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

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Matheus Silva

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, is not the truth values of its propositional contents. Extensional evidence is non-intensional evidence. Someone can accept a complex proposition, but deny its logical consequences 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 are the truth-values of its propositional contents. This tension motivates counterexamples to the negation of conditionals, the propositional analysis of conditionals, hypothetical syllogism, or-to-if and contraposition. It is argued that these counterexamples are non-starters because they rely on a mix of intensionally based premises and extensionally based conclusions. Instead, a genuine counterexample to classical argumentative forms should present circumstances where an intuitively true and extensionally based premise leads to an intuitively false conclusion that is also extensionally based. The other point is that extensional evidence always have the last word in evidentiary concerns, either because is based on optimal information or because the truth conditions presented by classical logic are requirements of coherence in truth value distributions. So, if intensionally based beliefs are incompatible with classical logic, they are ultimately incomplete or incoherent and need to be revised. These considerations allow us to dissolve some known conditional puzzles such as conditional stand-offs, Adams pairs, the opt-out property, and the burglar's puzzle.

1. INTRODUCTION

According to the material account of conditionals, a conditional $A \rightarrow B$ is true if, and only if, $\neg(A\&\neg B)$. So from $\neg(A \rightarrow B)$ it follows that $A\&\neg B$. Thus, from the negation of 'If God exists then the prayers of evil men will be answered', it follows that 'God exists and the prayers of evil men will not be answered' (Stevenson, 1970: 28). It will be argued that this and other strange puzzles involving conditionals can be explained as the result of a tension between the use of extensional and intensional evidence. 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, is not the truth values of its propositional contents. Extensional evidence is non-intensional evidence. Someone can accept a complex proposition, but deny its logical consequences 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 are the truth-values of its propositional contents.

The article will be divided as follows. Section 2 introduces and attempts to clarify the distinction between intensional and extensional evidence. Section 3 argues that despite intensional evidence being more salient than extensional evidence in our daily epistemic concerns, it must always come to terms with extensional evidence in logical matters. Some exceptional contexts where extensional evidence is preferred are also discussed. Sections 4-6 employ the distinction between intensional and extensional evidence to disarm counter-examples against the classical negation of conditionals, the propositional analysis of conditions, hypothetical syllogism, or-to-if and contraposition. It is argued that counterexamples are non-starters because they rely on premises that are intensionally based. In order for the counterexamples against classic logic to be successful, they need to present a circumstance where a premise that is intuitively true on extensional grounds leads to a conclusion that is apparently false on extensional grounds. The other point is that extensional evidence always have the last word in evidentiary concerns, either because is based on optimal information or because the truth conditions presented by classical logic are requirements of coherence in truth value distributions. So, if our intensionally based beliefs are incompatible with the possible combinations of truth values presented by classical logic, they are ultimately incomplete or incoherent and need to be revised. These considerations are also applied in sections 7-10, which are dedicated to the following conditional puzzles: the opt-out property, Adams pairs, conditional stand-offs and the burglar's puzzle. Section 11 concludes.

2. 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 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.

[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.

The distinction between intensional 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 cancelled is an intensional evidence to think that the last match was cancelled, while the fact itself that match was cancelled is an extensional evidence that the match was cancelled. It is also obvious that a true statement can be used as an intensional evidence for a false statement, but never an extensional evidence. In a sense, any intensional evidence that happens to be a true proposition is also an extensional evidence of itself.

The difference between intensional and extensional evidence suggests why the first has more epistemic relevance than the latter. 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 acceptance of intensional evidence for a simple proposition implies in the acceptance of extensional evidence for that proposition, but usually the acceptance of intensional evidence for a complex proposition does not imply the acceptance of extensional evidence for the propositional contents of 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 this proposition is true without making a compromise to the individual 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.

3. EXTENSIONAL EVIDENCE HAS THE LAST WORD IN EVIDENTIARY CONCERNS

It is arguable that extensional evidence always prevails over intensional evidence in logical matters, but we tend to nurture the opposite view because intensional evidence is more pertinent in our daily epistemic concerns. Let's consider first the relevance of extensional evidence. The possible extensional reasons to accept $A \rightarrow B$ are $A\&B$, $\neg A\&B$ and $\neg A\&\neg B$. But

[3] See Johnson (1921) and Stevenson (1970: 30).

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 ¬*A*&*B* is true or ¬*A*&¬*B* is true? ¬*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*. ¬*A*&¬*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]. ¬*A*&¬*B* can also be a reason to accept Dutchman conditionals ('If John's speaking the truth, I'm a Dutchman').

