THE MATERIAL ACCOUNT OF CONDITIONALS AND THE CLASH BETWEEN INTENSIONAL AND EXTENSIONAL EVIDENCE

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ABSTRACT

Intensional evidence is any reason to accept a proposition that is not the truth values of the proposition accepted or, if it is a complex proposition, its propositional contents. Extensional evidence is non-intensional evidence. Someone can accept a complex proposition, but deny its logical consequences in two circumstances: (1) when her acceptance is based on intensional evidence, while the logical consequences of the proposition presuppose the acceptance of extensional evidence, e.g., she can refuse the logical consequence of a proposition she accepts because she doesn't know what the truth-values of its propositional contents; (2) when she accepts a proposition based on extensional evidence, but thinks that this evidence is insufficient to establish its logical consequences, which would require intensional evidence. It is argued that this tension is responsible for the counter-intuitive aspects of the material account of conditionals involving the negation of conditionals, hypothetical syllogism, contraposition and the inferential passage from disjunctions to conditionals (or-to-if). This tension is also behind some known puzzles involving conditionals, namely, conditional stand-offs, Adam pairs, the cheating partner example, jump-out conditionals, the problem of counterfactuals and the burglar's puzzle. It is shown that this tension is always dissolved in favour of extensional evidence, since intensional evidence is defeasible, while extensional evidence is not. Thus, it is irrational to deny the logical consequences of an accepted proposition due to its reliance on intensional evidence and ignorance of its extensional evidence.

1. TWO TYPES OF EVIDENCE

Intensional evidence involves any reasons to accept a proposition that are not the truth-values of the proposition or, if it's a complex proposition, its propositional contents. The fact that there is a known connection between red spots and measles is an intensional evidence to accept the conditional "If John has red spots, he has measles". Intensional evidence requires a defeasible reasoning that supports the proposition, but can be defeated by additional information. The presence of red spots is an indicator of measles, but is possible that you do not have measles after all. It was just a rash. Intensional evidence only suffices for the acceptability of a conditional. It is inconclusive evidence.

Extensional evidence is non-intensional evidence. Knowing that John had red spots and measles is an extensional evidence to accept the same conditional. Extensional evidence is involved in a deductively valid reasoning. The truth of both antecedent and

consequent are not only compelling, but indefeasible. It is not possible to have red spots and measles when it is not the case that if John has red spots, he has measles. Extensional evidence suffices for the truth of a conditional. It is conclusive evidence[1].

Extensional evidence does not imply classical logic. The ideas that the truth of both A and B are sufficient evidence to accept $A \rightarrow B$[2], and that A and $\neg B$ are sufficient evidence to deny $A \rightarrow B$, are assumed by most conditional logics. However, the assumption that $\neg A$ or B are sufficient evidence to accept $A \rightarrow B$ is a prerogative of classical logic alone. As we shall see further along, of the problems considered, only one about negated conditionals involves classical logic.

The distinction between intensional evidence and extensional evidence is not restricted to complex propositions, but also holds for simple propositions. That the weather forecast for tomorrow indicates heavy rain is an intensional evidence to think that there will be heavy rain on August 2, while the occurrence of heavy rain in August 2 is an extensional evidence to accept that there is heavy rain on August 2. The fact that some trustworthy individual told me that the last match was canceled is an intensional evidence to think that the last match was canceled, while the fact itself that match was canceled is an extensional evidence that the match was canceled. It is also obvious that a true statement can be used as intensional evidence for a false statement, but never an extensional evidence.

The difference between intensional and extensional evidence suggests why the first has more epistemic relevance than the later. The use of extensional evidence flies in the face of our epistemic practice, which often involves ignorance about the truth values of the propositions that are being evaluated. When we are considering whether to accept a proposition A, we do not know whether A is true or not. This requires the use of intensional evidence.

The preference for intensional evidence is even more pronounced in the case of complex propositions such as conditionals. When we decide whether to accept or not $A \rightarrow B$, we look for intensional evidence. The reasons for this are plenty. First, we are usually in an epistemic position where we do not know the truth values of its propositional constituents, i.e., we do not know the truth values A and B. Secondly, conditionals are used to express connections between things (state of affairs, facts, properties, principles, etc), and in order to determine whether these connections hold we need intensional evidence. Thirdly, there is an epistemic requirement over the inferential use of conditionals in the sense that the only way to show that the premisses of a *modus ponens* or a *modus tollens* are well confirmed without begging the question or making the argument unsound, is by appealing to intensional evidence that confirms the first premise[3]. Fourthly, the

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[1] The distinction between intensional and extensional evidence is borrowed and adapted from Stevenson (1970), who uses the distinction in a more restricted sense. According to Stevenson (1970: 31), a 'body of evidence that confirms p ⊃ q is intensional just in case it does not confirm the stronger proposition, -p, and does not confirm the stronger proposition, q', whereas extensional evidence is merely nonintensional evidence. The distinction used in this article is more comprehensive, since it is not restricted to the material conditional, but also encompass any simple or complex proposition. The related argumentation presented in this article involving other concepts associated with this distinction (e.g., defeasible and conclusive evidence; acceptability and truth conditions; criteria of truth and truth conditions) are neither advanced or endorsed by Stevenson.
[2] I will use '→' for indicative conditionals, '⊃' for the material implication and the capital letters A, B, C…. for propositional variables. The symbols and variables quoted will be modified to ensure that the notation remains uniform.
[3] Stevenson (1970: 30); Johnson (1921).

acceptance of intensional evidence for a simple proposition implies in the acceptance of extensional evidence for that proposition, but the acceptance of intensional evidence for a complex proposition does not imply the acceptance of extensional evidence for that complex proposition. If one has intensional evidence to accept A, then she will think that A is true; but if one has intensional evidence to accept $A \rightarrow B$, one can think that $A \rightarrow B$ is true without making a compromise to the truth values of A and B.

