'll give three illustrations of this divergence. The first illustration is provided by the Kennedy cases already mentioned. One may entertain the supposition of Oswald not shooting Kennedy while holding fixed knowledge of subsequent events (Kennedy's death), imagining someone else doing the shooting. On the other hand, one might not hold that knowledge fixed, and imagine Kennedy living to a ripe old age.

Second, consider a setup familiar from discussions of the Newcombe problem. We know that there's a rare gene (G), which is the common cause both of a piece of behaviour (B) and of a disease (D)—and D and B are each almost invariably associated with G. I initially believe that Harry hasn't got the gene, nor will exhibit B or get D. We will consider what happens when I *suppose* that he indulges in behaviour B. As anticipated, there are at least two ways of developing this supposition. Under the supposition that he exhibits B, I may believe that he most likely has the gene and (so) will get the disease. After all, the behaviour is a reliable indicator of the presence of the gene. Or, just as cogently, I may hold fixed what I take to the be the relevant background facts (Harry not having the gene in the first place), in which case my credence-under-the-supposition that he develops the disease is low—I take him to be one of the exceptional cases exhibiting the behaviour without the gene, the behaviour in the absence of the gene doesn't tend to the produce the disease. The first, I contend, is supposing *as actual* that Harry exhibits B; the second makes sense if we *counterfactually* suppose that Harry *had exhibited* B.

Thirdly, to illustrate the breadth of cases available, consider the following future-directed example. The Oracle has told you that the Blitzers will win the cup. You entertain suppositions about who they play in the final. In one style of supposing, one holds fixed the oracle-given knowledge they in fact win. Engaging in supposition in this

[1] Thus, we reject certain interpretations of belief in conditionals and supposition that would render the identities automatic. I assume that it is not the case that '$P(A \to B)$' just reports the suppositional state $P_A(B)$. Equally, '$P_A(B)$' does not directly report an agent's (categorical) credence in $A \to B$. Of course, if our favoured reading of the Ramsey Identities get into trouble (and we'll see they do) we might revisit such interpretative assumptions. Just to guard against a further misreading: we are definitely not identifying 'belief in B under the supposition that A' with one's categorical credence in B, *if A obtains*.

Exactly parallel things go for the counterfactual Ramsey identity and its ingredient notions. The working assumption is that counterfactual suppositions do not simply report credences in counterfactuals, nor vice versa, and counterfactual supposition is definitely not to be identified with the (categorical) credences one would have were such-and-such to obtain.

[2] A related discussion is over the cognitive architecture of imagining. See Meskin & Weinberg (2003) for discussion.

way, one believes *even under the supposition that they in fact meet the Destroyers* the Blitzers win the cup—never mind that the Destroyers have been the Blitzer's nemeses in the past, beating them on every occasion they have met. But equally, one can engage in supposition in the counterfactual mode. You might categorically believe that the Blitzers will meet and beat the Pretenders (thus vindicating the Oracle); but equally believe under the counterfactual supposition that they had met the Destroyers, they'd have certainly lost. In each case, the two kinds of supposition correspond naturally to the credences intuitively appropriate to credence in indicative and counterfactual conditionals respectively. The divergence between two methods of handling supposition is a genuine phenomenon that any account must allow for.

It's one thing to agree that suppositional credences are a kind of mental state; quite another to say what mental state of this kind the rational agent *should* adopt. One isn't free to suppose in any fashion one likes. It's simply *irrational* for me to believe that I win the London Marathon next year, under the supposition-as-actual that I enter. The irrationality springs from a lack of fit between that suppositional credence and categorical beliefs about the competition and my running ability (I could regain rationality at the cost of inaccuracy by becoming deluded about the latter). This is what we capture by the requirement that for ideally rational agents, $P_A(B)$ should equal the conditional probability $P(B|A)$, which for present purposes I take to be defined as the ratio $P(A \wedge B)/P(A)$.[3] The requirement is analogous to the idealizing constraints built into subjective probability theory more generally. Irrational agents may have credence in a conjunction that is higher than their credences in either conjunct; part of being ideally rational is ensuring this doesn't happen. So to be clear: the ratio formula $P_A(B) = P(A \wedge B)/P(A)$ shouldn't be seen as an analysis or reduction of (indicatively) suppositional credence, but as articulating a wide-scope norm linking it to categorical belief.

Counterfactually suppositional credences, too, are constrained by one's wider mental state—it is irrational for me to believe I would have won last years marathon, under the counterfactual supposition of my entering. But the simple ratio of categorical credences doesn't give us a fix on the normative constraints on this sort of mental state. Below, I argue for a normative constraint that stands to counterfactual supposition as the ratio formula does to indicative supposition.

The plan of campaign is as follows. I first discuss a general worry some will have with the Counterfactual Ramsey Identity, and articulate weakened versions that should appeal even to those who feel the force of those concerns (section 2). I then formulate a constraint on counterfactual supposition (section 3). I show that the Lewis (1976) triviality result transfers to even the weakened forms of the Counterfactual Ramsey Identity (sections 4,5); and I examine the respective starting points of the counterfactual and indicative versions (sections 6 and 7). I end by sketching some applications (section 8).

[3]In cases where $P(A) = 0$, the ratio is undefined. I'll remain neutral as to what normative constraints there are on indicative suppositional belief in this limiting case—normative claims in this paper should be understood as tacitly restricted to cases where the ratio is defined.

Along with orthodoxy, I will speaking here as if the target for saving intuitions about probabilities of indicative conditionals—captured by the Ramsey Test—is given as above. Stefan Kaufmann in a series of papers (Kaufmann, 2004, 2005, 2009) has argued that this is wrong. Kaufmann's account of indicatives brings them closer to the above characterization of counterfactuals; cf. the section on objective chance in (Kaufmann, 2004). The results below presumably have application to indicatives, as well as counterfactuals, if Kaufman is right. (Compare also Briggs (manuscript)).

1 Ramsey Identities, Bounds and Zero

Some may feel, even at this early stage, that the Counterfactual Ramsey Identity is misconceived. Consider the following example:

If I had flipped this fair coin, it would have landed heads

Under the counterfactual supposition that I had flipped the fair coin, what credence should we give to the consequent? All else equal, the answer should be one-half. However, Lewis has urged that the counterfactual conditional itself is flatly false (cf. Lewis, 1973, p.6-8). If we accept Lewis's verdict, our credence in the counterfactual itself should be very low. So the Counterfactual Ramsey Identity would be violated.[4]

If one agrees with Lewis that the above counterfactual is false, one may well say the same of the corresponding indicative:

If Billy flipped the fair coin, it landed heads

If we classify this as 'flatly false', and so assign it low credence, we have a violation of the Indicative Ramsey Identity (compare Nolan, 2003).