Grice also presented three examples of contexts where it is plausible to suggest that the reasons employed to assert conditionals are extensional. According to Grice (1989a: 59), 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.

Grice (1989a: 60) 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 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.

In this game the use of information is explicitly extensional. The hearer asserts the conditional because he knows what the truth values of the conditionals constituents are, and he wants his hearer to make an educated guess using this conditional as a piece of information. Finally, Grice (1989a: 60) 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'. This conditional is extensional, through and through.

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,

[4] von Fintel (2012: 467).

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 turns 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 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 on facts that determine the truth values of the relevant propositions, i.e., extensional evidence. Thus, the tension between intensional and extensional evidence will always be resolved in favour of the latter, 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.

The truth conditions presented by classical logic are requirements of coherence in truth value distributions. Let's discuss the negation of conditionals. $A \rightarrow B$ is true if, and only if, it is not the case that A is true and B is false, i.e., $\neg(A\&\neg B)$. So the denial of this claim is that A is true or B is false, that is, $A\&\neg B$. So the denial of a conditional in this extensional sense that avoids commitments about the truth values of its propositional constituents is incoherent. Naturally, one might object that is precisely this extensional sense that is being questioned by the counterexamples that are intensionally based.

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But this criticism misses the target: classical logic only shows what are the conclusions that follow from extensionally based premises because is in the business of tracking argumentative forms that are truth preserving. In order to identify these patterns, the propositional constituents of a complex proposition and their possible combinations of truth values must be laid out. Intensionally based beliefs that ignore these values don't factor in it, because they are assumed in a context of imperfect information. If the reasoner makes a statement that is intensionally based, but refuses its logical conclusions, she is either logically uneducated or confused about the nature of her statement.

4. THE NEGATION OF CONDITIONALS

If indicative conditionals are material, from $\neg(A \rightarrow B)$ 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' (Stevenson, 1970: 28). 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 (1986: 16)[5] 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 Klinger (1971: 191). 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 he 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.

The root of these counter-examples results from a tension between the use of extensional evidence 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. Usually, when we evaluate a conditional, $A \rightarrow B$, we 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

[5] The counter-example is attributed to W.D. Hart (Edgington, 1986: 37, footnote 6).

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.

The counterexamples have the same structure: they interpret a premise on intensional grounds (e.g., the negation of a conditional), which force on us a conclusion on extensional grounds (e.g., a conjunction). That seems too strong because one could accept the premise without making the extensional commitments of the conclusion. But it can objected that the negation of conditionals assumes that the premise is extensionally based, i.e., that given the acceptance of $\neg(A \rightarrow B)$ *on extensional grounds*, it follows the acceptance of $A\& \neg B$ *on extensional grounds*. So the counterexamples are non-starters, since they rely on premises that are intensionally based. In order for the counterexamples against classic logic to be successful, they need to present a possible circumstance where the premise of a valid argumentative form is extensionally based, but the conclusion seems false even on extensional grounds. Classical logic deals with extensional grounds and their possible combinations. So a valid argument form preserves not only truth, but also grounds for believing[6]. The only difference is that they preserve extensional grounds for believing.

This line of thinking is not circular because evidentiary concerns should ultimately be constrained by the truth conditions of propositions. In other words, how someone decides whether to believe or not in a proposition cannot be incompatible with what makes an proposition true or false. Intensional evidence 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 assess the relevant proposition is intensional. But truth conditions have logical significance for they determine the conditions in which a proposition is true or false in contexts of truth value omniscience. Whatever are our reasons to think that a proposition is true or false cannot violate the circumstances that determine whether a proposition is true or false. Our evidentiary concerns should adhere to the constraints of truth value combinations presented by classical logic, and not the other way around.

In a sense, even if the negation of a conditional $A \rightarrow B$ is intensionally based, the additional fact that classical logic ensures us that $A\&\neg B$ cannot be false when $\neg(A \rightarrow B)$ is true is in itself *an additional intensional evidence* to accept that $A\&\neg B$ is true, even if the acceptance of $\neg(A \rightarrow B)$ did not involve any prior knowledge about the truth values of A and B. This should not be surprising since conjunctions, like any other proposition, can also 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. The same holds for the negation of a conditional. Now that I know what are the consequences of negating a conditional from a logical point of view, I also know what is the extensional evidence available for this proposition.

