Scuola Normale Superiore
Classe di Lettere e Filosofia
Corso di Perfezionamento in Filosofia

Ramsey'*s* Test

A reassessment of Ramsey's account of conditionals

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Anno accademico
2019 / 2020

S'i' fosse foco, arderei 'l mondo;
s'i' fosse vento, lo tempesterei;
s'i' fosse acqua, i' l'annegherei;
s'i' fosse Dio, mandereil'en
profondo;

s'i' fosse papa, sare' allor
giocondo,
ché tutti cristïani imbrigherei;
s'i' fosse 'mperator, sa' che farei?
A tutti mozzarei lo capo a
tondo.

S'i' fosse morte, andarei da mio
padre;
s'i' fosse vita, fuggirei da lui:
similemente farìa da mi' madre,

S'i' fosse Cecco, com'i' sono e
fui,
torrei le donne giovani e
leggiadre:
e vecchie e laide lasserei altrui.

<div style="text-align:right">

Cecco Angiolieri

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Sonetto LXXXVI, *Rimatori comico-realistici del Due e Trecento*, M. Vitale (ed.), 1956, Torino, UTET. En. (Evnine, Simon J.): «If I were fire, I would consume the world; If I were wind, then I would blow it down; If I were water, I would make it drown; If I were God, t'would to the depths be hurled. If I were Pope, I'd have a lot of fun with how I'd make all Christians work for me; If I were emperor, then you'd really see - I'd have the head cut off of everyone. If I were death, then I'd go to my father; If I were life, I'd not abide with him; And so, and so, would I do to my mother. If I were Cecco - as in fact I am - I'd chase the young and pretty girls; to others would I leave the lame or wrinkled dam».

Contents

Acknowledgements

I express my sincere gratitude to my advisor Prof. Mario Piazza for his support and advice, for introducing me keeping me up to date with the contemporary debates related to my work, and for trusting my judgment as to the directions this research had to take.

I am also deeply thankful to Prof. Massimo Mugnai, this thesis and my Ph.D. would not have been possible without him. His curiosity, knowledge, and philosophical thinking have led me to snoop around the history of philosophy, reawakening a dormant interest.

I would probably never have decided to study philosophy of logic and language, if I had not had the luck to attend Prof. Sergio Bernini's classes during my bachelor and master degrees. I owe my love for this subject to him. I thank him for teaching me that I must sincerely enjoy what I study, for the long conversations and the time he has dedicated to my work. His observations have been and always are sharp and keen, pushing me to face thorny issues and clarify my thoughts.

During these years of doctoral studies I met many people who paid to my research unexpected attention and to whom I am deeply indebted for the stimulating and thrilling intellectual exchanges we had. I thank Dr. Steven Methven for his invaluable guidance throughout Ramsey's work, his comments to this thesis and his supervision in Oxford. I thank Prof. Paul Égré for welcoming me to his research group in Paris and for the precious discussions on conditionals. I am also grateful to Prof. Gustavo Cevolani, who has patiently explained to me probability theory and has given me useful advice to improve this thesis. Some of the original results of this work

List of abbreviations

- C: *Chance*, 1928

- FP: *Facts and Propositions*, 1927

- GPC: *General Propositions and Causality*, 1929

- K: *Knowledge*, 1929

- MHP: *Meaning of hypohtetical propositions*, 1928

- OT: *On Truth*, 1927-29

- RDB: *Reasonable Degree of Belief*, 1928

- TP: *Truth and Probability*, 1926

- ULF: *Universals of Law and Fact*, 1928

Introduction

The problem of conditionals

The question of what will happen if something occurred or of what would have happened had something occurred is ubiquitous in our everyday life as well as in scientific contexts. Our actions are led by the answers we give to these questions, scientific hypotheses are expressed by hypothetical sentences, the analysis of dispositional predicates like "soluble" requires "if ... then ..." structures[1], as theories of causation do. Thus, it is not surprising that a long debate on the meaning of conditional sentences and their correct evaluation permeates the history of philosophy as well as contemporary philosophical discussions.

Already among Greek philosophers there was no agreement about the meaning of conditional sentences, to the extent that, as reported by Sextus Empiricus, the poet Callimachus complained that "Even the crows on the roof-tops are cawing about which conditionals are true"[2]. Thanks to Sextus Empiricus[3], we know that the Stoics already had different accounts for "if p then q" statements[4]. Philo of Megara, Chrysippus and Diodorus Cronus respectively propose different accounts with different truth conditions for conditional sentences. Philo suggests that a conditional is false only when its antecedent is true and its consequent false. Namely, he suggests the truth conditions of classical material implication, for which a conditional "if p then q" is equivalent to the disjunction $(\neg p \vee q)$. Diodorus revises Philo's proposal, stressing that these truth conditions vary through time. A con-

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[1] See, for instance, Carnap (1936).

[2] Cf. Kneale and Kneale (1962).

[3] In *Outlines of Pyrrhonism*.

[4] Here there is no particular assumption on p and q, viz. if they are atomic or not. If this will become relevant I will point it out.

ditional like "if it is sunny, it is hot" can be true at time t and false at t_1. Hence, Diodorus' truth conditions state that a conditional is true if and only if it *never* happens that the antecedent is true and the consequent false. Chrysippus, instead, seems to suggest an account similar to C. I. Lewis' strict implication: a conditional sentence is true if it is not the case that the antecedent is compatible with the negation of its consequent.

In the last century the interest in formalising natural language and scientific reasoning has growth, together with the awareness that classical logic does not offer fine-grained tools to account for everyday usage of some linguistic structures. In particular, material implication alone cannot explain our usage of conditional sentences. For instance, consider counterfactuals (conditionals with a false antecedent): they play a huge role in scientific contexts, as dispositional adjectives, but also as the hypotheses of thought experiments. In classical logic all counterfactuals are true, although we do not regard them as such – we accept some, while rejecting others. Hence, the necessity to find alternative tools for a refined analysis that allows to distinguish cases that are actually recognised as true (or acceptable) in our everyday life from those that are not.

The first contemporary theory of conditionals, alternative to material implication, is C. I. Lewis' strict implication[5]. Unsatisfied by the treatment of implication in Russell's and Whitehead's *Principia Mathematica*, Lewis proposes a modal, stronger reading of ordinary implication. "p strictly implies q" means that it is necessary that p materially implies q. In other words, material implication is within the scope of the necessity operator, and the implication $\Box(p \supset q)$ (where $\supset$ denotes the material conditional and $\Box$ the necessity operator) is equivalent to $\Box(\neg p \vee q)$ and to $\neg\Diamond(p \wedge \neg q)$. Lewis also develops different modal systems (S1–S5 from the weakest to the strongest). However, these systems validate some problematic inference patterns like transitivity, which is often blocked in other contemporary accounts, as well as a modal version of the *paradoxes of material implication* $q \therefore p \supset q$ and $\neg p \therefore p \supset q$, which are valid whenever the consequent q is necessarily true or the antecedent p necessarily false. Consequently, any counterfactual whose antecedent is necessarily false (think of the negation of any true mathematical statement) is true in Lewis' systems. But this seems not to capture our

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[5]C. I. Lewis, *A Survey of Symbolic Logic*, 1918, University of California Press. Reprinted by Dover Publications, 1960.

intuitions about counterfactuals. Consider, for instance, "if $2 + 2 = 5$, then the sun is shining", if not false, it seems quite odd to assert as it is.

From the Forties on, the research field focused on the analysis of conditional sentences and hypothetical reasoning has flourished. At the beginning, and I am thinking of R. Chisholm's and N. Goodman's works, the attention has been drawn to the problem of counterfactuals, believing that the other cases could be treated with material implication. Around the Sixties, a different classification of conditionals took hold, based on the morphology of such sentences, which is employed still today. Conditionals are divided into "indicatives", if the verb in the *protatis* (the antecedent) is in the indicative mood, and "subjunctives", if the verb in the *protatis* is in the subjunctive mood. The counterfactual category overlaps the subjunctive one, because counterfactuals are often expressed using the subjunctive mood. I will come back to this classification later.

From the Sixties, then, plenty of theories have been proposed, some to deal with one specific type of conditional sentences (like E. Adams' probabilistic system for indicatives), some others aiming at a unified account for all types (like R. Stalnaker's possible world semantics). Some other scholars, like P. Grice and F. Jackson, have argued in favour of material implication, ascribing the apparent nonsense of some classically true conditional sentences to conversational phenomena and to the pragmatics of conversation.