Stalnaker (1980) has long argued against the Lewisian view on the truth-values of such conditionals, urging that they are indeterminate rather than false, removing the immediate objection. I argue for Stalnaker and against Lewis on this issue in (Williams, 2010) (but see also (Williams, 2009)). However, I want my discussion here to speak to as broad an audience as possible. Luckily, there is a different form of the ' Ramsey Test', weaker than the Identity, that should seem appealing even to those who follow Lewis in these cases. This is the Counterfactual Ramsey *Bound*:

$$P^A(B) \geq P(A \mathrel{\Box\!\!\rightarrow} B)$$

The idea here is simply that we shouldn't have *more* confidence in a counterfactual, than we do in the consequent on the counterfactual supposition of its antecedent (compare Joyce, 1999, ch.5,6). For those like Nolan who feel the force of analogous worries about the Indicative Ramsey Identity, we can offer the corresponding Bound:

$$P_A(B) \geq P(A \rightarrow B)$$

Indeed, in either case, it turns out that all our arguments really need is the following special case: the 'Ramsey Zero'. Informally: if you give no credence whatsoever to a proposition under a given supposition, you shouldn't be investing any credence in the corresponding conditional. The Ramsey Zero comes in counterfactual and indicative versions:

$$P^A(B) = 0 \Longrightarrow P(A \mathrel{\Box\!\!\rightarrow} B) = 0$$
$$P_A(B) = 0 \Longrightarrow P(A \rightarrow B) = 0.$$

I'll use 'Ramsey Tests' as a general term for normative principles like the Ramsey Identities, Bounds, or Zero.

[4] Of course, it wouldn't be violated if we revised our judgement on the appropriate suppositional credence—for example, saying that our credence in the coin landing heads on the (counterfactual) supposition that it is flipped should be zero. But this is implausible, and is not endorsed by any author I am aware of. In particular, Lewis and Joyce, who are explicitly committed to the credence in the counterfactual being low, develop a notion of 'imaging probability' precisely to account for this data.

2 A constraint on counterfactual supposition

The Ramsey Tests, of whichever form, get their power when the notion of supposition they invoke is made formally tractable. In the case of indicative supposition, the consensus is that it should be identified with the (subjective) conditional probability of the consequent on the antecedent. (As mentioned earlier, I prefer to see this as a normative connection, but nevertheless, for ideal agents there will be an identity between conditional probabilities and indicative suppositional credences.) As already argued, there are cases where indicative and counterfactual supposition diverge. If the notion of supposition-as-counterfactual is to be formally tractable, we need other resources.

The correct norm on counterfactual supposition, I contend, is a conditional version of the Principal Principle.[5]

$$P^A(B) = \sum_x x \cdot P(Ch(B|A) = x)$$

The right hand side here expresses my (subjective) *expectation* of the conditional chance of B on A.

(The 'chances' here I take to be well defined, and non-trivial, even in a fundamentally deterministic world (else the applicability of the principle would be severely restricted). Certainly, a more-than-subjective account of chance seems implicit in ordinary thought and talk—consider our attitudes to the chances involved in dice-throws and coin-flips, which don't seem to presuppose any particular account of fundamental physics. Statistical mechanics, too, seems to requires such a notion (cf. Albert, 2001). I am convinced by recent work by Loewer that appearances here can be taken at face-value, and are not theoretically problematic.[6])

One issue in this formulation concerns the time-indexing of the chances—since chances evolve over time, expectation of conditional chance-at-t may not match my expectation of conditional chance-at-s. Which should norm our supposing? I'm not sure there's a definitive answer to be given to this question—there are various natural choices in individual cases (like the time just before A could come about). My preferred view is that any time-index gives a coherent way of engaging with counterfactual supposition; though some are more useful in a given situation than others. For us, that pushes the question back to: what time is relevant for the kind of counterfactual supposition that features in the Ramsey tests? For counterfactuals with antecedents about the obtaining of an event located at t, I think typically the relevant time will be just before t. [7]

A second issue, familiar from discussion of the original Principal Principle, is that chances (at t) *prima facie* constrain credences only for agents with no 'inadmissible information'—intuitively, information about outcomes of relevant chance processes. If a trusted Oracle tells you that the fair coin currently spinning in the air will land heads, you may rationally have high credence that it will land heads, without altering your estimation of the objective chances. If a trusted Oracle tells you that a fair coin *would* have

[5]See (Lewis, 1980) for the original, and (Joyce, 1999, ch.5) for the conditional version.

[6]See (Loewer, 2001, 2004). Skyrms (1980) also defends a view of chance compatible with determinism. For an opposed view, see Schaffer (2007).

[7]Choice of time index is discussed in (Elstein & Williams, manuscript). We argue there that backtracking and forwardtracking forms of counterfactual thinking can be viewed as resulting from different choices of time-index in the chances; and that the *relevant* choice is fixed by one's broader purposes—for example, when faced with a decision problem, it is the chances at the time the decision is to be made that are relevant).

landed heads *were* it flipped (on the assumption that such 'middle knowledge' is even possible), you may equally have high (counterfactual) credence without altering your views on the chance of obtaining heads on flipping. So our principle should be understood as restricted by similar admissibility constraints.[8]

In the remainder of this section, I describe two kinds of consideration that support the conditional chance norm on counterfactual supposition, and briefly address some initial worries about it. The discussion is fairly short. The reason is that while I personally endorse the norm, sceptical readers can still engage with what is to follow on the *hypothesis* that the chance norm holds (leaving them room ultimately to construe what is to follow as a reductio of it). So construed, our discussion still has important consequences for our understanding of counterfactuals, as I'll describe at the end of the paper. Interesting as it is, therefore, we do not need at this stage to provide some conclusive defence of the chance norm itself.

The first consideration in support of the norm is its successful qualitative and quantitative predications in a range of test cases. Consider, for example, the Kennedy cases introduced earlier. If we're Warrenites, the majority of our credence will be invested in worlds where there was no conspiracy. In such worlds, just before the assassination, the chance of Kennedy dying given Oswald not shooting is very low. The expected conditional chance will be correspondingly low. And this exactly matches what Warrenites take to be the intuitive credence in Kennedy being killed under the counterfactual supposition that Oswald had not shot him. I conclude that the constraint delivers the correct qualitative predictions in the Kennedy case.[9] Its quantitative predictions seem extremely plausible too. If one is certain that there's a chance of 0.1 of the cup smashing given I drop it, and I have no dodgy insider knowledge, how could one justify having credence *other* than 0.1, on the counterfactual supposition of its being dropped? And if one is uncertain whether the cup is fragile (0.9 chance of breaking, when dropped) or robust (0.1 chance of breaking when dropped), it again seems right that your credence in it breaking under the supposition it is dropped is a mixture between 0.9 and 0.1 proportionate to your credence in the two hypotheses about the state of the cup.[10]

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[8]Skyrms (1980, §IIA4) imposes no such restrictions. One upshot of this is that his account of the counterfactual conditional will violate probabilistic modus ponens: one can have high credence in each of A, $\neg B$, and $A \mathrel{\Box\!\!\rightarrow} B$—in a case where one knows that the conditional chance of B on A was high, that A occurred and that (unlikely as it was) B followed. Cf. Skyrms' discussion on p.99 of the "explanatory usage" of counterfactuals and his divergences from Stalnaker.