Despite the omnipresence of intensional evidence, systems of logics will invariably treat conditionals as a function of some kind. This is particularly evident with classical logic, which treats connectives as truth functions and demands omniscience of truth values in order to ascertain the validity of inferential forms. The whole system is based on the presumption of a type of evidence, the extensional kind, which is denied by our epistemic practices. It is not surprising then that a variety of puzzles and counter-intuitive examples pop up when we try to apply the basics of logic to everyday examples of conditional reasoning.

2. THE RELEVANCE OF EXTENSIONAL EVIDENCE

The possible extensional reasons to accept $A \rightarrow B$ are $A\&B$, $\neg A\&B$ and $\neg A\&\neg B$. Is it true that that these combinations of the truth values are never used to establish a conditional's truth value? Not quite. $A\&B$ is enough to accept puzzle conditionals ('I know where the prize is, but all I will tell you is that if it is not in the garden, it is in the attic'), Kennedy shooter conditionals ('If Oswald did not kill Kennedy, someone else did'), or incidental conditionals where A and B are coincidently true ('If he leaves at ten, a car accident will happen').

How about the other circumstances, when $\neg A\&B$ is true or $\neg A\&\neg B$ is true? $\neg A\&B$ can be a reason to accept even-if conditionals ('Even if he felt embarrassed, he showed no signs of it'), since they are accepted when B is assumed as true regardless of the truth value of A. $\neg A\&\neg B$ is enough to accept puzzle conditionals and sportscast play-by-play commentary conditionals ('If Messi waits just a second longer, he scores on that play')[4]. $\neg A\&\neg B$ can also be a reason to accept Dutchman conditionals ('If John's speaking the truth, I'm a Dutchman').

Grice also presented a variety of contexts where it is implicitly acknowledged that the reasons employed to assert conditionals are extensional. According to Grice, the conditional 'If Smith is in the library, he is working' would normally carry the implication that the speaker has intensional grounds to back his claim—what Grice called Indirectness Condition. But the speaker could opt out from this implication adding: 'I know just where Smith is and what he is doing, but all I will tell you is that if he is in the library he is working'. The speaker asserted this conditional because he had just looked and found him in the library, but wants to play a game with his interlocutor[5].

Grice also presented the example of a guessing game:

> You may know the kind of logical puzzle in which you are given the names of a number of persons in a room, their professions, and their current occupations, without being told directly which person belongs to which

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[4] von Fintel (2012: 467).
[5] Grice (1989: 59).

profession or is engaged in which occupation. You are then given a number of pieces of information, from which you have to assign each profession and each occupation to a named individual. Suppose that I am propounding such a puzzle … about real people whom I can see but my hearer cannot. I could perfectly properly say, at some point, "If Jones has black (pieces) then Mrs. Jones has black too." … indeed, the total content of this utterance would be just what would be asserted (according to truth-table definition) by saying "Jones has black ⊃ J Mrs. Jones has black." Thus one undertaking of the previous action has been fulfilled[6].

In this game the use of information is explicitly extensional. The hearer asserts the conditional because he knows what the truth values of the conditional's constituents are, and he wants his hearer to make an educated guess using this conditional as a piece of information. Finally, Grice ask us to consider a game of bridge with special conventions in which a bid of five no trumps is announced to one's opponents as meaning 'If I have a red king, I also have a black king'[7]. This conditional is extensional, through and through.

3. EXTENSIONAL EVIDENCE BEATS INTENSIONAL EVIDENCE

One way to deny the logical significance of intensional evidence is by observing the contrast of the defeasible character of intensional evidence with the conclusive aspect of extensional evidence. Intensional evidence is used in a defeasible reasoning that supports the proposition, but can be defeated by additional information. The presence of red spots is an indicator of measles, but it is possible that a person with red spots does not have measles after all. It is just a rash. Extensional evidence is involved in a deductively valid reasoning. It is not possible that Socrates had red spots and measles, and still be false that if Socrates has red spots, he has measles. The truth of both the antecedent and the consequent represents conclusive evidence that the conditional is true. Extensional evidence suffices for the truth of a conditional, but intensional evidence only suffices for the acceptability of a conditional, since it is not conclusive evidence.

It is also undeniable that extensional evidence always prevails over intensional evidence. Suppose that I assert about a fair

coin: 'If you flip that coin, it will come up heads'. But since the coin toss has at least 50% of resulting in tails, there is no intensional evidence to accept the conditional. Consequently, my assertion was unjustified, which induces you to promptly deny the conditional. But suppose that after this conditional was asserted, I flipped the coin and it came up heads. The result of flipping the coin provides extensional evidence that the conditional is not only acceptable, but true. Your negation was a mistake, after all. Now, imagine that the conditions were a little different, and that I knew that the coin toss was rigged to ensure that the result of the toss will be always heads. Knowing this, I assert: 'If you flip the coin, it will come up heads'. The same conditional would be acceptable in this modified circumstance, since now I have intensional evidence to accept it. But suppose that despite my excellent intensional evidence the result of the toss turn out to be tails (perhaps the rigged mechanism failed, etc.). Again, extensional evidence has the last word on the issue. What ultimately determines the truth value

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[6] Grice (1989: 60).
[7] Grice (I989: 60).

of the conditional are the truth values of its propositional constituents.

The predominance of extensional evidence over intensional evidence happens because intensional evidence can vary with time and it is based on imperfect information. But if an epistemic agent were to correct her beliefs given the opportunity, the optimal information will be always extensional, since our intensional based beliefs will ultimately be grounded in facts that determine the truth values of the relevant propositions, i.e., extensional evidence. Thus, the tension between the appeal to intensional evidence in negated conditionals and its classical logical consequences will always be resolved in favour of the later, since the intensional evidence will inevitably have to come to terms with the extensional evidence.