Although contemporary theories of conditionals are very different and use different formal tools, many of them are explicitly inspired by the work of the English philosopher, mathematician and economist Frank P. Ramsey. Much work on conditionals is today based on a Ramsey's footnote from the posthumously published paper *General Propositions and Causality* (henceforth GPC), written in 1929 and published for the first time in 1931, in the first collection of Ramsey's essays *The Foundations of Mathematics and Other Logical Essays*, edited by R. Braithwaite. The footnote is the following (GPC, p.247):

> If two people are arguing 'If p will q?' and are both in doubt as to
> p, they are adding p hypothetically to their stock of knowledge
> and arguing on that basis about q; so that in a sense 'If p, q'
> and 'If p, $\overline{q}$' are contradictories. We can say they are fixing their
> degrees of belief of belief in q given p. If p turns out false, their
> degrees of belief are rendered *void*. If either party believes $\overline{p}$ for

> certain, the question ceases to mean anything to him except as a
> question about what follows from certain laws and hypotheses.

This footnote is renowned as the "Ramsey test" for conditionals, a name coined by W. L. Harper, in his paper *Rational Belief Change, Popper Functions and Counterfactuals* (1975, p.245). The success of this footnote is due to the belief that it suggests a very intuitive (as well as vague) procedure for the evaluation of conditional sentences – alternative to material implication. Even before Harper's paper, the footnote had been already mentioned as source of inspiration by scholars like Chisholm (1946) and Stalnaker (1968). Since then, the Ramsey test or mentioning Ramsey in a work on conditionals, or related fields, is almost mandatory[6].

There is no consensus on the correct interpretation of the footnote, especially because the main interest of the scholars who use the Ramsey test is not in Ramsey's thought, but rather in developing an accurate and original account of conditional sentences. On the other hand, works on Ramsey's philosophy – there are a few starting from the Nineties[7] – are focused more on other aspects of Ramsey's production, like his philosophy of mathematics. This is also due to the fact that no Ramsey's paper focuses in particular on conditionals, and obviously many scholars working in the history of philosophy are not experts of contemporary theories of conditionals. The aim of my work is to fill this gap.

Before presenting the contents and goals of this thesis, I think it is worth spending a few words on Ramsey, his work, thought and environment.

Frank P. Ramsey

Frank Plumpton Ramsey was born in Cambridge in 1903, eldest son of Arthur Stanley Ramsey, a Cambridge professor of mathematics, and Mary Agnes Stanley, a suffragette fighting for women's rights. Ramsey studied

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[6]For related fields I mean, for instance, belief revision. For recent works in belief revision involving a version of the Ramsey test see, for instance, J. Chandler, *Preservation, Commutativity and Modus Ponens: Two Recent Triviality Results* 2017, Mind, Vol. 126 . 502. For latest works on conditionals Douven (2015) and Andreas, H., Günther, M. *On the Ramsey Test Analysis of 'Because'.* Erkenn 84, 1229–1262.

[7]Consider that the first complete work on Ramsey's thought is Sahlin (1990) and the first academic Ramsey's biography is Misak (2020) – before there was only his sister's, Margaret Paul, biography: "Frank Ramsey (1903-1930). A sister's memoir" (2012).

mathematics at Trinity College in Cambridge and graduated in 1923. During the college years, he became friend with C. K. Odgen, an English writer and linguist. Thanks to this friendship, Ramsey was introduced to Russell and he was commissioned, in 1921, the English translation of Wittgenstein's *Tractatus*. In 1923 he published for *Mind* a *Critical Notice* of the *Tractatus*, after travelling to Austria to discuss the text with Wittgenstein himself.

Ramsey became fellow of King's College in 1924 and in 1925 he published some of the most interesting paper, as *Universals*, where he discusses the problem of the distinction between particular and universal objects, arguing that there is no essential distinction between the two classes, as there is not between subjects and predicates. In the same year he publishes also *The Foundations of Mathematics* (hereafter FM), which gives the title to the first collection of his papers (1931, ed. by R. Braithwaite). In this work, Ramsey amends Russell's theory of types, as presented in Whitehead and Russell (1910), mainly criticising the empirical flavour of the axiom of reducibility, the axiom of infinity and the axiom of choice. It is particularly relevant that in this paper he embraces the tractarian view of quantification, where universal quantifiers are treated as infinite conjunctions and existential quantifiers as infinite disjunctions. Ramsey here adheres to the logicist school, against the «Bolshevik menace of Brouwer and Weyl» (FM, p.56), while in his later works, like GPC, he seems to turn towards a more intuitionistic view of mathematics. Indeed, in GPC he abandons the idea that general propositions like "all men are mortal" are infinite conjunction, claiming that they are not propositions at all, but rules for judging instead. This change belongs Ramsey's general intuitionistic and finitist turn[8] in the philosophy of mathematics. Indeed, Ramsey's new view on general propositions recalls Weyl's idea in *Das Kontinuum*: general propositions cannot be negated since the scope of an unrestricted quantifier would not be definite[9].

In GPC clearly emerges Ramsey's way of doing philosophy, led by what he calls "the realistic spirit" (GPC, p.252). As S. Methven (2015, p.2) has argued in his *Frank Ramsey and the Realistic Spirit*: «in the background,

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[8]See Majer (1991).

[9]This similarity with Weyl's view is pointed out by N. Sahlin *'He is no good for my work. On the philosophical relations between Ramsey and Wittgenstein* in M. Sintonen (ed.) *Knowledge and Inquiry: Essays on Jaakko Hintikka's Epistemology and Philosophy of Science*, Rodopi, 1997 and M. Marion in *Wittgenstein, Finitism, and the Foundations of Mathematics*, Oxford University Press, 1998.

and present in even his [Ramsey's] very earliest work, is a suspicion of the esoteric, the abstract, the mystical and the mysterious». We find this spirit also in his works on probability and on meaning, like *Truth and Probability* (1926) and *Facts and Propositions*(1927) – hereafter TP and FP – where the meaning of a proposition is said to be determined by the actions it leads to. Along the same lines, a rational degree of belief is nothing but an adherence to the frequencies of past experiences.

Ramsey is well known for his contribution to probability theory, as he is one of the first proponents (together with de Finetti, a few years later) of the subjectivist interpretation of probability. Ramsey's paper offers also a criticism of J. M. Keynes' *A Treatise on Probability*, whose friendship led Ramsey to write even about economic matters, with two important papers on taxation and savings[10].

A branch of combinatorics carries Ramsey's name and it is today known as "Ramsey theory", because it is based on a theorem Ramsey proved in *On a problem of formal logic* (1928), originally thought to solve a particular case of the *Entscheidungsproblem*. In philosophy of science, we find the "Ramsey sentence", a formal expression introduced to get rid of theoretical terms. Finally, in philosophical logic and philosophy of language we have the "Ramsey test" for conditionals.

Ramsey's influence is pervasive in contemporary philosophy, many scholars have borrowed Ramsey's ideas and developed them. However, until recent years, a comprehensive account of Ramsey's thought was missing. This is probably due partly to Ramsey's early death, and the eminent philosophers in Cambridge who survived him; partly to the incompleteness of Ramsey's work. He did not publish many papers during his very short life, and we have work mainly on his notes to understands his views. Therefore, many of his ideas are cut off and theories not carried out completely. Consider Ramsey's theory of truth: the only complete paper that partially discusses truth is FP; but Ramsey, from 1927, was working on a book about truth (*On Truth*, published only in 1931), that today shows us only what Ramsey's theory would not have been, without the positive part. It then is difficult to say

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[10]*A contribution to the theory of taxation*, The Economic Journal,37(145), 47–6, Royal Economic Society (reprinted in Ramsey (1978) and *A mathematical theory of saving*,The Economic Journal,38(152), 543–559, Royal Economic Society (reprinted in Ramsey (1978).

exactly what Ramsey's theory would have been[11].

The same can be said for Ramsey's theory of conditionals, I had to delve into Ramsey's notes, and then collect the scattered pieces and reassemble them into a coherent picture.

Ramsey's test

When I began, the aim of this research was primarily to discover whether Ramsey had an account of conditionals, especially of counterfactuals. Indeed, to my knowledge, there was and still there is no work focusing on Ramsey's conditionals, although the Ramsey test for this type of sentences is widely used. The main reason for this gap is due to the lack of interest in theories of conditionals for scholars in the history of philosophy and in historical investigation for conditional specialists.