What information is admissible, relative to the chances at t? This is a vexed issue in the discussion of the original Principal Principle and I won't attempt a full answer here. A standard sufficient condition is to assume that qualitative information about the past, and the laws of nature (and disjunctions thereof) are admissible. If deterministic chances are in play, we need to restrict further to qualitative descriptions in macroscopic vocabulary.

In the case of counterfactuals, information that $A \wedge B$ in fact occurred, or that $A \wedge \neg B$ occurred should count as inadmissible—at least if we want to hold onto the counterfactual Ramsey Tests. On the other hand, I think it's reasonable to assume that information that is (a) about the (macro) qualitative history of the world after t, and (b) entails $\neg A$, should be admissible relative to t and the counterfactual supposition that A. The treatment of the Kennedy cases is much simplified if this is correct, and I will assume it henceforth. (If such information is not admissible, we can still extract constraints on counterfactual supposing in Kennedy cases—but the argument is much more indirect.)

[9]As noted previously, a presupposition of application is that the information we have about the case is not inadmissible—but I think this is plausible (if the reader rejects this assumption, it's possible to give an argument that nevertheless, our suppositional credences should approximately match the expected conditional chance—but it is far more indirect).

[10]I think Kaufmann's cases (op cit) can also be used to illustrate the successful predictive power of this account of counterfactuals (even though Kaufmann himself uses them in other contexts). See also Moss

The second kind of support for the norm appeals to its role in wider theory. Joyce (1999) argues that the notion of counterfactual supposition should be at the heart of our theory of rational action. Causal Decision Theory, on Joyce's formulations, recommends choosing that action that maximizes causal expected utility—and the causal expected utility of an action is determined by counterfactually supposing one performs the action, and taking a weighted average of the utility of possible outcomes, with weights given by the credences-under-that-supposition invested in each.[11]

Let's suppose, with Joyce, that in the first instance causal decision theory makes appeal to counterfactual supposition in this way. Joyce notes that familiar chance-based presentations of casual decision theory (cf. Skyrms, 1980; Joyce, 1999; Oddie & Menzies, 1992) arise when one endorses the counterfactual chance constraint given above. Hence, we can argue for the norm above by arguing that chance-based formulations of causal decision theory are better than their rivals. I make this case elsewhere, giving instances where causal decision theories give intuitively unsatisfactory results exactly where their core notion diverges from expected conditional chance (Elstein & Williams, manuscript).

Before we move to consider the consequences of the conditional chance norm on counterfactual supposition, I want to respond to some initial concerns.[12] The first worry concerns *chance zero suppositions*. It's not immediately obvious how one applies the norm in cases where the supposed content is chance-zero. The standard grip we have on the crucial notion of conditional chance is through the ratio formula $Ch(B|A) = Ch(AB)/Ch(A)$. This goes undefined when A is chance zero. On the other hand, we can systematically and sensibly *counterfactually* suppose contents that we take to have zero chance of *actually* occurring (for example, a counterlegal supposition, or an all-heads result in an infinite series of fair coin flips). Often chance-zero cases can be handled by finding earlier times at which the chance of the supposed content is greater than zero. It's now chance-zero that Oswald didn't shoot Kennedy—but this had positive probability in 1960. But counterlegals and the like are more tricky, since they're *permanently* chance-zero. Even in these hard cases, it's perfectly consistent to take conditional chances to be well-defined even if the conditioned proposition is chance zero. Popper functions give one formal articulation of this; the ratio formula is satisfied where defined, but conditional chances outstrip it.[13] So there's no direct threat to the definedness of the conditional chance norm from chance-zero antecedents. And even if the relevant conditional chances in some hard cases were in fact undefined, so that the conditional chance norm was inapplicable, that wouldn't mean that it was inaccurate within its domain of applicability—which is all we need to assume to cause trouble below.

Second, *counterchance* suppositions may seem tricky in this framework. Intuitively, there's something odd about reasoning about contrary-to-fact suppositions about chances, by appeal to the actual chances. But in fact they introduce no new issues. It'd certainly be odd to assess the counterfactual supposition that the chances at t are thus-and-such by appeal to the actual t-chances. But in lots of cases, we can simply track back to a time, s, such that the supposed t-chances have a positive s-chance of coming about. More recherche cases, where the chances never had any chance of coming about, are just another case of a permanently chance-zero supposition. I've already argued that those don't threaten the use I want to make of the conditional chance norm.

(manuscript) for careful and detailed discussion of data on credences in counterfactuals.

[11]Joyce calls it 'causal suppositional probability', but I think he'd agree that we're talking about the same notion.

[12]Thanks to Al Hájek and Barry Loewer for discussion of these concerns.

[13]See (Leitgeb, manuscript) for discussion of conditional chances.

The third and final worry I will consider concerns *objective chance sceptics*. Some philosophers deny there are such things as well-defined objective chances. But surely it's odd to advise such agents—on pain of irrationality—to set their counterfactual suppositional beliefs by her subjective take on what the objective chances are. After all, they specifically disclaims any positive belief about chance! We can response on various levels. First, if the idea is that our sceptics totally lack attitudes to chances, then the norm doesn't apply to them at all. But as we noted in an analogous case, at worst this is a limit on the applicability of the norm, not an attack on its cogency where applicable. Secondly, the sceptics are quite likely mistaken about their own attitudes, on the assumption that they are wrong on the substantive issue of whether there are objective chances around at all. It's quite possible for someone to have opinions about the chances, manifested in their everyday behaviour and ordinary talk about dice and coins and election-results, but to favour some devious (but ultimately misguided) reinterpretation of what they themselves believe. Thirdly, even if neither of these lines persuade, it's still not clear the constraint itself is under threat. Suppose we have to say that chance sceptics violate the norm. Perhaps they have zero credence in any claim about conditional chances, so the expected conditional chance of anything on anything is zero, whereas they have non-null beliefs under counterfactual suppositions. The widescope norm we're endorsing only says that the sceptic is in a bad kind of state, in virtue of the divergence between her opinions about chance and her counterfactually suppositional credences. The obvious place to lay the blame is with their (ex hypothesi) mistaken views about chance—and so the thing for them to do to rectify the situation is to correct their views on this matter. Even here, therefore, the conditional chance norm delivers a plausible verdict. What *would* be damaging is the verdict that sceptics should adjust their counterfactual suppositions to bring them into line with their rejection of chances—but that narrow-scope recommendation does not follow from the norm above.