If the truth value combinations of cannot be satisfied in the conclusion is because there is an incoherence in the interpretation of the premise. Thus, what appears to be a negation of a conditional in Stevenson's counterexample, 'If God exists then the prayers of evil men will be answered', is actually another conditional with a negated consequent, 'If God exists then the prayers of evil men will not be answered'[7]. The consequent of the conditional presented by

[6] Pace Sinnott-Armstrong et al. (1986: 300).
[7] See, for example, Richards (1969: 421), Fulda (2005: 1421), and Lycan (2005: 91).

Edgington can also be explained in a similar fashion. The premise 'If God doesn't exist, then it is not the case that if I pray my prayers will be answered (by Him)' can also be reinterpreted as 'If God does not exist, then if I pray my prayers will be ignored by Him' (Ortiz, 2010: 2), which is acceptable. Finally, 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'.

So, the requirement is that if our intensionally based beliefs are incompatible with the possible combinations of truth values presented by classical logic, they are ultimately incoherent and need to be revised in order to prevent this incoherence.

5. THE PROPOSITIONAL ANALYSIS OF CONDITIONS

Akman (2017) argued that our logic textbooks should be burned, since they present a propositional analysis of necessary and sufficient conditions that leads to a contradiction. The propositional analysis of necessary and sufficient conditions that is used in most logic textbooks translates the proposition 'A is sufficient for B 'as a conditional 'if A, then B', which is represented symbolically as the material conditional, $A \supset B$. The proposition expressed by 'A is necessary for B' is then interpreted as 'if not A, then not B', which can be symbolised as $\neg A \supset \neg B$, which on its turn is equivalent to $B \supset A$. These two assumptions imply that the proposition 'A is necessary and sufficient for B' could be represented symbolically as $(B \supset A)\&(A \supset B)$. Now, suppose that one asserts 'A is neither necessary nor sufficient for B'. According to Akman, this proposition amounts to the acceptance of both 'A is not necessary for B' and 'A is not sufficient for B', which according to the propositional analysis is equivalent to $\neg(B \supset A)\&\neg(A \supset B)$. This proposition is a contradiction in classical logic, but since it is obvious that one could deny that A is either necessary or sufficient for B without implying a contradiction, the propositional analysis of conditions is surely false (Akman, 2017: 378) .

This argument has a flaw. It assumes that the proposition 'A is neither necessary nor sufficient for B' should be represented symbolically as $\neg(B \supset A)\&\neg(A \supset B)$. That this interpretation is incorrect becomes clear once we consider that 'A is neither necessary nor sufficient for B' is the negation of 'A is necessary and sufficient for B', which is represented symbolically as $(B \supset A)\&(A \supset B)$. But the negation of this proposition is not $\neg(B \supset A)\&\neg(A \supset B)$, but $\neg(B \supset A) \vee \neg(A \supset B)$, and this is not a contradiction in classical logic. Of course, we can still infer a contradiction from the propositional analysis in a slightly different way. Let us suppose that both propositions 'A is not a necessary condition for B' and 'A is not a sufficient condition for B' are accepted by the same person. Their joint acceptance is represented symbolically as $\neg(B \supset A)\&\neg(A \supset B)$, which again is a contradiction in classical logic.

This surprising result is a consequence of the truth conditions of the material conditional. The negation of $A \supset B$ is logically equivalent to $A\&\neg B$, while the negation of $B \supset A$ is logically equivalent to $B\&\neg A$. The joint acceptance of $A\&\neg B$ and $B\&\neg A$ is obviously a contradiction, since it is tantamount to accept both $A\&\neg A$ and $B\&\neg B$. However, it seems obvious that one can accept that A is neither a necessary nor a sufficient condition for B without a contradiction. This theoretical shock happens because the negation of the material conditional forces the denier to accept that the antecedent is true and the consequent is false, but intuitively we can deny a natural language conditional without making commitments to the truth values of its antecedent and consequent.

Akman neglects this counter-intuitive aspect of the material conditional. Instead, he attempts to prevent the contradiction by adopting a first-order analysis where conditions are interpreted as one-place predicates. In his favoured solution, a statement such as 'A is a sufficient condition for B' should be interpreted as 'everything that possesses the property A possess the property B', which is then represented symbolically as $\forall x(Ax \supset Bx)$. The statement 'A is a necessary condition for B' should be interpreted as 'nothing possesses the property B if it does not possess the property A', which is represented symbolically as $\forall x(Bx \supset Ax)$. The idea is that this would prevent the generation of a contradiction since the negation of both claims will be logically equivalent to $\neg(\forall x(Ax \supset Bx) \text{ v } \forall x(Bx \supset Ax))$, which is not a contradiction in classical logic (Akman, 2017: 379).