Indeed, when I first started working on this topic, it was doubtful that Ramsey actually had an account of conditionals, since no one had ever investigated it. The attention has been always drawn to the first two sentences of Ramsey's footnote on conditionals, where he seems to use conditional probability for the evaluation of conditionals. However, if carefully read, the last bit of the footnote suggests a way to understand counterfactuals. Moreover, simply by broadening the view from the footnote to the context where the footnote appears, it becomes clear that Ramsey had a sharp idea of what it means to assert a conditional – and even sharper of what it means to speak and think counterfactually. And we find the same ideas, expressed in the footnote, repeated and further explained throughout the whole GPC. Indeed, the footnote comes within an example that discusses different types of conditionals, their usage and acceptance, and the relation between their assertion and the truth of the corresponding material implication.

It is clear that Ramsey had in mind an explanation of the assertion, acceptability and truth of conditionals (of all types). However, from GPC alone, it is not possible to recover a complete account. It is then necessary to consider the entire Ramsey's production, from published papers to notes[12].

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[11]I do not discuss truth in detail in this work – this omission is harmless for the aim of my work. Nonetheless, in ch.1 I give some references of works that deal with Ramsey's account of truth.

[12]Ramsey's scientific notes are stored in the University Pittsburgh archives of scientific philosophy, and a significant portion of them has been published in 1991, in *Notes on*

I have found a note, *The Meaning of Hypothetical Propositions*, 1928, (henceforth MHP) entirely focused on conditional sentences and here discussed for the first time ever. The note is linked to GPC by its content, but also by a brief comment by Braithwaite on top of the folder in the Pittsburgh archives. The note explains counterfactuals and thus the last sentence of Ramsey's footnote, as well as indirectly determining and limiting the role of conditional probability. It emerges that many assumptions about Ramsey's approach to conditionals are not correct – like that he proposes a conditional probability account for indicative conditionals and rejects the idea that conditionals are truth-bearers. By exploring Ramsey's works, it comes out a far more complex picture, where different levels of analysis are considered. This requires, for instance, to abandon the idea that the degree of belief in the consequent given the antecedent determines, in Ramsey, the acceptability of an indicative conditional. Surprisingly and against any expectation, I am able to claim that Ramsey had a well-defined account of conditionals, and especially of counterfactuals.

Once verified that more than a simple footnote on conditionals could be found in Ramsey, the research to be carried out was twofold. From one side, it was important to reconstruct with historical accuracy Ramsey's account of conditionals. But it was also important and interesting to see whether a complete and updated contemporary theory of conditionals could be recovered and developed from his ideas.

Hence the thesis is structured into two parts: part I is historical and it deals with Ramsey texts and their interpretation, in order to reconstruct his epistemology and collect all the bits of text about conditionals. Part II is devoted to develop a tenable unified theory of conditionals – I propose two possible solutions – and to compare it with the most influential contemporary accounts.

The relevance of this work is both historical and philosophical. First, it shows that Ramsey had a clear vision of conditional sentences and beliefs, contrary to what it is generally held. It brings to light new elements of Ramsey's work, like MHP, and hence new aspects of Ramsey's thought. It also stresses that Ramsey's footnote was not meant to be a test for conditionals at all, but rather a description in technical terms of what it means for a

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philosophy, probability and mathematics, ed. M. C. Galavotti, Bibliopolis. Ramsey's personal notes are at King's college at the University of Cambridge.

person to accept a conditional. Second, this work highlights some specific requirements a theory of conditionals should satisfy. It seems not possible to have a suitable theory of conditionals without a theory of belief and knowledge as general framework. Indeed, the evaluation of conditional sentences cannot be unrelated to the beliefs an agent has, for, especially in counterfactual situations, it depends on what the agent thinks more plausible it would have happened according to what he knows and what guiding principles for judging he has. Accordingly, the beliefs a person has play a fundamental role in both my updated versions of Ramsey's account.

This thesis also shows that it is possible to have a theory of conditionals which ties together truth and acceptability conditions. Indeed, Ramsey does not reject material implication but simply recognises that it is inappropriate if the goal is to explain the usage of a conditional sentence in everyday life. Hence, the analysis and the formal tools implied strictly depend on the type of investigation we are interested in. This suggests that there are several and distinct levels of study. Ramsey seems to distinguish between classical semantics, for which material implication is enough, and the pragmatical and epistemological features of asserting a conditional, which require more than classical logic.

The first possible development of Ramsey's view on conditionals that I propose results in what I believe to be an original theory of conditional, with new, intuitive acceptability and validity criteria. My second proposal is the result of the joint work with Mario Günther[13] and it inserts Ramsey's notions into Stalnaker's possible world semantics.

Both my unified accounts stress the importance of context for the evaluation of conditionals. Here context is intended broadly, it can refer to the conversational context, if the conditionals is asserted within an exchange between two (or more) people, or it can simply refer to the beliefs a person has. From the context, additional information are extrapolated and might be used, together with the antecedent of the conditional, to infer the consequent. Ramsey gives strict limitations to the logical form such information can have (and other more) and this provides a more defined picture of what it means to understand, evaluate, and accept a conditional sentence. These contextual information can contain also laws, and this is a common feature between Ramsey's view and theories like Goodman's and Chisholm's (see

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ch.4). But, contrary to Goodman and Chisholm, laws do not exhaust the possible propositions that can be added to the antecedent.

Another relevant philosophical point that emerges from Ramsey's work, and that is here adopted, is the refutation of the classification of conditional sentences based on the mood of the verbs involved. Indeed, this type of classification relies on the morphology, which, however, does not often correspond to the logical properties of conditional sentences – consider for instance counterfactuals and subjunctives, mistakenly overlapped. In Ramsey, as in my two proposals, the meaning and hence the type of analysis of a conditional is determined by the truth value of its components, its antecedent and consequent. The formal tool apt to describe the process of evaluation and acceptance depends on the truth value of the corresponding material implication, whether it is already settled or not. Conditional probability, which represents a bet according to Ramsey (see TP and ch.1 and 2 here), cannot express a conditional if its truth (or falsity) is already known – clearly, betting on an event that we know has already occurred is pointless.

Finally, this thesis proves that Ramsey's famous footnote, today known as the Ramsey test, is actually not a test for the evaluation of conditional sentences. Rather it is a description in technical and formal terms of the process of acceptance of conditionals.

The thesis is made up of four chapters and divided into two parts, following the two sides of my research. Part I is historical, focused on the analysis of Ramsey's texts and their interpretations, compared to contemporary works on Ramsey's thought. It presents an overview of Ramsey's account of some philosophical concepts that are strictly related to his approach to conditionals.

The first chapter outlines Ramsey's epistemology, presenting three concepts that play a fundamental role in his account of conditionals: beliefs, variable hypotheticals and knowledge. It is an introductory chapter to Ramsey's philosophy of beliefs and knowledge. I first consider Ramsey's work on probability and his subjectivist interpretation. Some of the scholars who have influenced Ramsey's work on probability are also discussed, to give an idea of the intellectual context he was working in. The analysis of beliefs is strictly related to the possibility of measuring degrees of belief. To do so, Ramsey relates beliefs to the actions they, if endorsed, would lead to. This connection between actions and beliefs can be found also in *Facts and Propo-*

sitions (1927), where Ramsey suggests a deflationist approach to truth. In the draft *On Truth* (1927-29), Ramsey distances himself from pragmatist and coherentist theories of truth and defines his own view as correspondentist, introducing, but not explaining[14], the notion of "propositional reference". Considering that it is difficult to have a clear idea of what Ramsey's theory of truth would have been and that it is not essential to his analysis of conditionals, as well as to my attempt to develop it, I do not focus on truth, but rather on the notion of reasonable degrees of belief.