3 Lewis's triviality proof

The core of Lewis's triviality proof can be presented as the following simple argument. It uses the fact that $P(\bullet|X)$ is a probability function for arbitrary X (assuming $P(X) > 0$). We use the notation P' for the probability function $P(\bullet|B)$, and P'' for $P(\bullet|\neg B)$. The argument runs:

1.	$P(A \to B)$	$=$	$P(A \to B\|B).P(B) + P(A \to B\|\neg B).P(\neg B)$	(probability theory)
2.		$=$	$P'(A \to B).P(B) + P''(A \to B).P(\neg B)$	(definition of P' and P'')
3.		$=$	$P'(B\|A).P(B) + P''(B\|A).P(\neg B)$	(using IRI twice)
4.		$=$	$1.P(B) + 0.P(\neg B)$	(construction of P' and P'')
5.		$=$	$P(B)$	(calculation).

The first step is uncontroversial, under the assumption that conditionals express propositions. The second line simply rewrites the first, using the notation introduced above. The Indicative Ramsey Identity is used in the third line, applied to the probability functions P' and P''. The fourth line just uses the fact that, since P' already gives probability 1 to B, it gives probability 1 to that proposition conditionally on anything; and since P'' already gives probability 0 to B, it gives probability 0 to B conditionally on anything. The last line follows immediately.

The argument as presented presupposes that we apply the Indicative Ramsey Identity to probabilities that arise from P by conditionalizing. I think for Lewis this move is motivated by two thoughts. The first is that the normative force of the Ramsey Identity is no local phenomenon—it is *binding* on all rational agents. The second is that the relevant probabilities are possible belief states of a rational agent—which we derive from a *plenitude* assumption that conditionalization on B or on $\neg B$ takes us from one rational belief state to another. The full force of plenitude isn't needed to run a single instance of this argument against the Ramsey Identity (only the two specific instances of plenitude are needed); but full plenitude is required if we want to run the argument schematically against every such instance.

This doesn't yet get us to 'triviality'. But the game is already up, for the last line counts as a reductio of the premises, given appropriate choices of A and B. On any view endorsing the data supporting the Indicative Ramsey Identity, one simply cannot maintain that one should have no more credence in 'If I open my eyes, I'll see a vase' than to 'I'll see a vase' (given that I'm presently very confident I *won't* open my eyes, and so won't see anything!).

What if we started from a weaker assumption—that of an Indicative Ramsey Bound rather than Identity? In that case, line 3 fails. But since we would be assuming that $P(B|A) \geq P(A \to B)$, we could derive an analogous result, using inequalities rather than equalities:

1.	$P(A \to B)$	$=$	$P(A \to B\|B).P(B) + P(A \to B\|\neg B).P(\neg B)$	(probability theory)
2.		$=$	$P'(A \to B).P(B) + P''(A \to B).P(\neg B)$	(definition of P' and P'')
3.		$\leq$	$P'(B\|A).P(B) + P''(B\|A).P(\neg B)$	(using IRB twice)
4.		$\leq$	$1.P(B) + 0.P(\neg B)$	(construction of P' and P'')
5.		$\leq$	$P(B)$	(calculation).

It is no more plausible that one's credence in an indicative conditional should be bounded above by one's credence in its consequent, than that it should be identical to it. Certain error theorists—like Hájek (MS.)—might be thought to be in a position to endorse it—since they will think that conditionals are mostly false anyway.[14] But even error-theorists of this stripe will be in trouble in suitably selected cases—for example, it's an important element in Hajek's position that suitably hedged conditionals (for example, 'if I dropped this cup, it'll very likely smash') are true, even if their unhedged cousins are not. For these special cases, the Hajekian error-theorist faces the same sorts of problems as everyone else. In sum, the Lewis-style argument can target the Bound as well as the Identity version of the Ramsey Test.

We can weaken the assumptions yet further. What we really need in the above is simply that if $P''(B|A) = 0$, then $P''(A \to B) = 0$—but this is just the Ramsey Zero assumption applied to P''. Then we argue:

1.	$P(A \to B)$	$=$	$P(A \to B\|B).P(B) + P(A \to B\|\neg B).P(\neg B)$	(probability theory)
2.		$=$	$P'(A \to B).P(B) + P''(A \to B).P(\neg B)$	(definition of P' and P'')
3.		$=$	$P'(A \to B).P(B) + 0.P(\neg B)$	(using Indicative Ramsey Zero)
4.		$=$	$k.P(B)$	($0 \leq k \leq 1$, since P' a probability)
5.		$\leq$	$P(B)$	(calculation).

We already noted in the previous proofs that $P''(B|A) = 0$, by construction of P''. Here we simply use this to apply the Ramsey Zero principle to move from line (2) to line (3).

[14] Hajek's primary concern is to defend an error-theory about counterfactuals. But his arguments, I believe, have straightforward parallels in the indicative case.

The last line is the same unacceptable result that we derived from the Ramsey Bound.

4 A counterfactual version

What is important to note is that the form of the argument doesn't presuppose any particular interpretation of probability, nor any particular interpretation of the conditional operator. For arbitrary notions of probability ($\mathbb{P}$) and conditionals ($\rightsquigarrow$) we simply need relevant instances of one of the following:

$$\mathbb{P}(A \rightsquigarrow B) = \mathbb{P}(B|A)$$

$$\mathbb{P}(A \rightsquigarrow B) \leq \mathbb{P}(B|A)$$

$$\mathbb{P}(B|A) = 0 \Longrightarrow \mathbb{P}(A \rightsquigarrow B) = 0$$

We now finesse this into problems for the counterfactual Ramsey Identity, Bound, or Zero. Take a context at which the objective chances are described by Ch. Consider the credences of an agent fully informed about Ch, and with no inadmissible information.[15] By the Counterfactual Ramsey Identity, the agent's expectation of conditional chances is just equal to the real conditional chance. In this case, therefore, the conditional version of the Principal Principle simplifies to:

$$P^A(B) = Ch(B|A)$$

Further, assuming the Principal Principle, a rational agent should fix their credences to the (known) chances. Thus the agent's credence in the counterfactual should match the chance that the counterfactual is true:

$$P(A \mathrel{\Box\!\!\rightarrow} B) = Ch(A \mathrel{\Box\!\!\rightarrow} B)$$

Putting this together with the Counterfactual Ramsey Identity $P^A(B) = P(A \mathrel{\Box\!\!\rightarrow} B)$, we get:

$$Ch(B|A) = P^A(B) = P(A \mathrel{\Box\!\!\rightarrow} B) = Ch(A \mathrel{\Box\!\!\rightarrow} B)$$