Notice that just as our epistemic biases may favour intensional evidence over extensional evidence, they may also favour acceptability conditions, i.e., the conditions where a proposition is acceptable or not, over truth conditions, i.e., the conditions where a proposition is true or not. The negation of a conditional does not seem to imply a conjunction if we rely only on acceptability conditions, but just as intensional evidence is not a proper substitute for extensional evidence, acceptability conditions are not a proper substitute for truth conditions. We should not confuse claims about what is acceptable or unacceptable with claims about what is objectively true or false. One proposition may be acceptable for an epistemic agent due to the intensional evidence available and yet be revealed as false; or it could be unacceptable due to lack of intensional evidence and it turn out to be true. Considerations associated with acceptability conditions cannot be a metric to determine which logic we should use because they rely on the vagaries of our epistemic constraints,

whereas truth conditions are determined by matters of fact that are independent of epistemic agents and their epistemic situation.

Similarly, it would be tempting to argue that natural language conditionals should not be interpreted as material since the truth conditions of the material conditional are unsuitable as criteria to decide whether a given conditional is true or not. In these cases, we use intensional evidence, not a calculus of the truth values of the antecedent and the consequent. But this criticism falls in the trap of confusing truth conditions with criteria of truth. Truth conditions have logical significance for they determine the conditions in which a proposition is true or false, but criteria of truth only have epistemic significance because they are standards used in contexts of imperfect information to distinguish whether a given proposition is true or false, i.e., in contexts where the only evidence available to asses the relevant proposition is intensional. The use of criteria of truth is similar to the use of intensional evidence in the sense that it is fallible, e.g., the testimony of experts is a criterion to decide whether I should believe in a proposition about a topic that is outside my area of expertise, but is a fallible guide since the experts could be wrong. Truth conditions are the circumstances that determine whether a proposition is true or false. Thus, it does not matter that the truth conditions of the material conditional are unsuitable as a criterion of truth in contexts of imperfect information and scarce extensional evidence, since truth conditions are not criteria of truth and should not be judged as such.

The epistemic bias against the material conditional is also untenable in different way. It assumes that the acceptance of a conjunction that follows from the negation of a conditional requires extensional

evidence, but it is obvious that conjunctions can be accepted on intensional grounds. I can accept the proposition "The weather tomorrow will be rainy and cold" because I trust in the weather forecast prediction that tomorrow will be rainy and cold. In this case, the evidence I used to accept the conjunction is intensional. An intensional-based conjunction will only require extensional evidence in the sense that once we accept that the conjunction is true, we also make commitments to the truth values of its conjuncts, namely, we also accept that both conjuncts are true. But that is very different from saying that a conjunction cannot be accepted on intensional grounds. This shows that the contrary intuition against the material conditional must be formulated in a different way if it wants to be taken seriously.

4. THE NEGATION OF CONDITIONALS

If indicative conditionals are material, from the negation of $\neg(A \rightarrow B)$ it follows $A\&\neg B$. This assumption faces counter-intuitive instances when someone accepts the premise due to intensional evidence, but the conclusion is a conjunction he ignores. For example, if I deny the conditional 'If God exists then the prayers of evil men will be answered' I must admit that, 'God exists and the prayers of evil men will not be answered'[8]. Thus, from the negation of a simple conditional, I can prove that God exists. This is implausible, because someone could refuse the conditional based on assumptions about the moral dispositions of God even if she does not believe in the existence of God.

Edgington[9] presented another version of the trivial proof of God's existence that relies on a different conditional: 'If God doesn't exist, then it is not the case that if I pray my prayers will be answered (by Him)'. Intuitively, this conditional is true. However, if I do not pray, the antecedent of the conditional in the consequent is false, which implies that the negation of the conditional is false. Thus, the only way to maintain the assumption that the whole conditional is true is that we must admit that the antecedent of the whole conditional is false. Therefore, we must admit that God exists.

Yet another counterexample was advanced by. Imagine a lawyer that tried to utilise the classical logic to defend his client – curiously, we can also suppose that the judge made a basic course of Logic I, just to follow the argumentation. The lawyer, admitting that his client was encountered in the crime scene, could argue that the fact that the accused was found on the crime scene is not a sufficient condition for his culpability. He could represent this affirmation by means of a conditional 'It is not the case that if the accuser was found on the crime scene, he is guilt'. It is clear that from this we could infer the surprising conclusion 'The accused was found on the crime scene and is not guilty'. However, to avoid this surprising conclusion we could not reinterpret the denied conditional as 'If the accused was found on the crime scene, he is not guilty', since that would imply that being found on the crime scene is a sufficient condition for innocence, which is not the case[10].

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[8] Stevenson (1970: 28).

[9] Edgington (1986: 16). The authorship of the counter-example is attributed to W.D. Hart (Edgington, 1986: 37, footnote 6).

[10] Klinger (1971: 191).

The root of these counter-examples result from the already mentioned tension between the material account and our common epistemic practices. The material account rests on extensional calculus, which works under an assumption of omniscience logic, i.e., that the evaluator of the conditional knows the truth-values of its propositional constituents, but in practice the evidence that is usually available when we evaluate a conditional is intensional. When we evaluate $A \rightarrow B$, we usually do not know if A and B are true or not. If I want to establish whether John wasn't late to work if he left his home late, we need to consider how the traffic was today, etc. However, our eventual ignorance about the truth-values of A and B are completely ignored by the extensional calculus. This explains why it is intuitive to think that A and $\neg B$ entails $\neg(A \rightarrow B)$, but the converse is not intuitively true: the extensional evidence is sufficient to discard the conditional, but the refusal of the conditional can be motivated by intensional evidence depending of the epistemic situation of the evaluator.

It is not surprising then that some authors may even suggest that the type of conditional negation should vary according to the epistemic state of the evaluator. Thus, it was argued that the negation of $A \rightarrow B$ should be interpreted as $A \& \neg B$ only when the evaluator is sufficiently informed or confident in the truth values of A and B. Otherwise, the negation of $A \rightarrow B$ must be a conditional negation such as $A \rightarrow \neg B$ or $A \rightarrow \Diamond \neg B$. $A \rightarrow \neg B$ should be the choice if the evaluator has enough information to believe that the possibilities described by the antecedent are enough to exclude the

consequent. If not, the conditional negation should be $A \rightarrow \Diamond \neg B$[11].