Reasonable degrees of belief are strictly related to the notion of habit, since they are evaluated according to the frequency with which the habit has lead us to truth. Induction, for instance, is a very useful habit, for it leads us, very often, to true beliefs. Habits are one of the two components of Ramsey's variable hypotheticals, a fundamental concept for what concerns conditionals. Variable hypotheticals are those general statements whose range of application is unrestricted, infinite, like "all men are mortal". These general statements are not infinite conjunction, as Ramsey himself believed a few years before GPC[15], they are not propositions at all, but rather rules for judging. They are the general beliefs that guide our actions and inferences, they include laws of nature, and, as such, they can also express causal connections. The variable hypotheticals a person endorses are what determine, at the very end, the acceptance or rejection of conditional sentences, inasmuch the conditionals accepted by someone are instances of the variable hypotheticals he endorses. "Variable hypothetical" is an original notion introduced by Ramsey, although the idea of general statements as rules for judging was already present in Weyl's *Über die neue Grundlagenkrise der Mathematik*[16]. This change of mind on general propositions marks Ramsey's conversion to finitistic and intuistionistic philosophy of mathematics, as many scholar have suggested[17].

Variable hypotheticals are tightly connected to Ramsey's theory of knowledge too. Ramsey sketches a reliabilist account of knowledge, which I present (showing also some potential problems) in the last part of the first chapter. Ramsey's account has three requirements that a belief must satisfy to be considered knowledge, plus a proviso that specifies a connection between degrees

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[14]*On Truth* is an unfinished work, published posthumously.

[15]See *The Foundations of Mathematics*, 1925.

[16]Cf. MacBride et al. (2019).

[17]For instance, see Majer (1989), Dokic and Engel (2002), Methven (2015).

of belief and the reliability of the process of acquiring beliefs. It turns out that reliable methods are those habits that the subject has adopted as variable hypotheticals, rules for guiding to form new beliefs, since they produced reasonable degrees of belief in past situations. The last part of the chapter considers Ramsey's theory of knowledge as a possible solution to some tricky problems of contemporary epistemology, like some Gettier's cases.

The second chapter introduces the first original parts of my research. Here, by moving from an analysis of Ramsey's famous footnote, I challenge the common assumptions that Ramsey did not attach truth values to conditional sentences and that no theory of counterfactuals, in particular, can be found in his works. I present and discuss texts like GPC and TP, where conditionals and important related notions are introduced and explained. An examination of these papers already supports my argument against what I call the "orthodox interpretation" and it shows that Ramsey actually discusses counterfactuals, especially for their specific role in expressing disagreement as well as causality. This peculiarity of counterfactuals is interesting for it connects the study of such sentences to related fields of investigation like general philosophy of science – causality and counterfactuals is an already largely discussed topic – but also social epistemology. The space where Ramsey moves is always eclectic, for he combines different levels of investigation: from semantics to epistemology and pragmatics. This is evident in the note MHP – here presented for the first time – which is entirely focused on the analysis of those conditionals whose corresponding material implication is already known as true. The analysis proposed in MHP corresponds to the one sketched in GPC. Putting all things together, we obtain a complex picture of Ramsey's view of conditionals: on one side we have conditional probability, on the other an "additional premises" account. However, contrary to the current common practice, the two different analyses do not depend on the mood of the verbs involved, but on the truth value of the material implication corresponding to the conditional – whether it is already known or unknown, settled or unsettled.

At the end of the second chapter I discuss the distinction between indicative and subjunctive conditionals. Indeed, Ramsey is well aware of this morphological feature, which he justifies by means of the generalisations each conditional is an instance of. Ramsey's argument casts doubts on the contemporary practice that distinguishes conditionals into indicatives and sub-

junctives, these latter usually identified with counterfactuals. Indeed, this is a mere grammatical distinction that is not relevant from a logical point of view. Furthermore, even in natural language, counterfactuals are sometimes expressed in the indicative form (for instance, all those cases where we really want to stress the absurdity of the antecedent), as not all subjunctives have a false antecedent. The second chapter ends with two different analyses of conditionals: one using conditional probability and the other the inferential account. Part II of my work is committed to unify these two analyses. I first propose two possible solutions for a unified theory. I then compare my two accounts with contemporary theories of conditionals.

In the third chapter I propose two solutions for a unified theory of conditionals *à la* Ramsey. Indeed, a single theory that covers all types of a syntactic structure is preferable over several, distinct accounts. Both my proposals replace truth conditions with acceptability conditions, in order to respect Ramsey's intuition (or what I take it to be). Contrary to what is usually held in contemporary theories of conditionals, in my both proposals, truth does not exclude acceptability, but the two concepts coexist and are layered one over the other.

In my first account, that I call the "theoretical approach", the truth value of the material implication corresponding to a given conditional sentence determines the analysis and the meaning of that conditional. If the corresponding material implication is known to be true, the meaning of the conditional assertion cannot be that of a bet, for there is nothing to bet on – the truth value being already settled. What a person conveys with this type of statements is that he endorses a variable hypothetical and holds some information that allow him to infer the consequent from the antecedent. If, on the other end, the truth value of the corresponding material implication is not known, the conditional statement can properly be seen as setting a bet. The joining link of these two analyses is the necessity for additional information, that added to the antecedent make the whole conditional instance of a variable hypothetical endorsed. These additional information must obey Ramsey's specific requirements and determine the acceptability of a conditional. By treating this set of additional propositions as the context needed for the evaluation (and hence for the acceptability) of a conditional, I am also able to define a validity criterion based on the idea that there must be no contextual shift between the premises and the conclusion of a

valid inference. What results is a theory of conditionals, from subjunctive to indicatives, from counterfactuals to factuals, that relies on the intuitive idea that an inference is valid if the belief and/or conversational context that makes acceptable the premises makes acceptable also the conclusion of an argument.

The "formal" account, my second proposal for a unified theory, takes Stalnaker's possible world semantics and introduces in it Ramsey's notions like variable hypotheticals. By comparing Ramsey's and Stalnaker's views on conditionals, it emerges that Ramsey has in common with possible world semantics more than what has been always acknowledged. Indeed, recovering Ramsey's lost inferential account sheds light on the last sentence of his famous footnote and on a missing part of the story about the Ramsey test. It remains to establish how it is possible to unify the two Ramsey's paths: probabilistic and inferential. Again, giving a look at contemporary theories, we find Lewis' *imagining*, a probabilistic updating rule for beliefs that, in place of conditional probability, allows a unified treatment of all types of conditionals, counterfactuals included[18]. With respect to original Stalnaker's theory (but also Lewis'), Ramsey's account can rely on a more solid and defined epistemological structure. For instance, thanks to variable hypotheticals, it is possible to justify and give a criterion for the similarity among worlds. The propositions true in a world can be seen as the context of evaluation, the additional premises that allow the acceptance (or the truth for Stalnaker and Lewis) of a conditional.

Both my proposals, I believe, highlight some problems contemporary accounts might have – like the negligence for an epistemological framework where a conditional theory would find its place – and the study of Ramsey's work suggests possible amendments for a more accurate analysis.

The last and fourth chapter offers an overview of the most influential accounts of conditionals from the Forties on. First, I reassess a Ramsey test for each of my proposals, I translate the famous footnote into the respective acceptability criteria of my two accounts. I present theories of counterfactuals or of conditionals that have some similarities with Ramsey, or mention him explicitly, and I then compare them to my two approaches. I start from Chisholm, the first to mention Ramsey in a work on conditionals, and then

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[18]Conditional probability cannot be applied to counterfactuals, the false antecedent makes the ratio undefined.

I consider other additional premises accounts, Adam's probabilistic account of indicative, possible worlds semantics, up to more recent developments of belief revision theory. Ramsey's ideas thus result incredibly modern and similar, for different reasons, to many contemporary theories. This suggests that my theoretical and formal approaches can be seen as good alternatives, for they gather together different features of different accounts. This is made possible also by the several levels of analysis Ramsey is engaged with. This comparison is useful to show that my two proposals can actually compete with contemporary theories, but also that adding Ramsey's notions can be, in some cases, a real improvement of them. For instance, the limitations on the logical form of additional premises are stricter in Ramsey than in any other theory; the way conditional probability is employed in my theoretical account casts doubt on whether it is actually the right tool to evaluate *all* conditionals in the indicative mood indiscriminately. Variable hypotheticals can be used as the criterion to establish the similarity of worlds or as the conditions that determine what kind of revision is reasonable and acceptable and which is not – they could explain why certain beliefs are preferred and accepted over others.

The results of this research are, I believe, very interesting from an historical point of view, for they reassess Ramsey's ideas and work on conditional sentences. For a contemporary philosopher the thesis proposes an original theory of conditionals and stresses relevant but often overlooked problems of the studies on conditionals, proposing possible feasible solutions by enlarging the view to field with which a theory of conditionals must inevitably interact.