This first-order analysis of conditions is a move in the right direction. It provides a more fine-grained analysis of conditions with an elegant use of predicate logic. It clarifies our intuitions by interpreting conditions as properties, and explaining the sufficiency and necessity in conditionality statements as inference relations. However, Akman's use of predicate logic does not accurately represent most attributions of conditions. Akman assumes that every conditionality statement involves the use of universal quantifiers, but most attributions of conditions do not work that way. Suppose that I assert 'Socrates being a philosopher is a sufficient condition for Socrates being Greek'. Following Akman's solution, this statement must then be interpreted as 'Everything that possesses the property of being philosopher, possesses the property of being Greek', but this interpretation is too strong, for it seems obvious that I was making an attribution of condition that is specific to Socrates. In a more sensible formulation of the first-order analysis, this statement should be interpreted as 'If Socrates possesses the property of being philosopher, he possesses the property of being Greek', which must be represented without a universal quantifier, i.e., as $Aa \supset Ba$.

This qualification is also important because it shows that the first-order analysis also makes use of the negation of the material conditional and thus it is still unsuccessful in its attempt to prevent contradictions. Suppose that I claim both 'Socrates being a philosopher is not a sufficient condition for being Greek 'and 'Socrates being a philosopher is not a necessary condition for being Greek'. Taken together these statements will be equivalent to $\neg(Aa \supset Ba) \supset \neg(Ba \supset Aa)$, and thus leading us to $(Aa\&\neg Ba)\&(Ba\&\neg Aa)$, which is a contradiction.

This is not a surprise. If we consider the way in which conditionals and conditionality statements are related, it becomes obvious that it was not the propositional analysis, but the truth conditions of negated material conditionals that was responsible for the contradiction. First, let us consider the way in which conditionals and conditionality are connected. Suppose that $A \supset B$ is true; given the truth conditions of the material conditional, it follows that if A is true, B must be true. In other words, A must be a sufficient condition for B. Now, suppose that $B \supset A$ is true; given the truth conditions of the material conditional, it follows that if A is false, B must be false, i.e., A is a necessary condition of B. Now, let the natural language conditional be represented as $A \rightarrow B$. If we replace the material conditional for the natural language conditional, we can still maintain the rationale that motivates the propositional analysis of conditions. For if $A \rightarrow B$ is true, it follows that if A is true, B must be true, i.e., that A is a sufficient condition for B, while if $B \rightarrow A$ is true, it follows that if A is false, B must be false, i.e., that A is a necessary condition for B. If we employ this natural language conditional in our propositional analysis of conditions, the propositions 'A is not a sufficient condition for B' and 'A is not a necessary condition for B' should be interpreted as $\neg(A \rightarrow B)$ and $\neg(B \rightarrow A)$, respectively, which on its turn implies $A \rightarrow \neg B$ and $B \rightarrow \neg A$. But notice that their conjunction does not generate a contradiction. If we employ $A \rightarrow \neg B$ on a *modus ponens,* we can infer $\neg B$ from A, but then $B \rightarrow \neg A$ will only allows us to infer $\neg B$ from A by *modus tollens*. On the other hand, if we employ $B \rightarrow \neg A$ on a *modus ponens*, we can infer $\neg A$ from B, but then we only employ $A \rightarrow \neg B$ on a *modus tollens* and infer $\neg A$ from B. But there is no circumstance where we can infer both A and $\neg A$ or B and $\neg B$. The same reasoning holds for the first-order analysis, the only difference being that instead of interpreting $A \rightarrow \neg B$ as the consequence of $\neg(A \rightarrow B)$, and $B \rightarrow \neg A$ as the consequence of $\neg(B \rightarrow A)$, we interpret $Aa \rightarrow \neg Ba$ as the consequence of $\neg(Aa \rightarrow Ba)$, and $Ba \rightarrow \neg Aa$ as the consequence of $\neg(Ba \rightarrow Aa)$.