However, this suggestion and the counterexamples against conditional negation commit an *ignoratio elenchi*, since they confuse the question about which evidence can be used to support a proposition with the question about the truth conditions that constitute the truth or falsity of a conditional[12]. In other words, what interest us is knowing what makes an indicative conditional true and not how someone decides whether to believe in a conditional or not[13]. The counterexamples assume that the material account should provide the belief conditions of conditionals instead of its truth conditions[14], but we should not confuse our claims about what is unacceptable or acceptable with claims about what is true, since the first relies on the evidence available to the epistemic agent about the proposition, but the second relies on the truth-conditions of the proposition in case[15]. For the same reason, a valid argumentative form should preserve truth, not grounds for believing[16]. If conditional negation does not preserve grounds for believing, that is irrelevant from a logic point of view.

This distinction explains why Stevenson's and Edgington's arguments have the same general structure: they start with a reasoning that is intensional based, which is then mixed with extensional one in order to extract a counterintuitive conclusion. But this is a sophisticated form of cheating, since for reasons of coherence, the reasoning that motivates the counterexamples should be entirely intensional. But then we cannot provide

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[11] Egré and Politzer (2013: 11).
[12] Richards (1969).
[13] Pace Stalnaker (1968: 100).
[14] Chakraborti (2003: 168).
[15] Armstrong, Moor & Fogelin (1990: 10–14).
[16] Sinnott-Armostrong, Moor and Fogelin (1986: 300).

genuine counterexamples to classical negation relying entirely on intensional grounds. Intensional thinking will interpret examples of external negation of conditionals as examples of internal negation of conditionals, i.e., examples $\neg(A \rightarrow B)$ are best interpreted as $A \rightarrow \neg B$. However, if people tend to interpret $\neg(A \rightarrow B)$ as $A \rightarrow \neg B$, there is no real counter-example against classical negation of conditionals, since $A\&\neg B$ doesn't follow from $A \rightarrow \neg B$. The reasoner then is not denying $A \rightarrow B$, but is actually asserting a different conditional, $A \rightarrow \neg B$[17].

There are other criticisms to Edgington's argument, which is interpreted as follows: (1) If God does not exist, then it is not the case that if I pray my prayers will be answered by Him. (2) I do not pray. Therefore, God exists. First, it can be argued that the formalisation of the first premise is mistaken. (1) should actually be interpreted as (1*): $\neg E \supset (P\&\neg A)$, then if God does not exist, the speaker is committing himself to pray, but this is implausible, since the speaker, by means of (2), already discarded this possibility. Intuitively, the speaker does not pray with the objective of making (1) true in case God does not exist. If that were the case, the non-existence of God would lead to a contradiction: 'I pray and I do not pray'. The truth of 'I pray' comes from the consequent in (1*): '$P\&\neg A$', and the truth of 'I do not pray' comes directly from (2).

Moreover, (1*) is equivalent to '$(\neg P \vee A) \supset E$', but certainly the speaker does not want to say that this refuse to pray is sufficient to establish the existence of God. On the other hand, is reasonable to assume that the meaning of (1) is the following: 'If God does not exist, then if I pray my prayers will be ignored by Him'. The

formalisation then is '$\neg E \supset (P \supset I)$', which is in agreement with our intuitions: the speaker is not committed with a pray. From these premises it does not follow neither E nor $\neg E$. (1) is equivalent to '$(P\&\neg I) \supset E$' and '$(\neg E\&P) \supset U$', and both are intuitively acceptable[18].

The Klinger counter-example can also be disarmed with the observation that the consequent has a modal operator of possibility implicit in the consequent. When this modal operator is specified, the conditional is more reasonably interpreted as 'It is not the case that if the accused was found on the crime scene, he cannot be innocent'. When we interpret the conditional in this manner, we can do justice to the lawyer's argument, while we eliminate the counter-intuitive aspect of the correspondent conjunction, which should be interpreted as 'The accused was found on the crime scene and he can be innocent'. The reinterpretation of the negation of the conditional as internal will also be plausible: 'If the accused was found on the crime scene, he could be innocent'.

Perhaps another reason why classical negation can be counter-intuitive lies in the fact that it allows us to infer a conjunction from the denial of a conditional. This may seem unacceptable at first, because conjunctions are categorical assertions about facts, i.e., $A\&B$ is an assertion about A and B, while conditionals can be interpreted as mere conditional assertions, i.e., $A \rightarrow B$ is a conditional assertion of B given the assumption A. Thus, it would be intuitive to assume that the negation of $A \rightarrow B$ must be $A \rightarrow \neg B$, since the negation of a conditional would have to be a conditional itself. This reasoning, however, assumes the fallacy of confusing the negation of an assertion with the assertion of what is being negated. This

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[17] Fulda (2005: 1421); Richards (1969: 421); Lycan (2005: 91).
[18] Ortiz (2010: 2).

occurs in other cases, for instance, when we wrongly assume that the denial of a conjunction ¬(A&B) is equivalent to the conjunction with both its conjuncts denied ¬A&¬B, since both have a similar logical form. This is a mistake, since the negation of a conjunction is not a conjunction with negated conjuncts, but a disjunction with the form ¬A∨¬B. Other mistake is to think that the negation of A ∨ B is ¬A ∨ ¬B, when in fact is ¬A&¬B, or to think that the negation of 'All As are Bs' is 'All As are not Bs', when in fact is 'Some As are not Bs'[19]. The controversies about the negation of conditionals are no different. It is common to think that negation of A → B is A → ¬B, but this a mistake, since the negation of a conditional is not a conditional with a negated consequent, but the negation of a conjunction with the form ¬(A&¬B).