A few remarks on the notation used in this work. Following Ramsey's texts, I use p and q – if not signalled differently – to refer respectively to the antecedent and the consequent of a conditional. Both p and q can be formulae of first or propositional logic. They can be tautologies or contradictions – this does not affect my analysis, for what matters is the truth value, not if it is logically necessary. I use the horseshoe $\supset$, for the material implication; the arrow $\rightarrow$ to represent the "if ... then ..." structure for whatever account does not treat a conditional as a material implication – I use this symbol for my two theories too – except for Stalnaker's and Lewis's conditionals, for which I follow them in using $>$. Universal quantifier is $\forall$, but not in quotes from Ramsey, who used brackets (x), as it was the case at that time follow-

ing *Principia*'s notation. Existential quantifier is everywhere $\exists$. Finally, as negation I use the standard $\neg$, but Ramsey uses the overline $\bar{s}$.

Part I

Chapter 1

Ramsey's epistemology

In this chapter I present Ramsey's epistemology. This is a preliminary chapter, where fundamental notions that will be needed in the following chapters, in the reconstruction of Ramsey's theory of conditionals, are introduced.

I start from Ramsey's analysis of full beliefs, and what identifies and distinguishes them from other mental states. I believe that the "dispositionalist" and "pragmatist" labels that have been often attached to Ramsey's view do not entirely capture his ideas. Indeed, I suggest a distinction between a pragmatic and a pragmatist approach to beliefs, ascribing Ramsey's attitude to the former rather than the latter. Unfortunately, due to Ramsey's early death, his unfinished works and style of writing (taking for granted arguments and explanations which are not) it is difficult to retrieve a theory of true beliefs. I am here not interested in assessing Ramsey's theory of truth for it is unnecessary for the scope of this work. However, I argue that some recent developments based on Ramsey's work are perhaps based on too simplistic readings of Ramsey's view.

An overview of Ramsey's account of beliefs cannot ignore his subjective interpretation of probability in terms of degrees of belief. Here I briefly discuss his theory, but I focus mainly on some scholars who have strongly influenced Ramsey. For instance, Peirce's influence is explicit in Ramsey's distinction between *logic of consistency*, deductive logic, and *logic of truth*, inductive logic. In the *logic of truth*, i.e. the logic that should tell us *what* to think, the notion of habit and its evaluation are central. The evaluation is carried out in terms of frequency of past events, to which subjective degrees

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of belief, if reasonable, should correspond. This shows that Ramsey does not reject any interpretation of probability in favour of another, but he each time selects the one that best suits his goals – and this holds in general, the type of interpretation depends on the goal.

I then turn to the analysis of general propositions as proposed by Ramsey in GPC, which will be essential to understand Ramsey's conditionals. Here, general propositions are no longer viewed as infinite conjunctions or disjunctions, and hence no longer truth-bearers. These *variable hypotheticals* are, instead, rules for judging, e.g. "if I meet a Fx I should judge it a Gx", forming the system through which a person meets the future. Variable hypotheticals determine people's expectations and are the source of agreement and disagreement. They can be of different types, according to the probability relation which connects the antecedent to the consequent - laws ($= 1$) or chances (< 1) - or to the temporal relation between the two - laws or causal laws. For this, and to highlight some loose ends of Ramsey's approach, we present in a few words his account of causality. In the following chapters, it will become clear that the acceptability of conditionals depends on what variable hypotheticals a person has endorsed, and that the different types can account for different degrees of belief in conditionals.

I conclude the chapter by sketching the theory of knowledge that results from Ramsey's fragments on the topic. Indeed, we will see (chapters 2 and 3) that, in order to accept a conditionals, there must be some *known* information the subject has. Ramsey as a reliabilist account of knowledge, where reliability is defined in terms of frequency and habit. Following my interpretation of the evaluation of habits, I argue that reliable processes are those processes that lead to true beliefs in the majority of cases. This amounts to «formulate in a variable hypothetical the habit of following the way» (K, 258). It is shown that the reliable processes behind knowledge acquisition are identified by those variable hypotheticals expressing laws.

This characterisation of reliability and knowledge, however, faces two main problems, but it seems also to solve two other famous problems: Gettier (1963) example and BonJour (1980) Norman case.

This chapter introduces the notions that we will need to understand Ramsey's account of conditionals, but also to develop a contemporary theory of conditionals. Unfortunately, the critical discussion of many of these notions is somehow limited for lack of space. Indeed, I have chosen to present them

mainly as they are presented in Ramsey, often without a deep philosophical analysis, since they are only needed for recovering Ramsey's account of conditionals. It will become that Ramsey's epistemology offers a background, a framework, where Ramsey's theory of conditionals can be inserted. As I will argue (see ch.4 and conclusion) this is one of the main quality of Ramsey's theory with respect to contemporary accounts: a theory of conditionals cannot stand alone, without a precise explanation of the system of beliefs and general beliefs a subject has and with which conditionals interact.

I will here use "⊃" as implication because Ramsey uses it, but it should not be taken literally as material implication since it used to formalised sentences that Ramsey claims not to be propositions.

1.1 Beliefs

Ramsey has been mostly[1] considered as an adherent to a dispositional account of beliefs: a belief is identified by the actions it would lead to in certain circumstances. The analysis of belief Ramsey proposes in his works[2] is essential to his theory of truth and meaning, to the extent that ultimately, they are same: «but before we proceed further with the analysis of judgment, it is necessary to say something about truth and falsehood, in order to show that there is really no separate problem of truth but merely a linguistic muddle» (FP, 142) – "belief" and "judgment" and "assertion" are used interchangeably (cf. FP, p.138). If we understand what is the meaning of saying that there is a relation R connecting a to b, we understand the meaning of saying that aRb is true (or false).

The dispositional approach is recurrent in Ramsey's work, but this might be because it is the only feasible way to talk about beliefs and judgements, and not because he embraces a strict behaviourist account of beliefs[3]. For instance, in TP (p.170) Ramsey repeatedly stresses the amount of fiction intrinsic to this kind of investigation:

> But when we seek to know what is the difference between

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[1]See, for instance, Sahlin (1990), Dokic and Engel (2002), Misak (2016).

[2]The core theory can be found in *Facts and Propositions* (1927), but significant parts are also in *Truth and Probability* (1926) and in the manuscript, posthumously published, *On Truth* (1927-29).

[3]As Sahlin (1990), Dokic and Engel (2002) and Glock (2005) seem to claim. For "strict behaviourism" I mean the idea that there is nothing mental, no mental event, and any usage of mental concepts should be avoided.

believing more firmly and believing less firmly, we can no longer
regard it as consisting in having more or less of certain observable
feelings; at least I personally cannot recognise any such feelings.
The difference seems to me in how far we should act on these
beliefs: this may depend on the degree of some feeling or feelings,
but I do not know exactly what feelings and I do not see that
it is indispensable that we should know. Just the same thing
is found in physics; men found that a wire connecting plates of
zinc and copper standing in acid deflected a magnetic needle in
its neighbourhood. Accordingly as the needle was more or less
deflected the wire was said to carry a larger or a smaller current.
*The nature of this 'current' could only be conjectured: what were
observed and measured were simply its effects*[4].

As in physics, the investigation into beliefs and judgements can only rely on
what is directly observable: actions or dispositions to act. This, however,
does not imply that the nature of a belief – what, for instance, distinguishes
it from other mental states – is exhausted by its causal properties[5]. Rather,
the causal properties are what is directly observable of a belief, hence the
only possible object of investigation[6].

Russell in the *Analysis of Mind* (1921) objects to the idea that beliefs are
to be identified by the actions they produce that: (I) not all beliefs lead to
action. Ramsey avoids this problem adopting a betting method to measure
degrees of belief - they do not have to lead to actual actions (see § 1.1.1).
And (II) beliefs cannot differ from other mental states for their effects only.
There must be something more to distinguish different mental states, oth-
erwise the same effects (e.g. actions) would mean the same mental states –
which is clearly not the case[7]. Ramsey (TP, 170) admits that this might be
true, but adds that «the difference of the causes is entirely or very vaguely
unknown, and that what we want to talk about is the difference between
the effects, which is *readily observable*[8] and important». There might be the
belief-feelings Russell (1921) talks about, but from a *practical* point of view

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[4]My italics.

[5]Moreover, notice that in the passage above Ramsey is interested specifically in degrees
of belief, so it is even more plausible that this is not Ramsey's view of the nature of beliefs.