What if we start with the Counterfactual Ramsey Bound instead? In parallel style, we get:

$$Ch(B|A) = P^A(B) \geq P(A \mathrel{\Box\!\!\rightarrow} B) = Ch(A \mathrel{\Box\!\!\rightarrow} B)$$

If we started just with the Counterfactual Ramsey Zero assumption, we have on the same assumptions:

$$Ch(B|A) = P^A(B) = 0 \Longrightarrow Ch(A \mathrel{\Box\!\!\rightarrow} B) = P(A \mathrel{\Box\!\!\rightarrow} B) = 0$$

Thus, the Ramsey Identity/Bounds/Zero end up committing us to a relationship (either Identity, or a Bound, or Zero) between the *chance* of a conditional and the corresponding *conditional chance*. For *any possible* chance assignment at any time, we can argue for this relationship—assuming only that the conditional and original Principal Principle constraints on rational belief appealed to above hold of that chance assignment.

[15]I'm going to suppose that this is at least possible. One worry concerns Lewis' 'big bad bug'—perhaps information about the chances embeds information about the future. This is arguable at least for Lewis's Humean views on the nature of chance, but I take it this won't arise on other treatments of chance, and I won't discuss it further here. Thanks to NN for raising this point.

Now let us go back to the Lewis arguments—for illustrative purposes, I'll work with the Bounds version. The idea will be to *reinterpret* the notions that figure in the argument, but otherwise run it unchanged. Specifically, interpret the probability as chance (Ch) rather than credence, and the conditional as counterfactual rather than indicative. By analogy to our earlier notation, we use $Ch'(X)$ for $Ch'(\bullet|B)$, and Ch'' for $Ch(\bullet|\neg B)$. The key moves in the original form of the argument rely on applying the bound between the probability of the conditional and the conditional probability with respect to two probability functions derived by conditionalization from the one we start with. The analogous starting points for our argument will be:

(α) $Ch'(A \mathrel{\Box\!\!\rightarrow} B) \leq Ch'(B|A)$

(β) $Ch''(A \mathrel{\Box\!\!\rightarrow} B) \leq Ch''(B|A)$.

I will discuss the standing of these equations shortly, and in particular, the status of the derived probability functions Ch' and Ch''. But assuming that (α) and (β) are in place, the reinterpreted argument runs as follows:

1.	$Ch(A \mathrel{\Box\!\!\rightarrow} B)$	$=$	$Ch(A \mathrel{\Box\!\!\rightarrow} B|B).Ch(B) + Ch(A \mathrel{\Box\!\!\rightarrow} B|\neg B).Ch(\neg B)$	(probability theory)
2.		$=$	$Ch'(A \mathrel{\Box\!\!\rightarrow} B).Ch(B) + Ch''(A \mathrel{\Box\!\!\rightarrow} B).Ch(\neg B)$	(definition of Ch',Ch'')
3.		$\leq$	$Ch'(B|A).Ch(B) + Ch''(B|A).Ch(\neg B)$	(using α, β)
4.		$\leq$	$1.Ch(B) + 0.Ch(\neg B)$	(construction of Ch',Ch'')
5.		$\leq$	$Ch(B)$	(calculation).

This is just as unacceptable as the original. It entails, for example, that the *expected chance* of a counterfactual is always less than or equal to the *expected chance* of its consequent. And by the (unconditional) Principal Principle, this tells us that one's credence in a counterfactual should never be higher than our credence in its consequent. This is absurd.

Analogous adaptions of the Identity and Zero versions of the argument also go through, with the same absurd conclusion.

5 Comparing the arguments: plenitude and evolution

I conclude at this point that the counterfactual forms of the Ramsey Identity, Bounds or Zero are just as problematic as the indicative forms. But some resist. They say the critical assumptions (α), (β) needed to generate the reductio are easier to resist in the case of counterfactuals than the assumption Lewis needed for his argument—*even if we accept the Ramsey Tests in each case.* In this section we identify parallels and divergences between the assumptions needed for the two arguments. For simplicity, we continue to focus just on the Bounds case, but what we say generalizes.

To argue for (α) and (β) from the Ramsey Tests, we will assume two things. The first—call it the *Binding* assumption—is that the normative constraints in play (the Ramsey Tests and the Principal Principle) are binding not only on actual agents, but on *possible* agents too. The second is the *Plenitude* assumption that, given that Ch is a chance distribution at t, there are worlds w', w'' and times t' and t'' such that Ch' is the objective chance distribution at w',t' and Ch'' likewise at w'',t''.[16] (The alternative thought is that while Ch', say, is a perfectly good *probability*, there's no world and time in which the objective chances are exactly as described by that probability.) The Plenitude assumption would follow from the following modal closure claim: if c is the chance distribution at some world w at time t, P any proposition (with positive chance of obtaining by the lights of c), and c' is the probability assignment that results from conditionalizing c on P, then there's a world w' and time t' whose chances at t' are described by c'.

Plenitude ensures that Ch' and Ch'' are *possible* chance distributions. Suppose they obtain at worlds and times w_α,t_α and w_β,t_β respectively. Agents with full knowledge of chance in those worlds will satisfy the various rationality constraints described earlier, by the binding assumption. As before, it follows that the w_α,t_α-chance of a counterfactual must be bounded by the corresponding conditional w_α,t_α-chance, and likewise for β. (α) and (β) follow immediately.

Lewis's original argument, I mentioned earlier, can be viewed as having an analogous pair of assumptions. The *binding* assumption needed was that the indicative Ramsey Test applied to all rational belief states. The *plenitude* assumption was (particular instances of) the principle that *rational credence assignments were closed under conditionalization.* How do these starting points compare?

I take it that the binding assumptions in the two cases have a similar status—I will not discuss them further. It is in the Plenitude assumptions that we find differences. Lewis's Plenitude assumption is a claim about possible rational states of mind. Our Plenitude assumption makes a claim about *possible chancy states of the world.* So the subject matter of the plenitude claim looks very different.

If all we had to go on was the *bare* plenitude claim in each case, perhaps the difference in subject matters wouldn't make that much difference. In either case, we can challenge those who deny Plenitude to explain why prima facie coherent probability functions (those resulting from conditionalization) don't describe rational states of mind, or possible chance distributions. But Lewis' plentitude assumption is often given additional motivation: it is sold as a foundational assumption of Bayesian epistemology.[17] By contrast, a Plenitude claim about possible chancy states of the world won't be foundational to probabilistic *epistemology.* So one might conclude that there's something better motivated about Lewis's Plenitude assumption than the one I appeal to here.