This conclusion is counterintuitive since the acceptance of $\neg(A \rightarrow B)$ on intensional grounds does not seem to provide intensional grounds to accept $A \& \neg B$. But as we saw in the discussion about the negation of conditionals, this disagreement does not represent a genuine counterexample. Thus, strange as it seems, to accept that any given proposition A is neither necessary nor sufficient for *B is* to accept a contradiction. If we think any different is because we are accustomed to epistemic constraints that favour intensional evidence, acceptability conditions and criteria of truth. We are biased by our epistemic practices. In this sense, classical logic is no different of many scientific findings of physics and biology that also conflict with our feelings 'of what reality *ought to be*'. What should this bother us? This is just business as usual. Let us keep our textbooks safe from the bonfire.

6. HYPOTHETICAL SYLLOGISM, OR-TO-IF AND CONTRAPOSITION

The putative counter-instances of hypothetical syllogism also highlight the tension between intensional evidence and extensional evidence. Consider the following counterexample advanced by Dale (1972: 439–440):

(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.

The problem in this case is that while there are intensional evidence 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 from previous propositions. This intuition can be criticised 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. In this case, the acceptance of previous premisses leads to further commitments of truth values, whether we are aware of this or not. Besides, hypothetical syllogism can only be refuted by an example where the premises are accepted on extensional grounds, but the conclusion is unacceptable on extensional grounds.

Next we have the inferential form $A \vee B \vDash \neg A \rightarrow B$, commonly known as or-to-if. Now imagine a context where 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'. The context can be modified a little bit so that 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’ (Edgington, 1987: 55–56).

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 two are accepted on intensional grounds. There is no evidentiary 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 (Grice, 1989b: 44–45) . 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.

The reason why or-to-if seems valid in both cases is that it preserves the grounds for believing in the premise. That is precisely the reason why or-to-if seems invalid in the counterexample: the premise is accepted on intensional grounds, but not the conclusion. However, or-to-if is nothing more than a requirement of coherence in distribution of truth values. Or, to put in other words, that given the acceptance of the premise on extensional grounds, it follows a certain conclusion on extensional grounds. So the fact that is implausible to think that an intensionally based premise leads to an extensionally based conclusion is not a problem for the material account.

Finally, let’s consider contraposition: $A \rightarrow B \vDash \neg B \rightarrow \neg A$. Suppose that the following inference is uttered while one waits for the judges’ decision: ‘Well, if he didn’t win, he certainly tried his hardest. Therefore, if he didn’t try his hardest, he won.’ According to Skyrms (1978, p. 178), one could accept the premise, but reject the conclusion. The reason is that the premise, but not the conclusion, can be acceptable on intensional grounds. But what should we conclude if the premise and the conclusion were evaluated from an extensional lens? The premise ‘if he didn’t win, he certainly tried his hardest’ is accepted given the background fact that its consequent is true, even though the truth value of the antecedent is still open to debate. However, the conclusion seems false if it is evaluated in a circumstance where the antecedent is true, i.e., in which he didn’t try his hardest, which most likely would ensure that he wouldn’t win. But this alters the background facts assumed in the premise, which depends on the condition that he tried his hardest. So, there are no coherent distributions of truth values where the premise is true and the conclusion is false. Contraposition preserves extensional grounds for believing in the premise and that's all that matters.

7. THE OPT-OUT PROPERTY

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 (Jackson, 1987: 28). 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 (2003: 55) 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*. 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.

This resistance to the robustness requirement and employability on *modus ponens* is what Bennett (1995: 340) described as 'the Opt-out Property'. He believes that most subjunctive conditionals have this property. 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.

The conditional 'If I had not gone to UBC I would have left Canada' 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 satisfies the robustness requirement, it doesn't have the Opt-out Property.

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' (Anderson, 1951: 37). Bennett sees 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'

(Bennett, 1995: 341). 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 led 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 led 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.

8. ADAMS 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 so called Adams 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 (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 (Lewis, 1973: 3)[8].

The intuitive discrepancy between the Adams 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 by 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

[8] This example is a modification of the original example presented by Adams (1970: 90). Hence the name 'Adams pairs'.

instantiation rule to the first propositional form, we have Fb, and this together with ¬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 (∃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[9].

The next step is to show that (1) and (2) are entailed by the same evidence. Since (1) is entailed by (∃x)Fx & ($a \neq$ x), (2) is also entailed by it because it has the same logical form, namely, ¬Fa → (∃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.

9. 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 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 presented by Gibbard (1981: 226–32):

> 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 (Edgington, 1995: 294):

> 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

[9] 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).

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.

10. 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? (Ramachandran, 2016: 29).

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

11. CONCLUDING REMARKS

The truth conditions of classical connectives are 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 an 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, 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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