[6]Note also that TP was written one year before FP, fact that, although not being a
cogent proof, might suggest a continuity of thought.

[7]For instance, I could be led to the same action by a belief as well as by a desire.

[8]My italics

investigating[9] them is quite difficult; for instance, they might strongly vary from an individual to another. Therefore, we must restrict ourselves to what we can directly observe, i.e. the effects, and to consider "belief *qua* basis of action" (TP, 171). Ramsey's choice is *pragmatic* rather than pragmatist[10].

In a later paper, *Facts and propositions* (1927), Ramsey distinguishes between an objective factor (or factors) and a mental factor (or factors). The former can be roughly seen as the content of the belief, playing the role propositions do in propositional theories of belief. The latter Ramsey (p.144) takes to be «words, spoken aloud or to oneself or merely imagined, connected together and accompanied by a feeling or feelings of belief or disbelief»[11]. This distinction is slightly different from the one proposed by Russell (1921)[12], who separates the content of the belief from the feeling of belief – in this sense, Russell's belief can be identified with Ramsey's mental factor *tout court*.

As in Russell (1921), Ramsey in TP speaks of "feeling belief" or "feeling disbelief", as well as possible distinct feelings for disjunction and conjunction, belonging to, but not exhausting, the mental factor. These feelings are belief-relations essential to belief self-ascription, and, somehow, they also determine the order in which the referents (their names) occur in the belief[13]. Each logical operator is represented by a different relation. For instance, in the negation case, which is the case Ramsey covers more extensively, there is not an additional component to the content of the belief, but rather a different relation which ties together all the components of the belief and the believer. Namely, "Tom believes that Lara likes Charles" and "Tom believes that Charles does not like Lara" involve two different belief-relations, belief-feelings, and the latter really means that "Tom *disbelieves* that Charles likes Lara".

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[9]In particular, measuring them – cf. next subsection.

[10]In the sense of endorsing behaviourism as explained above.

[11]This reference to words should also suggest that the chicken-example presented on the same page, where a chicken refrains from eating a caterpillar because it *believes* that it is poisonous, should not be taken as a model for human beliefs too. In the chicken case mental factors are parts of chicken's behaviour, and it is not what Ramsey is interested in when discussing the nature of belief - as, in fact, he explicitly admits. Ramsey is rather interested in those beliefs «consciously asserted or denied». Cf. along these lines (Methven, 2015, §6.2.1) and against (Sahlin, 1990, 70 ff.).

[12]See *Lecture IX* and ff.

[13]How this is possible is not totally clear, cf. (Loar, 1980, 51 ff.) for an attempt of explanation and some critiques.

As pointed out by Loar (1980), the introduction of different belief-relations is one of the two sources of multiplicity in Ramsey's account of beliefs, the other being the number of referents a belief can have[14]. This approach implies that negations and disjunctions are totally different from assertions. Disbelieving p expresses a precise attitude of the subject, namely his agreement with the possibility that p is false and disagreement with it being true. Likewise, believing p *or* q means agreeing with the possibilities that p is true and q false, p false and q true, p and q both true, and disagreeing with the possibility that p and q are both false. And so forth, with all the other logical operators. It is worth stressing, however, that in FP Ramsey never mentions implication. We think this is because with conditionals the situation is a bit more complicated. In particular, it seems that when a person *can* and *does* decide to act according to a conditional belief or judgment that "if p then q", she actually acts on the disjunction "not-p or q" – beliefs are identified by their causal properties. However, we can utter or believe a conditional also when the truth of it is not something depending on our actions – i.e. we do not have the power to make it true – or we just want to express our expectations about a future event[15]. In any case, if we are interested exclusively in truth-condition, then «'If p, then q' can in no sense be true unless the material implication $p \supset q$ is true; but it generally means» something more[16].

Since beliefs are identified by their causal properties, different beliefs have presumably different causes and surely different effects. This means that the subject who believes not-p will act as if p is false - the same applying to all other complex propositions[17]. In this sense, believing p and not-not-p are equivalent: they have the same causal properties and will lead the believer to the same actions.

Ramsey claims that the problem of truth is not separate from that of understanding judgment, and, indeed, in FP he states in a nutshell the main

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[14]To avoid the multiplicity due to the number of referents a belief might have, (Loar, 1980, 51) introduces ordered couples.

[15]«When we deliberate about a possible action, we ask ourselves what will happen if we do this or that. If we give a definite answer of the form "If I do p, q will result", this can properly be regarded as a material implication or disjunction 'Either not-p or q ». (GPC, 246.

[16]see ch.2 for a detailed discussion.

[17]It must be pointed out that Ramsey (FP, 150) is vague on how this exactly should work.

idea of what is today known as the redundancy theory of truth. The core is this (p.142):

> 'It is true that Caesar was murdered' means no more than that Caesar was murdered, and 'It is false that Caesar was murdered' means that Caesar was not murdered. They are phrases which we sometimes use for emphasis or stylistic reasons, or to indicate the position occupied by the statement in our argument.

The predicate "true" is redundant, it does not add anything to the bare assertion of the proposition "Caesar was murdered", and we can get rid of it[18].

Although Ramsey's account of truth does not concern my work, since it is not necessary to the reenactment of Ramsey's epistemology and theory of conditionals, it is nonetheless impossible to completely ignore it, since it is closely connected to beliefs and judgments.

Ramsey has been considered as one of the first (if not *the* first) proponents of the redundancy theory of truth, as outlined in the example above. However, not much else can be found about truth in this paper.

In the last three years of his life, Ramsey was working on a book on truth, which has been posthumously published in 1991 by N. Rescher and U. Majer. In this draft Ramsey repeats the idea that "true" is a redundant predicate, but he also introduces the idea of a *propositional reference* to which this predicate is ascribed. The intuitive idea is that the propositional reference involves a correspondence with facts. Unfortunately, the chapter where this notion of propositional reference should have been explained has never been written.

What is really interesting about this unfinished book is Ramsey's rejection of the pragmatist and the coherentist theories of truth. Indeed, Ramsey sets his account within the correspondence theory and, as suggested in the editors' introduction, he seems to consider that the redundancy claim is at the heart of this approach. This also suggests that the so-called *successful semantics*, which has been developed first by J. T. Whyte in his *Success semantics* (1990) and then by Blackburn (2005) and supported by Dokic and Engel (2002), is probably not the road Ramsey would have taken. In

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[18]Ramsey (FP, 143) shows how we can eliminate the predicate "true" also in more complex cases, when the proposition is not explicit – i.e. "He is always right" – thanks to the introduction of quantifiers, in which case the elimination of the predicate seems more complicated. For more details on the elimination procedure see Sahlin (1990, ch.2).

fact, in FP (p.144) Ramsey puts together truth and utility, but he does so while discussing the chicken example. In this example, the chicken's belief is identified by the set of useful actions if and only if the belief is true. But it can be the case that this does not apply to all types of beliefs, since Ramsey says that the chicken-belief is not what he is interested in. Furthermore, in explaining the meaning of "useful" he simply states the correspondentist claim (fn. 1, FP, 144), suggesting that the notion of truth is not the same as utility, but that rather is prior to it: «it is useful to believe aRb would mean that it is useful to do things which are useful if, and only if, aRb; which is evidently equivalent to aRb.».

Despite the fact that the pragmatist requirements, such as utility or simplicity, undoubtedly play relevant roles in Ramsey's account of truth – especially concerning true scientific systems[19] – nonetheless I want to stress that, in my interpretation of Ramsey, beliefs are useful (and then actions successful) *because* they are true, and not the other way around. This is testified by Ramsey's endorsement of the correspondentist approach, against the pragmatist and coherentist ones, and the introduction of the notion of propositional reference, which would be meaningless if truth were to be identified with successful actions *tout court*.

My discussion of Ramsey's account of truth must end here for two main reasons: first, I am not an expert of theories of truth and my discussion would then be very approximate; second, a longer treatment would lead us astray from the scope of this work. For more detailed explanations and interpretations see Sahlin (1990), Dokic and Engel (2002), MacBride et al. (2019), Frápolli (2005).

With this brief discussion of true beliefs and truth in Ramsey's work, I wanted to suggest that his theory of truth seems far from a "straight" redundancy theory of truth and not even a pragmatist theory; but that rather the picture is more complex and «contrary to an established view of Ramsey as holding the analysis of "true" to require no elaborate philosophical constructions» (Loar, 1980, 49). This is clearly implied by the draft of the book he was working on, which due to its incompleteness does not say much about the theory Ramsey would have developed, as well as by the introduction there of propositional reference.