This is expected since it is known that many of our intuitions associated with the logical form of complex propositions are confused. For example, some recent studies in conditional reasoning indicate that people have many difficulties to understand the negation of conditionals. The negation of A → B can be interpreted not only as A&¬B and A → ¬B, but also ¬A → ¬B, ¬A&¬B, ¬A&B and even A&B[20]. Another study report differences depending on whether the conditional sentence is in the past tense, or the future tense[21]. Naturally, these intuitions about logical form may indirectly reinforce the intuitions about the use of intensional evidence, but both are unfounded.

5. A COUNTEREXAMPLE TO HYPOTHETICAL SYLLOGISM

The putative counter-instances of hypothetical syllogism also highlight the tension between intensional evidence and extensional evidence. Consider the following example:

(1) If I knock this typewriter off the desk then it will fall.

(2) If it falls then it is heavier than air.

(3) If I knock this typewriter off the desk then it is heavier than air.

(4) If the typewriter is heavier than air then an elephant is heavier than air.

(5) If I knock this typewriter off the desk then an elephant is heavier than air. From (1)-(4) hypothetical syllogism[22].

The problem in this case is that while there are intensional evidences to accept (1)-(4), the only evidence to accept (5) is extensional, i.e., the assurance that both its antecedent and consequent are true given the inference by hypothetical syllogism on previous propositions. The intuition that supports the counter-example is that while there are intensional evidence to accept the premises from (1)-(4), there are only extensional evidence to accept the conclusion, namely, the facts that both the antecedent and consequent are true. This intuition can be criticising for assuming without argument that the only evidence to accept a conditional is of the intensional kind. Once this misunderstanding is clarified, it becomes perfectly natural to accept the conclusion on extensional grounds.

[19] Rescher (2007: 51–52).
[20] Espino & Byrne (2012).
[21] Handley, Evans and Thomson (2006).
[22] Dale (1972: 439–440).

6. COUNTEREXAMPLES TO OR-TO-IF

Another example involves the inferential form $A \lor B \vDash \neg A \to B$, commonly known as Or-to-If. Now consider an instance of this inferential form in the following context: suppose that there are two balls placed in a bag, labelled as a and b. The only thing we know is that one of these balls are red, but we do not know which one. In this case, we accept that 'either a is red, or b is red', and feel entitled to infer from this that 'if a is not red, b is red'. Now suppose that the context can be modified a little bit. We know that ball a comes from a collection in which 99% of the balls are red, but we do not have any reason to think that b is red. Maybe b comes from a collection in which only 1% of the balls are red. My confidence that a is red justifies my belief that 'either a is red, or b is red', but does not justify the conclusion that 'if a is not red, b is red'[23].

It is not difficult to explain why our intuitions are different in the two contexts. In the first context, there is nothing weird about inferring the conditional from the disjunction, because the evidence to accept the two are intensional. There is no evidential tension involved because the type of evidence employed in both cases is the same. In the second context, the evidence to accept the disjunction 'either a is red, or b is red' is extensional, i.e., the assumption that a is red, but this evidence does not seem sufficient to justify the conclusion that 'if a is not red, b is red'. In other words, while extensional evidence seems sufficient to accept a disjunction, intuitively is not sufficient to accept a conditional, for it is assumed that we need intensional evidence to establish a connection between the antecedent and the consequent.

The reason why someone would be lead to this mistake is that the conditional seems to transport us to a context in which the antecedent is assumed as true. Since the extensional evidence in this case consists in the falsity of the antecedent, it is automatically discarded as irrelevant. But the assumption that conditionals cannot be justified by extensional evidence is controversial, to say the least.

This dynamic also explains why some instances of Or-to-If attract no criticism. For instance: 'Either the butler or the gardener did it. Therefore, if the butler didn't do it, the gardener did'. This example is intuitively valid because the intensional grounds that are used to accept the disjunction (facts about the crime, main suspects, etc.) are the same that are used to accept the conclusion.

This also happens when the reasons involved are extensional. Consider the following example: 'I can say to my children at some stage in a treasure hunt, The prize is either in the garden or in the attic. I know that because I know where I put it, but I m not going to tell you'. In this context is obvious to the children that the grounds for accepting the disjunction is that the speaker knows a particular disjunct to be true[24]. What is interesting is that this disjunction is intuitively equivalent to the following conditional, 'If the prize is not in the garden, is in the attic', which can be also accepted in the same situation due to extensional reasons alone.

But the reason why Or-to-If seems intuitively valid is misguided in both cases. This inferential form is indeed valid, but because it perseveres the truth of the

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[23] Edgington (1987: 55–56).
[24] Grice (1989: 44–45).

premise and not because it preserves the grounds for believing in the premise.

7. THE PROBLEM OF COUNTERFACTUALS

How can we verify a conditional with extensional evidence when the antecedent is contrary-to-fact? This once popular[25] philosophical problem is now completely ignored. The reason for this indifference is that most philosophers nowadays think that the truth conditions of counterfactuals must be explained by a non-material alternative that will dissolve the problem. Enthusiasts of extensional evidence, however, have a reason to bring this problem back into the fold. Consider the following example: suppose that my friend almost touched a live wire. I say, with a sign of relief: 'If you had touched that wire, you would get an electric shock'. How are we supposed to confirm the conditional if you did not touch the wire? The material answer is obvious: if the conditional has a false antecedent, it is vacuously true. Yet there is the intuition that this answer is too easy, since what really interest us is knowing whether she would get a electric shock in a hypothetical circumstance where she touched the wire. The extensional evidence will keep us in the dark, since it is tied to the way things actually are and not how the could be in a hypothetical circumstance.

One solution that seems perfectly suited to explain such cases is the Ramsey's test. The test states that we accept $A \rightarrow B$ if, and only if, after the hypothetical addition of A to our belief system, and after making the required adjustments to maintain consistency without modifying the hypothetical belief in A, we would be willing to accept B[26]. The example mentioned above will then be explained as follows: the conditional 'If you had touched that wire, you would get an electric shock' is acceptable if after the hypothetical addition to our belief system of a situation where she touches the wire and required adjustments of consistency, we would be willing to infer that she gets a electric shock. Otherwise we will not accept the conditional. Thus, it becomes possible to test or verify whether the consequence of the antecedent expressed by the conditional would realize in the proper circumstances by means of a hypothetical alternate.