However, just as we provide independent motivation for rational-credence-Plenitude by appeal to the place of conditionalization in wider theory, we can similarly motivate chance plenitude. To see this, we turn our attention from the evolution of credences given new information, to the evolution of chances over time.

An orthodox view about chance evolution, as set forward in Lewis (1980), is that chances at a given time arise from earlier chance distributions by *conditionalizing on what has in fact occurred in the intervening period.* If Ch_0 is an 'initial' chance distribution, and H_t is the proposition describing the complete qualitative history of the world from that initial time to time t, then the chances at t, $Ch_t(\bullet) = Ch_0(\bullet|H_t)$.[18] And if Ch describes

[16]Note that we do not need to assume that $t = t' = t''$. Our earlier argument that the chance of a counterfactual equalled the conditional chance can be run for chance-omniscient agents in the relevant world at whatever time is appropriate.

[17]Though we need to be careful here—to claim that updating must always proceed by conditionalizing, as some Bayesians would, is not to commit ourselves to all conditionalizations being rationally permissible updates of our credences.

[18]If we're dealing with fundamental, micro-chances, H_t will be the complete micro-qualitative history. If we're dealing with macro-chances compatible with determinism, H_t should be the complete macro-qualitative history.

the chances at s, and H_t^s describes the qualitative history of the world between s and t, then $Ch_t(\bullet) = Ch(\ \bullet\ |H_t^s)$.

For simplicity, suppose that at time s only two possibilities for the next day are given non-zero chance: H' and H''. Let Ch be the chances at s. Then the chances at t, one day later, arise from conditioning Ch on H' or H''. (If s is the first instant in time, this follows directly from the characterization of chance evolution given above. Even if it isn't, it's easy to derive this relationship—see Lewis (1980) for discussion.) If we write these as Ch' and Ch'' respectively, we have two possible chance functions that can support the Lewis-style argument, if we interpret B as H'. For by construction $Ch'(\bullet) = Ch(\ \bullet\ |H')$, and it turns out that $Ch''(\bullet) = Ch(\ \bullet\ |\neg H')$.[19]

We now simply choose any proposition A that is non-zero on each of Ch' and Ch'', and consider the counterfactual $A \mathrel{\Box\!\!\rightarrow} H'$. We obtain the unacceptable result that $Ch(A \mathrel{\Box\!\!\rightarrow} H') \leq Ch(H')$.

6 Extending the result to incomplete consequents

To fix ideas about the *kind* of result we've got, suppose an unlucky football team—the Blitzers—have got to the cup final for the first time in many years. But due to financial difficulties they're going to have to sell all their best players this summer, so they won't get a second opportunity to win. Finally, they're facing a much better side. I intend the situation to be one where everyone (short of the Hájekian error-theorist) will agree that *if the Blitzers were to win the cup in the next five years, they will win this year*—even though everyone agrees that the antecedent is overwhelmingly unlikely to come about.

Let A be the proposition that the Blitzers win the cup sometime in the next five years. H' is the proposition that they win this year; H'' that they lose this year. We want to endorse $A \mathrel{\Box\!\!\rightarrow} H'$—and so we take it that it is high chance (if it was low chance, we wouldn't believe it). But H' is low chance. But, on the contrary, our result above would require that the chance of the counterfactual be no higher than the chance of the consequent. So unless we're prepared to reject ordinary counterfactuals like the one above (i.e. go error-theoretic) we cannot live with this result.

However, our example cheats a bit, since our motivation for the required plenitude assumption only covered conditionalization on a complete qualitative description of a segment of history. But 'the Blitzers win this year' is not complete! The result for complete histories is bad enough, I think. But furthermore, with some additional assumptions, we really can get the embarrassing result about the Blitzers.

To begin with, we can extend the above evolutionary argument for plenitude to arbitrary finite branching—say non-zero chance given by Ch to all and only the H_i ($i \leq n$). One notes first that $Ch(A \mathrel{\Box\!\!\rightarrow} H_i) = \sum_i Ch(A \mathrel{\Box\!\!\rightarrow} H_1|H_i)Ch(H_i)$. Conditioning Ch on any one of the possible futures H_i gives a chance distribution Ch_i to which the Ramsey bound applies, and so $Ch(A \mathrel{\Box\!\!\rightarrow} H_1) \leq \sum_i Ch_i(H_1|A)Ch(H_i)$. But each term is zero except for $Ch_1(H_1|A)Ch(H_1) = Ch(H_1)$. Hence $Ch(A \mathrel{\Box\!\!\rightarrow} H_1) \leq Ch(H_1)$.

Let's suppose that B is true at all and only histories H_j, for j in some index set I. Then $Ch(A \mathrel{\Box\!\!\rightarrow} B) \leq Ch(B|A)$ by the Ramsey Bound, and the latter is just $Ch(\bigvee_{j \in I} H_j|A)$. Since the H_i are incompatible, the last term is equal to $\sum_{j \in I} Ch(H_j|A)$. If the counterfactual conditional is governed by conditional excluded middle (and weakening-of-the-consequent

[19] As initially characterized, $Ch''(\bullet) = Ch(\ \bullet\ |H'')$. But we're assuming that H' and H'' are the only two possible futures given non-zero chance by Ch, and hence $Ch(\neg H_1|H_2) = Ch(H_2|\neg H_1) = 1$. It follows that $Ch(\bullet\ |\neg H_1) = Ch(\bullet\ |H_2)$, which gives the quoted result.

is valid), then $A \mathrel{\Box\!\!\rightarrow} \bigvee_{j\in I} H_i$ is logically equivalent to $\bigvee_{j\in I}(A \mathrel{\Box\!\!\rightarrow} H_i)$. So $Ch(A \mathrel{\Box\!\!\rightarrow} \bigvee_{j\in I} H_i) = \bigvee_{j\in I}(A \mathrel{\Box\!\!\rightarrow} H_i)$. Granted conditional non-contradiction (and A as possibly true) each of the conditionals in the disjunction is mutually incompatible, so we can argue $Ch(A \mathrel{\Box\!\!\rightarrow} B) = Ch(A \mathrel{\Box\!\!\rightarrow} \bigvee_{j\in I} H_i) = Ch(\bigvee_{i\in I}(A \mathrel{\Box\!\!\rightarrow} H_i)) = \sum_{i\in I} Ch(A \mathrel{\Box\!\!\rightarrow} H_i)$. By our earlier result, each $Ch(A \mathrel{\Box\!\!\rightarrow} H_i)$ is bounded by $Ch(H_i)$. And hence $Ch(A \mathrel{\Box\!\!\rightarrow} B) \leq \sum_{i\in I} Ch(H_i)$, which is just $Ch(B)$. That is, $Ch(A \mathrel{\Box\!\!\rightarrow} B) \leq Ch(B)$.