So far I have considered only full beliefs: those beliefs believed with

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[19]Cf. also (GPC, 253)

full certainty. Another feature of beliefs is that they may come in degrees. Indeed, beliefs can be quantitatively characterised too, by means of real numbers, this being another aspect of their nature.[20].

1.1.1 Degrees of belief

Ramsey is well known for being one of the first proponents of the subjective interpretation of probability[21]. Since the notion of "degree of belief" is pivotal in Ramsey's epistemology and also appears in the famous Ramsey Test for conditionals, it is worth spending a few words on it.

Presented in *Truth and Probability* (1926), Ramsey's foundation of subjective probability has a strong assumption at its basis: all beliefs are in principle measurable, all degrees of belief can be expressed numerically[22].

Of course, if we want to develop a theory of probability as the «logic of partial belief and inconclusive arguments» (TP, p.157) a certain amount of fiction should be introduced. But fictional elements are ubiquitous in science, as, for instance, the transitivity of the equivalence relation among objects in physics[23]. And as for many physical notions, degree of belief is defined operationally, through the method of measuring it. There can be different methods of doing it, but it is essential to be able to compare degrees of belief and to put them in a order of magnitude.

Ramsey considers two possible ways of obtaining degrees of belief: (I) by introspection, namely according to the (degree of) strength of the feeling which accompanies each belief. But this way is not feasible, it is not possible to assign numbers to different intensities as if they were degrees of belief, because there is no objective way to measure them. They depend upon sub-

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[20]"The quantitative aspects of beliefs as the basis of action are evidently more important than the intensities of belief feelings" (TP, 171). I thank S. Methven for this point.

[21]He is usually acknowledged as one of the founder of the subjectivist interpretation of probability together with de Finetti, whose works are slightly later - one of his first is *Sul significato soggettivo di probabilità* (1931). Cf., for instance, Hájek (2012), (Kyburg, 1970, ch.6), Bradley (2004).

[22]For instance: «It is a common view that belief and other psychological variables are not measurable, and if this is true our inquiry will be vain. [...] we are bound to hold that beliefs can to some extent be measured» (TP, p.166). Furthermore, the idea that some beliefs can be measured while other do not is supported by (Keynes, 1921, ch.3), from which Ramsey explicitly distances himself (cf. TP, p.167)

[23]«The logical simplicity characteristics of the relations dealt with in a science is never attained by nature alone without any admixture of fiction.» (TP, p.168).

jective perceptions and they are not "readily observable" (TP, p.170) from an external point view. Furthermore, it seems that the stronger the belief is, the feebler the feeling which accompanies it: those beliefs which are believed as certain are not connected to any feeling at all.

The other possible way of measuring belief is (ɪɪ) by considering «that the degree of a belief is a causal property of it» (TP, p.169), so that two degrees of belief differ in relation to the propensity we have to act on them. As we have seen, Ramsey identifies beliefs by their causal properties, it should not be surprising, then, that degrees of belief too are connected to the causal properties of beliefs.

Ramsey is then naturally driven to the betting method: propose a bet to a person and see what his lowest odds are. For instance, I want to know what is your degree of belief in t: "your train will be on time", then I ask you how likely you think that t is false, and to set a bet on it. Suppose you bet 4:1 that t is not true, hence your degree of belief in t is 0,20 - since that in $\neg t$ is 0,8. You presumably do not trust much your rail company.

This method, however, lacks of generality and some factors might spoil the bet and contribute to modify the lowest odds: for instance, the financial situation of the gambler (i.e. the diminishing marginal utility of money) and his inclination to take risks. But also the bet itself may modify the agent's beliefs. In order to avoid these difficulties and reach more generality, Ramsey makes other fictional assumptions. He assumes that actions are entirely determined by opinions and desires, so that a person would act according to what she thinks the most plausible way to fulfil them. The objects of desire are called "goods" and assumed to be measurable and additive[24]. The notion

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[24]cf. Dokic and Engel (2002): this is Bayesian expected utility maximisation. C. Howson in Misak (2020, 257) and Sahlin (1990) disagree on what kind of Bayesianism this is. While the former argues in favour of *subjective* Bayesianism (no constrains on prior probability distribution), like de Finetti's approach, the latter claims that if we consider Ramsey's theory of laws – cf. §1.2 – and his probability theory together we move towards an *objective* Bayesianism (constrains on prior probability, like the *principle of indifference*). This because laws are of statistical type, based on the notion of chance and thus strictly limiting the rational probability assignments – i.e. the rational degrees of belief. However, Ramsey explicitly rejects any restrictions on prior probability distribution, like the *principle of indifference* (TP, p.189). Furthermore, it is true that laws in Ramsey are of statistical type, chances with the probability value 1, which are said to be «objective, in that everyone agrees about them, as opposed e.g. to odds on horses» (C, p.208), but it is not clear to what extent people actually agree about them. Indeed, in GPC, chances are classified as a type of variable hypotheticals – i.e. rules for judging – and the endorsement of different ones is claimed to be the source of disagreement among people. I will argue (see §1.2.2) in favour of this last option. See Elliott (2017) and §6 in MacBride et al. (2019) for a

of "degree of belief" is thus explained (TP, p.174):

> Suppose his [a person's] degree of belief in p is $\frac{m}{n}$; then his action is such as he would choose it to be if he had to repeat it n times, in m of which p was true, and in the other false.

Consider this example with the above proposition t: your degree of belief in it is 0.2, $\frac{1}{5}$. Now, following Ramsey's definition, this means that you act as if you arrived to the rail station five times 30 minutes before the train arrival and only one time, among the five you went, your train was on time (every time you do not remember the previous one). So now, you rarely arrive at the rail station 30 minutes before the scheduled arrival of the train, because you believe that trains are very often delayed.

When proposing a bet, different courses of action are proposed to the gambler and, when he bets, he chooses the one which would give him "so much extra good" if, in the previous example, the proposition t turns out false, "so much extra bad" if true. Mathematical expectation is then defined by establishing degrees of preference among options – not vice versa[25]. What a subject believes and to what degree is determined by the order of preference of possible worlds, namely "possible course of the world" (TP, p.176).

The way to measure the degree of belief a person has in a proposition p is by offering her options like these: would you prefer world α in any case; or β if p is true and γ if p is false? In this situation, if the person thinks p for certain, she will choose between α and β simply on the utility for her of the two possible worlds.

However, the goal is to put someone's preferences in a (linear) order, to attach them probability values (degrees of belief) accordingly. That is why Ramsey introduces *ethically neutral propositions*: propositions towards which the agent has no preference. Such propositions are introduced to avoid the possibility that a proposition p spoils the preference the agent is required to express among the options proposed (e.g. among α, β, in α if p is true, β, if p is false), being its truth or falsity object of desire. The ethically neutral propositions have default value of $\frac{1}{2}$, and allow an overlapping of subjective probability and subjective utility[26]. An atomic

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detailed discussion and actualisation of Ramsey's system.

[25]Cf. Zabell (1991).

[26]Sahlin (1990, 17-19) correctly criticises the existence of ethically neutral propositions but he seems to forget that Ramsey is doing what has been doing so far: he is introducing

proposition is ethically neutral if «two possible worlds differing only in regard
to the truth of p are always of equal value» (TP, p.177). Ethical neutrality
is compositional. A subject is then said to have a degree of belief of $\frac{1}{2}$ in p
if she has no preference between the possible courses of the world α and β
based on the truth or falsity of p. The preference between the two options
is based solely on the preference between α and β.

From the introduction of this kind of propositions, Ramsey can assign
values to preferences. First, he introduces the idea of a difference in value
between two possible worlds in one option as being the same as that between
two other worlds in another option. So that if p is an ethically neutral
proposition, then the subject has no preference between the options:

1. α if p is true, δ if p is false;

2. β if p is true, γ if p is false.

A *value* is any set of all worlds *equally preferable* to a given one, say α. This
means that if α is preferred to β, then any world with the same value as α,
is preferred to any world with the same value as β, and so on. The axioms
that Ramsey states assure that there is a one-to-one correspondence between
values and $\mathbb{R}$[27].