Another way to describe the test is as follows: during the evaluation of $A \rightarrow B$, the hypothetical addition of A is viewed as an opportunity to test the relation between the hypothesis, A, and its prediction, B. If we are willing to infer B after the hypothetical addition of A, the relation between the hypothesis and the prediction is confirmed. If B turns out to be false when A is true, the relation between the hypothesis and its prediction is refuted. If A does not occur, I do not confirm nor refute the relation between the hypothesis and its prediction, since I do not have the available reasons to evaluate the conditional.

One criticism is that the notion that the Ramsey's test can provide an acceptability criterion of conditionals is that it gets things backwards. It is not that we should consider whether we would be willing to infer B after the hypothetical assumption of A to decide whether $A \rightarrow B$ is acceptable or not, but instead we would be willing to infer B after the hypothetical assumption of A *if we already accept the conditional*. The test seem plausible in the example above

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[25] Chisholm (1946), Goodman (1947), Will (1947), Watling (1957), Walters (1961), Tredwell (1965).
[26] Stalnaker (1968: 102). The original formulation can be found in Ramsey (1929: 143).

because it can be applied effortlessly to conditionals that are known to be true due to independent reasons. I know that given standard conditions, a person will get a electric shock after touching a live wire. Given those assumptions, I would be willing to infer the consequent after the hypothetical assumption of the antecedent, but only because I already decided that the conditional was true in the first place.

Now, given the lack of independent reasons to determine whether a conditional is acceptable or not, the test will be ineffective. Consider the following pair of conditionals[27]:

> If Bizet and Verdi had been compatriots, Bizet would have been Italian.

> If Bizet and Verdi had been compatriots, Verdi would have been French.

I cannot tell if Bizet would be Italian or if Verdi would be French under the hypothetical assumption that Bizet and Verdi are compatriots because the available evidence does not point in one direction or the other. The test fails.

The same pessimistic diagnostics can be extended to other theories that are heavily inspired by the Ramsey's test, such as the suppositional view and possible world theories[28]. Let's consider the suppositional view, according to which conditionals are not propositions, but acts of conditional assertion. The idea is that there is no assertion of $A \rightarrow B$, but an assertion of B given the assumption of A. The theory is powerless to guide us in the Bizet-Verdi example because we have no way of knowing whether we would assert that Bizet would be Italian or that Verdi would be

French given the assumption that Bizet and Verdi are compatriots. The same criticism applies to possible world theories, according to which $A \rightarrow B$ is true iff the closest A-world is a B-world[29]. There is no way of knowing whether Bizet would be Italian or Verdi would be French in the closest world where Bizet and Verdi are compatriots.

Thus, it seems that the alternatives do not represent such an improvement over the material account. Besides, they are motivated by a wrong expectations about the role of logic. The task of a conditional logic is to provide the truth conditions of the conditional and not the counterfactual circumstances where we could test whether the consequent would follow from the antecedent's truth. To insist that extensional evidence is not enough is to assume that logic should provide answers to matters of fact that are completely irrelevant from a logic point of view. Intensional evidence is a purely epistemic phenomenon related to a cognitive agent particular beliefs and should have no bearings on logical matters.

One of the main reasons that lead us to the prevailing idea that subjunctives are not material is that the vast majority of subjunctive conditionals are asserted under the assumption that their antecedents are false. If they were all material, it would follow that the vast majority of subjunctive conditionals are vacuously true. But this line of reasoning can be questioned using the same line of reasoning that material account theorists already employ regarding indicative conditionals with false antecedents. A large number of indicative conditionals have false antecedents, but any material account proponent would admit that: (1) most indicative conditionals are

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[27] Quine (1982: 23).
[28] Stalnaker is pretty clear on this: 'The concept of a possible world is just what we need to make this transition [from belief conditions of the Ramsey's test to the truth conditions of a semantics], since a possible world is the ontological analogue of a stock of hypothetical beliefs' (Stalnaker, 1968: 102).
[29] Or iff all the closest A-worlds are B-worlds, if you choose Lewis over Stalnaker.

vacuously true, (2) their counter-intuitive aspects can be explained away by pragmatic means, and (3) the fact that they are in large numbers is irrelevant to the question. If these answers can be plausible in this case, they will also be plausible if most subjunctive conditionals are vacuously true. The fact that there are even more vacuously true subjunctives than vacuously true indicatives does not affect the strength of the argument.

8. THE CHEATING PARTNER EXAMPLE

It is intuitive to think that $A \rightarrow B$ is acceptable when $A \supset B$ is robust with respect to A, i.e., when $\Pr(A \supset B)$ is high and would remain high after learning that A[30]. This implies that $A \rightarrow B$ is acceptable when it is employable on a *modus ponens* inference. This assumption faces the following counter-example: Suppose I'm certain that I would never know that my wife is deceiving me; she is too smart to get caught. However, because I trust her, I don't believe she is deceiving me. In this case, the conditional probability that I don't know that she is deceiving me given that she is deceiving me is high. Nevertheless, I would not infer that I don't know that she is deceiving me given that I found out that she is deceiving me (Van Fraassen, 1980: 503). In this case, the conditional 'If my wife is deceiving him, I would never know' is acceptable, but it is not employable on a *modus ponens*.

Bennett attempts to explain this counter-example by arguing that the speaker will not be willing to employ the conditional in a *modus ponens* but believes that any other person that accepts the conditional would be willing to employ it on a *modus ponens*[31]. But this explanation is *ad hoc* and only clouds the issue.

What happens is that conditionals with the form 'If A, I will never know A' can never be employed in a *modus ponens* by the speakers who are asserting them. The reason is that to employ this conditional on a *modus ponens* would require extensional evidence that falsifies the conditional. It was the intensional evidence that lead the speaker to accept the conditional, but the conditional can only be employed in a *modus ponens* due to the admission of falsifying extensional evidence.