The upshot is that assuming a Stalnakerian logic for the counterfactual (recently defended, for example, in Williams (2010)) we derive our result for conditionals with consequents that are only partial descriptions of histories.

In summary, the situation is this. The premises of Lewis's original triviality proof for indicative conditionals relied on a plenitude principle about rational states of mind (either full plentitude, for a full schematic version of the Lewis argument; or specific instances, if the argument is to be run on a single conditional). The plenitude principle can be further motivated by a certain view about how beliefs evolve under the impact of new information—this is where appeal to Bayesianism becomes relevant. The situation here is exactly analogous. Our version relies on a plenitude principle, in exactly the same fashion as the original, but in this case about possible chance distributions rather than states of mind—which can be further motivated by certain views about how chances evolve over time. Even without the 'additional' motivation, the arguments are each interesting, but one could resist either by simply arguing that it is a *brute fact* that the states of mind required to run the proof are irrational, or that the required chance distributions are impossible. The further motivations provide a more pressing challenge to one who tries to resist the result by denying Plenitude: what story about the evolution of credences or chances can you provide, given that standard stories seem unavailable?

7 Applications

I have argued for the *prima facie* plausibility of a Ramsey Bound for counterfactuals, cashed out in terms of expectations of conditional chance. I adapt the Lewis triviality argument to show that this thesis, initially plausible as it is, is highly problematic. I have explored just one of the array of 'triviality/impossibility results' in the literature—the core of Lewis's original argument. It is well worth considering how the others transfer.[20]

I finish by drawing out some implications for the study of counterfactuals. Since Adams (1975), 'no truth value' treatments of indicative conditionals have been widespread (see, e.g., Edgington, 1995; Bennett, 2003). The view that counterfactuals have no truth conditions is far less prominent (though see Skyrms, 1980, 1994; Edgington, 1997).

I see no difference in our reasons for believing the indicative over the counterfactual version of the Ramsey Identity/Bound. And, as we have seen, they are equally susceptible to Lewis's argument. So I cannot see a principled reason for treating the two differently.

[20] For an excellent survey of the literature (and much else!), see (Hájek & Hall, 1994). Independently of the present results, but in closely related fashion, (Briggs, manuscript) proves an array of impossibility results for counterfactuals, though she works with (what I've called) the counterfactual Ramsey Identity rather than Ramsey Bounds and doesn't explore the Lewis result directly. (Leitgeb, manuscript), in developing a semantics for counterfactuals based on chance, takes pains to distinguish his proposal from one that satisfies our 'Ramsey Identity', for fear of triviality results. Edgington (1997) endorses an argument based on triviality results against the view that counterfactuals have truth-conditions, but says that the triviality results apply *directly* only to indicatives, and *derivatively* to counterfactuals, on the grounds that counterfactuals (at least sometimes) express what an indicative use to express before certain information arrived. Our present argument targets counterfactuals directly.

I suggest that friends of the 'no proposition' view of indicatives should use the above triviality result as a lever to motivate a 'no proposition' view of counterfactuals. Just as in the former case indicatives are depicted as devices for expressing a high probability of the consequent on the antecedent supposed-as-actual, in the latter case counterfactuals would be devices for expressing high probability of the consequent on the antecedent supposed-as-counterfactual, as Skyrms has long urged.

Likewise, in the literature on conditionals, there are various well-known ways of trying to accommodate Ramsey data within a truth-conditional account. Whether within a Stalnaker-esque logic (van Fraassen, 1976), combined with material truth-conditions (Jackson, 1987) or in some other form (McGee, 1989), it is natural to try to replicate these strategies for the counterfactual.

Such approaches run head-on into the triviality arguments, and so must decide how they are going to resist them. This is most acute for the version I think is most promising: a 're-semanticized' version of the van Fraassen approach (see Author), on which the Ramsey Identities (in all the cases that matter to get our argument running) are endorsed at face-value. The plenitude assumptions are a natural point of resistance in both the indicative and counterfactual cases—but as urged above, this leaves us with the challenge of articulating replacement accounts of the dynamics of belief and chances. But perhaps the challenge can be met. In other work (Williams, manuscript), I investigate generalizations of conditionalization that allow us to spell out credence updating and the time-evolution of chances, while avoiding the Lewisian trivaility results. This project is feasible but highly non-trivial.

The above suggestions would attempt to *reconcile* counterfactuals with the Counterfactual Ramsey Identity. There is another reaction to the above. One could insist that the lesson we should learn is that the Ramsey Identity is misguided. From this perspective, it is a good thing that the counterfactual Ramsey Test has had less influence than its indicative cousin—for this has allowed the literature to grow unbound by its malign influence. Of course, rejecting the Ramsey Identity is one thing, rejecting the weaker versions explored above is another. One adopting this strategy should be clear-eyed that something as intuitive as the Ramsey Zero is being given up.

But unless the Ramsey-based intuitions are called out for what they are, they will exert hidden influence. As a case study, consider the views of Lewis (1979) and Williams (2008) on counterfactuals and indeterminism. One source of disquiet with such accounts has been that they allow 'If I had dropped the cup, then it would have broken'; and even 'If I were to flip this fair coin a billion times, it wouldn't have landed heads every time' to be flat out *true*, even whilst we acknowledge that the chance that the consequent fails to obtain, given the antecedent, is non-zero. It turns out that on Lewis's account, and my own, the probability of the counterfactual can be higher than the corresponding counterfactually suppositional probability. Some call such results counterintuitive, amplifying the initial disquiet by constructing cases where the disparity is dramatic.[21] But is it reasonable to object to a theory of counterfactuals on these grounds, given our discussion? After all, it will be *very hard* to satisfy the Ramsey Tests for any conditional over a wide range of antecedents and consequents—so hard that consensus opinion in the indicative debate is that the enterprise is quixotic.

In the case of counterfactuals, illuminating truth-conditional accounts are so entrenched that many will react by dispensing with Ramsey Tests rather than reconstructing

[21]Such strategies can be found in (Hawthorne, 2005), especially the 'exclusion of the more probable' and (Dodd, 2009). (I am not sure if the authors would endorse this descriptions of their motives).

their theories. This may indeed by the right reaction. But if this is an acceptable treatment in the counterfactual case, surely the principled line should be to make a parallel move in the case of indicatives, and break free of the influence of the Indicative Ramsey Tests. What could motivate breaking the symmetry? (As mentioned, Nolan (2003) explicitly advocates such a 'counterfactualizing' of the indicatives debate. If we do take this route, it would be nice to offer some 'explaining away' of the intuitive appeal of the Ramsey Tests (compare Kratzer, 1986).)