9. ADAM PAIRS

The Apartheid thesis states that indicative and subjunctive conditionals have different truth conditions. One of the main arguments that have been presented to support this thesis are the Adam pairs. Consider the following pair of conditionals:

(1) If Oswald did not kill Kennedy, someone else did.

(2) If Oswald had not killed Kennedy, someone else would have.

Intuitively, these conditionals have different truth conditions. After all, in order to accept

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[30] Jackson (1987: 28).
[31] Bennett (2003: 55).

(1) is enough to know that Kennedy was killed by someone, but to accept (2) is necessary to assume a conspiracy theory regarding its murder[32].

The intuitive discrepancy between the Adam pairs is due to a discrepancy in supposedly available intensional evidence for each conditional. The intensional evidence that someone killed Kennedy and Oswald is the main suspect is enough to accept (1), but it is not sufficient to accept (2). This happens because the assertion of (2) suggests to its grammatical form that the speaker is already committed with the extensional evidence that Oswald is the killer and, thus, would require the stronger intensional evidence that someone would had killed Kennedy if necessary.

Against this reasoning it could be argued that the evidence that supports (1) not only is not intensional, but also entails both (1) and (2). The fact that Kennedy was killed by someone appears to be intensional evidence, while in fact is an extensional evidence. The conditional 'If Oswald did not kill Kennedy, someone else did' depends on whether Kennedy was killed, and thus on whether Kennedy was killed by someone. If the logical form of the proposition 'Someone killed Kennedy' is represented as

$(\exists x)Fx$, the logical form of the proposition 'Oswald did not kill Kennedy' can be represented as $\neg Fa$. If we apply the existential instantiation rule to the first propositional form, we have Fb, and this together with $\neg Fa$ give us $(a \neq b)$ by indiscernibility of identicals. The conjunction then gives us $Fb \& (a \neq b)$ and by applying the existential generalisation we have $(\exists x)Fx \& (a \neq x)$, which is the logical form of the consequent of the conditional. Thus, the conditional is entailed by its consequent. Now suppose that the antecedent of the conditional is false. Thus, it is true that Oswald killed Kennedy, and, therefore, that someone killed Kennedy. Therefore, the conditional will again be true[33].

The next step is to show that (1) and (2) are entailed by the same evidence. Since (1) is entailed by $(\exists x)Fx \& (a \neq x)$, (2) is also entailed by it because it has the same logical form, namely, $\neg Fa \rightarrow (\exists x)Fx \& (a \neq x)$. If things seem different is probably due to our linguistic habits of interpreting subjunctive conditionals as being asserted under the assumption that the antecedent is false, but these habits should have no bearings in logical matters.

10. CONDITIONAL STAND-OFFS

Conditionals stand-off are another particular instance of the tension between intensional and extensional evidence. In very loose terms, stand offs occur when one individual has grounds to accept '$A \rightarrow B$', while another has equally compelling grounds to accept what seems to be the opposite

conditional, '$A \rightarrow \neg B$'. If conditionals have truth conditions, '$A \rightarrow B$' and '$A \rightarrow \neg B$' cannot both be true, because they seem contradictory. The reasoning then is that in order for one of the conditionals to be false, someone would have to make a mistake about the facts of the case. However, both

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[32] Lewis (1973: 3). This example is a modification of the original example presented by Adams (1970: 90). Hence the name 'Adam pairs'.

[33] Mellor (1993: 238–239). In fact, it could be said that the premise 'Someone killed Kennedy' not only entails, but is logically equivalent to the conclusion, 'If Oswald did not kill Kennedy, someone else did'; since there are no circumstances in which the conditional is true and the negation of the premise, namely, 'No one killed Kennedy', is true (Lowe, 1979: 139–140). See also Johnston (1996: 99–100).

individuals have perfect good reasons to accept each conditional. If none of them is making a mistake, none of them is saying something false. Therefore, conditionals have no truth conditions. This puzzle is evidenced in the following example[34]:

> Sly Pete and Mr. Stone are playing poker on a Mississippi riverboat. It is now up to Pete to call or fold. My henchman Zack sees Stone's hand, which is quite good, and signals its content to Pete. My henchman Jack sees both hands, and sees that Pete's hand is rather low, so that Stone's is the winning hand. At this point, the room is cleared. (…) Zack knows that Pete knew Stone's hand. He can thus appropriately assert "If Pete called, he won." Jack knows that Pete held the losing hand, and thus can appropriately assert "If Pete called, he lost." From this, we can see that neither is asserting anything false.

There is a caveat with this example though. It is arguable that the example is not really symmetric because Jack has better reasons to justify his belief than Zack. This lead to attempts to offer new stand off examples which ensured perfect symmetry[35]:

> In a game, (1) all red square cards are worth 10 points, and (2) all large square cards are worth nothing. X caught a glimpse as Z picked a card and saw that it was red. Knowing (1), he believes "If Z picked a square card, it's worth 10 points". Y, seeing it bulging under Z's jacket, where Z is keeping it out of view, knows it's large. Knowing (2), he believes "If Z picked a square card, it's worth nothing".

What we are supposed to make of this example? What justifies X's and Y's beliefs is the available intensional evidence, which is inconclusive and heavily dependent on their particular epistemic situations. But is the extensional evidence determined by the facts of the case, namely whether Z picked a square card that is worth 10 points or not. That is what will ultimately set the issue and determine whether each conditional is true or not. Once the truth-values kick in, the symmetry disappears. It is a non-issue. These conditionals are objectively false or objectively true, and their truth values are determined by asymmetrical facts.

11. THE BURGLAR'S PUZZLE

Consider the following sentences:

(1) If Alf was the burglar, we'll find his fingerprints in the room.

(2) If Sid was the mastermind, we won't find any fingerprints in the room.

Someone could accept both (1) and (2) without knowing (3):

(3) Alf was the robber but Sid was the mastermind.