The main part of this paper extends triviality results from the Indicative to the Counterfactual case, based on a counterfactual version of the famous Ramsey Test. I've now drawn out two possible reactions. The first is to make the discussion about counterfactuals resemble extant discussion of indicatives, by making the Counterfactual Ramsey Identity (or Bound) a desideratum on such theories. The second reaction motivates the opposite project: to make the discussion of indicatives resemble extant discussion of counterfactuals, steeling ourselves to ignore complaints based on violations of the relevant Ramsey Test. Whichever way we go, new work opens up for us.[22]

[22]The triviality results, and related phenomena, have relevance beyond the literature on counterfactuals itself. In other work, I trace the implications for the foundations of decision theory (especially for Joyce's 'imaging' formulation (Joyce, 1999)) and for desire-as-belief in its supposedly consistent counterfactual formulation (Byrne & Hájek, 1997). Taking counterfactual supposition as central, and normed by conditional chance, has a destructive effect on each.

References

Adams, E. W. 1975. *The Logic of Conditionals*. Dordrecht: Reidel.

Albert, David Z. 2001. *Time and chance*. Cambridge, MA.: Harvard University Press.

Bennett, Jonathan. 2003. *A Philosophical Guide to Conditionals*. Oxford: Oxford University Press.

Briggs, Rachael. manuscript. 'Two interpretations of the Ramsey Test'.

Byrne, A., & Hájek, A. 1997. 'David Hume, David Lewis, and decision theory'. *Mind*, **106**(423), 423–428.

Dodd, Dylan. 2009. 'Quasi-miracles, typicality and closeness'. *Synthese*.

Edgington, Dorothy. 1995. 'On conditionals'. *Mind*, **104**, pp. 235–329.

Edgington, Dorothy. 1997. 'Truth, Objectivity, Counterfactuals and Gibbard'. *Mind*, **106**, 107–116.

Elstein, Daniel Y., & Williams, J. Robert G. manuscript. 'Suppositions and decisions'.

Hájek, Alan. MS.. *'Most counterfactuals are false'*.

Hájek, Alan, & Hall, Ned. 1994. 'The hypothesis of the conditional construel of conditional probability'. *In:* Eels, E., & Skyrms, B. (eds), *Probability and Conditionals*. Cambridge: CUP.

Hawthorne, John. 2005. 'Chance and counterfactuals'. *Philosophical and Phenomenological Research*, 396–405.

Jackson, Frank. 1987. *Conditionals*. Oxford: Blackwell.

Joyce, James M. 1999. *The foundations of causal decision theory*. Cambridge, UK: Cambridge University Press.

Kaufmann, S. 2004. Conditioning against the Grain. *Journal of Philosophical Logic*, **33**(6), 583 606.

Kaufmann, S. 2005. Conditional predictions. *Linguistics and Philosophy*, **28**(2), 181 231.

Kaufmann, S. 2009. Conditionals right and left: Probabilities for the whole family. *Journal of Philosophical Logic*, **38**(1), 1 53.

Kratzer, Angelika. 1986. 'Conditionals'. *CLS*, **22**(2). Reprinted in Arnim von Stechow and Dieter Wunderlich, eds., Semantics: An international handbook of contemporary research. Berlin: de Gruyter, 1991, 651-656.

Leitgeb, Hannes. manuscript. 'A probabilistic semantics for counterfactuals'.

Lewis, David K. 1973. 'Counterfactuals and comparitive possibility'. *Journal of Philosophical Logic*, **2**, 418–46. Reprinted with postscripts in Lewis, *Philosophical Papers vol. II* (Oxford University Press, 1986) 3–31.

Lewis, David K. 1976. 'Probabilities of Conditionals and Conditional Probabilities'. *Philosophical Review*, **85**, 297–315. Reprinted with postscripts in Lewis, *Philosophical Papers vol. II* (Oxford University Press, 1986) 133-52. Also reprinted in Jackson (ed) *Conditionals* (Oxford University Press, 1991) 76-101.

Lewis, David K. 1979. 'Counterfactual Dependence and Time's Arrow'. *Noûs*, **13**, 455–76. Reprinted with postscript in Lewis, *Philosophical Papers II* (Oxford University Press, 1986) 32–51. Also reprinted in Jackson (ed) *Conditionals* (Oxford University Press, 1991) 46-76.

Lewis, David K. 1980. 'A subjectivist's guide to objective chance'. *Pages 263–93 of:* Jeffrey, Richard (ed), *Studies in Inductive Logic and Probability*, vol. II. University of California Press. Reprinted with postscript in Lewis, *Philosophical Papers II* (Oxford University Press, 1986) 83–113.

Loewer, B. 2001. Determinism and chance. *Studies In History and Philosophy of Science Part B: Studies In History and Philosophy of Modern Physics*, **32**(4), 609–620.

Loewer, B. 2004. David Lewis's Humean Theory of Objective Chance. *Philosophy of Science*, **71**(5), 1115–1125.

McGee, Vann. 1989. 'Conditional Probabilities and compounds of conditionals'. *Philosophical Review*, **98**, 485–541.

Meskin, A., & Weinberg, J.M. 2003. Emotions, fiction, and cognitive architecture. *The British Journal of Aesthetics*, **43**(1).

Moss, Sarah. manuscript. 'Constraining credences in counterfactuals'.

Nolan, Daniel. 2003. 'Defending a possible-worlds account of indicative conditionals.'. *Philosophical Studies*, **116**, 215–269.

Oddie, Graham, & Menzies, Peter. 1992. 'An objectivist's guide to subjective value'. *Ethics*, **102**, 512–533.

Schaffer, J. 2007. Deterministic chance? *The British Journal for the Philosophy of Science*.

Skyrms, B. 1980. *Causal necessity: a pragmatic investigation of the necessity of laws*. Yale University Press.

Skyrms, Brian. 1994. 'Adams conditionals'. *Pages 13–26 of:* Eells, E., & Skyrms, B. (eds), *Probability and conditionals*. Cambridge: Cambridge University Press.

Stalnaker, R. 1980. 'A defense of conditional excluded middle'. *In:* Harper, Stalnaker, & Pearce (eds), *Ifs: Conditionals, Belief, Decision, Chance and Time*. The Netherlands: Kluwer Academic Publishers.

van Fraassen, Bas. 1976. 'Probabilities of conditionals'. *Pages 261–308 of:* Harper, W.L, & Hooker, C. A. (eds), *Foundations of Probability Theory, Statistical Inference, and Statistical theories of science*, vol. 1. D. Reidel.

Williams, J. Robert G. 2008. 'Chances, counterfactuals and similarity'. *Philosophy and Phenomenological Research*, **77**(2), 385–420.

Williams, J. Robert G. 2009. 'Vagueness, probability and conditionals'. *Erkenntnis*, **70**(2).

Williams, J. Robert G. 2010. 'Defending conditional excluded middle'. *Nous*, **44**(4).

Williams, J. Robert G. manuscript. 'Tenable conditionals'.