Thus, it would be improper for that person to deny the conjunction of the antecedents since she doesn't whether (3) is false or not. However, the denial of (3) is entailed by the simultaneous acceptance of (1)-(2), for it is the truth that Alf was the robber and Sid was the mastermind, it follows that we'll find Alf fingerprints in the room and we won't find any fingerprints in the room. What is the problem here?[36]

A detective could endorse both (1) and (2) because she is not working with the

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[34] Gibbard (1981: 226–32).
[35] Edgington (1995: 294).
[36] Ramachadran (2016: 29).

truth-values of the antecedent and the consequent, but with the intensional evidence associated with the behaviour of Alf and Sid. That's why she can ignore (3), because she is not making any inferences based on the antecedents yet. However, once the truth-values are settled, for instance, Sid confessed being the mastermind, she will have to conclude that there aren't any fingerprints in the room, thus abandoning (3) and the antecedent of (1).

This puzzle results from a tension between our use of intensional evidence and the actual truth-values of the components that have logical significance. When you are dealing with evidence, you are ignoring attribution of truth-values for the most part. It doesn't mean that you are actually entitled to maintain this attitude once the truth-values are revealed. (1) and (2) are co-tenable when you are considering the evidence to accept the connection between the antecedent and the consequent of each conditional, but are not co-tenable if the antecedent of one of them turns out to be true. You have evidence to think that if the antecedent of each pair is true, the consequent will be true, but you don't have evidence to accept the antecedent of each conditional when you initially accept both.

We could say that there are two levels of evidentially. The first involves the acceptance of a conditional based on intensional reasons that there is a connection between the antecedent and consequent. The second involves the actual truth-values, or a mix of truth-values and intensional evidence, e.g., if you that the antecedent is true and have good reasons to accept that there is a connection between antecedent and consequent, you must accept one of the conditionals and drop the other. What matters is the truth-values of the antecedent and the consequent and not the intensional evidence. The second level of evidentiality always trumps over the first.

12. THE OPT-OUT PROPERTY

Bennett argues that indicative conditionals have what he calls 'the confidence property': if $A \rightarrow B$ is accepted given the *ceteris paribus* conditions, learning that A would lead one to infer B[37]. However, he believes that this property is lacking in most subjunctive conditionals. He presents the following example to illustrate this phenomenon:

> In 1970 I went to the University of British Columbia, where I worked for nine years; I am sure that if I had not gone to UBC I would have left Canada. However, I am not even slightly disposed to infer, upon learning that I did not go to UBC, that I left Canada. On the contrary, if "I did not go to UBC" is added to my belief system with its multitude of seeming memories of life there, the resulting system implies that I have gone mad and cannot tell what I did in 1970[38].

The conditional 'If I had not gone to UBC I would have left Canada' has what he calls 'the Opt-out Property'. It can be accepted by someone who assumes that the antecedent is false, but would be dropped in the minute he learns its antecedent's truth. The speaker would opt out of the conditional. This implies that if a conditional has the Confidence Property, it doesn't have the Opt-out Property.

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[37] Bennett (1995: 340).
[38] Bennett (1995: 340).

One problem with this explanation is that subjunctive conditionals are sometimes asserted precisely because the speaker wants to reinforce his belief in the truth of the antecedent, e.g., 'I think she took arsenic; for she has symptoms X, Y, and Z, and these are just the symptoms she would have if she had taken arsenic'[39]. Bennett see no problem in admitting that a conditional with the Opt-out Property may be accepted by someone who believes in its antecedent and obsess that 'I am not denying that. I say merely that a conditional which has the Property can be comfortably accepted by someone who is entirely confident that the antecedent is false; that is an aspect of the meaning of such a conditional'[40]. But this answer is unsatisfactory. If subjunctives had an Opt-out property that is characteristic of their meaning, they couldn't be turned off wherever the speaker sees fit.

The reasons that lead Bennet to accept the conditional includes abundant evidence about what is actually the case, including the extensional evidence that he went to UBC, and intensional evidence about what would be the case if his choices were different in the past. To realise that the antecedent is actually false would undermine extensional evidence that lead him to accept the conditional in the first place. It would be an incoherence.

There is also something to be said about the relationship between evidence and inferential employability, namely, that our inferential dispositions are determined by the evidence that lead us to accept the conditional. For example, some conditionals are accepted only when we are willing to employ the conditional in a *modus tollens* inference, instead of a *modus ponens*. When I accept 'If John's speaking the truth, I'm a Dutchman', I am not willing to infer that I am a Dutchman if it turns out that John was telling the truth: the conditional was asserted under the assumption that the antecedent is false. Or considered the already mentioned cheating partner example. When I accept the conditional 'If my wife is deceiving me, I will never know', I am not willing to infer that I will never know that she is deceiving me if I found out that she is deceiving me after all.

13. CONCLUDING REMARKS

The truth conditions of connectives in classical logic is simplified and striped of all psychological and epistemic factors, which includes the role of intensional evidence and epistemic states of imperfect information. But it is precisely this simplification that generated many of its counter-intuitive aspects. It is appealing to think that the material conditional is not an adequate representation of the logical properties of conditionals in natural language, if we assume that its logical properties must include our epistemic practices.

But those contrary intuitions have a epistemic bent and should be criticised for that. Logic is about the truth-conditions of propositions, which are determined by the metaphysical substrate that is responsible for the truth-values of its propositional components. This substrate, and therefore their truth-values of its propositional components, are largely independent of epistemic agents, their epistemic situation,

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[39] Anderson (1951: 37).
[40] Bennett (1995: 341).

degrees of confidence, etc. Belief conditions, intensional evidence and preservation of grounds for believing are epistemic phenomena that are affected by the epistemic agent's ignorance. Truth preservation is a semantic phenomenon, which is independent of the epistemic agent ignorance. Semantics always trumps epistemic ignorance. If intensional evidence and grounds for believing preservation clashes against extensional evidence and truth preservation, so much the worse for the first.

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