We can now move from preferences (i.e., values, i.e. utilities) to degrees
of belief. A subject's degree of belief in p is: $\frac{\alpha-\gamma}{\beta-\gamma}$[28], where α is independent
from the truth value of p – its utility does not depend on whether the subject
prefers p or $\neg p$. In γ p is false and in β is true. Following Elliott (2017), we
can say that, given the maximisation of expected utility and other assump-
tions, the utility of the option α is equal to that of the option β if p true,
and γ if p false: $\alpha = \beta(Pr(p)) + \gamma(1 - Pr(p))$ (here again Greek letters stand
also for utility values). Hence $Pr(p) = \frac{\alpha-\gamma}{\beta-\gamma}$.

Finally, conditional probability is introduced [29] and the "fundamental law
of probable belief" (TP, p.181), i.e. the axioms of probability, are stated.

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some fiction and approximation. To see this, it is enough to consider the assumption that
a person always acts to maximise her desires. There are some attempts to get Ramsey's
systems without ethical neutrality (cf. Elliott (2017)).

[27]However, Ramsey does not prove the representation theorem, Sahlin (1990, p.30 ff.)
sketches the proof.

[28]Greek letters stand also for utility values of each possible world.

[29]See Sahlin (1990) and Methven (2015) to see how conditional probability stated in
terms of utility values is equivalent to the standard formulation.

For the sake of the following discussion on conditionals, it is worth spending a few words on Ramsey's introduction of conditional probability. Indeed, the degree of belief in q given p

> does not mean the degrees of belief in 'If p then q', or that in 'p entails q', or that which the subject would have in p if he knew q, or that which he ought to have. It roughly expresses the odds at which he would now bet on p, the bet only be valid if q is true[30].

Ramsey's only requirement for a set of degrees of belief is its consistency with the law of probability, if someone's degrees violate the laws of probability, there is a Dutch book of bet that he would always loose, whichever combination of bets he accepted. In this sense, the theory of probability is «an extension to partial beliefs of formal logic, the logic of consistency» (TP, p.182).

A case not covered yet concerns the degrees of belief when the alternatives are infinite: this possibility, however is not worth considering, Ramsey argues, because it is difficult to imagine a mind contemplating an infinite number of options. Nonetheless, this case can be thought to become relevant when discussing induction, but also in this circumstance there is no need to wonder what the probability of an event "for evermore" (p. 184) will be. An interesting question to be raised is whether our past experience gives high probability to an event. Indeed, this can be the only ground for a logical justification of induction, namely the analysis of the expectations we have of determinate events, which are based on inductive generalisations[31].

Let us briefly consider Ramsey's account of probability as compared to those of other scholars he refers to – I will return the justification of induction in §1.1.3.

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[30]Note that Ramsey misplaces p and q: he starts by "the degree of belief in p given q" but he swaps the two propositions, correctly stating only the subjunctive one. Edgington has recently (MacBride et al. (2019)) argued that Ramsey is here suggesting that conditional degree of belief is a synchronic notion rather than diachronic, thus rejecting the Ramsey test applied to belief revision. I will come back to this in ch. 2.

[31]What Ramsey means here is that we are more certain of some events rather than others, e.g. that the sun will shine tomorrow than that the first throw of two dice will be 12 (Ramsey's example). In this difference of expectation, evidently based on past experience, logic – understood as including probability theory – could explain w this difference, in the same way as it can explain why some inductive inferences are more justified than other on these same bases – i.e. past frequencies.

Donkin

At the beginning of TP, Ramsey mentions *On certain questions relating to the theory of Probabilities* (1851), a paper by W.F. Donkin - a professor of Astronomy at Oxford University in the mid-19th century. Here, Donkin (1851, p.353) says:

> It will, I suppose, be generally admitted, and has often been more or less explicitly stated, that the subject-matter of calculation in the mathematical theory of probabilities is *quantity of belief*. Every problem with which the theory is concerned is of the following kind. A certain number of hypotheses are presented to the mind, along with a certain quantity of information relating to them: in what way ought belief to be distributed among them?

He answers to this question, for the general case, by stating the *Principle of indifference*, according to which, in case of ignorance, probability (degrees of belief) should be distributed equally among the options. Even though Ramsey (TP, p.189) rejects this principle, Donkin's discussion presents many similarities with Ramsey's account of probability, besides witnessing that the Bayesian interpretation of probability was already widespread and accepted. Taking into account this paper by Donkin is then useful to set Ramsey's background and see who his referents were, apart from the Cambridge group.

By rejecting the Principle of indifference, Ramsey is on the same side of de Finetti's (1937) strict subjectivist interpretation of probability. However, his account of laws and chances, as here interpreted (see § 1.2), ties degrees of belief to a weak form of objectivity. Some of these can be found also in Donkin. Donkin (p.354) argues for the possibility to represent «every definite state of belief [...] by numerical expression, however difficult or impracticable it may be to ascertain its actual value». Ramsey clearly holds the same position, though well aware of the amount of the fiction this approach requires.

Donkin claims that the meaning of probability generally accepted in works of his time is that of "quantity of belief" and it "is nothing inherent in the hypothesis to which it refers" (p.355). Therefore, the degree of belief is "always *relative* to a particular state of belief", but "[the quantity of belief] is *absolute* in the sense of not relative to any individual mind"

(ivi). Namely, once assumed the same information of a particular individual, we *ought* to distribute degrees of belief among propositions in the same way. This is the coherence requirement: a person's degrees of belief must be coherent, they must follow the classical axioms of probability to prevent possible books against her - e.g. Dutch books[32].

Each hypothesis has a determinate numerical value relative to a given state of information, and this assumed, the fact that in some circumstances we wonder about the prior probability of a proposition does not imply that it does not have a determinate value. What it implies is simply that the proper calculation has not been carried out.

Donkin's assumption that a degree (or quantity) of belief is *always* expressible by numbers is the content of one of the critiques Ramsey moves to Keynes, who rejects it.

Ramsey's criticism of Keynes' *Treatise*

In *A Treatise on probability* (1921), Keynes (p.3 ff.) holds that, strictly speaking, probability means the "degree of rational belief" in a proposition, which is the conclusion of an argument. Indeed, given two sets of propositions, one taken as the premises (h) and the other the conclusions (a) of a possible argument, «if a knowledge of h justifies a rational belief in a of degree α, we say that there is a probability-relation of degree α between a and h.».

The degree of belief in the conclusion is rational if it corresponds to the probability relation between the two sets of propositions: there is one and only one probability relation which justifies the degree of belief in the conclusion. Namely, if in any situation the relation has degree α, a rational agent would attribute to the conclusion a corresponding degree of belief, i.e. α. This explains objective validity as attached to probable inferences, and why another agent in similar circumstances but with different degrees of belief would be judged irrational.

Ramsey moves several critiques to Keynes's account. Let us consider them in order:

I. Keynes denies that it is always possible to attach numerical values to degrees of belief. But, if this is the case, Ramsey (TP, p.160) argues,

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[32]Cf. TP, p.183.

then the correspondence between degrees of belief and degrees of probability relation cannot mean that they are expressed by the same number.

II. But even if we take the correspondence above to be a bijection, preserving the orders of magnitude from degrees to relations and vv., some of Keynes' objections to measurements of probability relations work well against such possible bijective function too. For instance, from the fact that some actual degrees of belief cannot be determined, Keynes derives that there must be a correspondence between non-numerical degrees and non-numerical relations – for it cannot be the case that the latter are measured when the former are indeterminate. Clearly, for Ramsey, the conclusion of this argument is totally wrong: this only shows that degrees of belief, expressible numerically, do not have a one-to-one correspondence to probability relations.

III. But the strongest objection, however, concerns precisely the nature of such probability relations. Keynes suggests that we *perceive*[33] them whereas Ramsey firmly rejects this possibility, especially because there seems to be little agreement among people about their values. Moreover, even if we allow the perception of some kind of relation among propositions, the fact that very often they might be not measurable is suspicious. It is obviously suspicious for a philosopher like Ramsey, who rejects the postulation of unnecessary obscure entities.

IV. As a final critique, Ramsey quotes a passage from Keynes (1921), which could be read as suggesting a different interpretation of probability. Here, probability relations, previously said to be always comprehensible for the human mind although not always expressible numerically, are claimed to be justified by logical relations. Contrary to the former, these latter «are, and must always be, incapable of comprehending» (p.34), which seems utterly nonsense given that they are needed to *justify* (comprehensible) relations. According to Ramsey, even if we dismiss Keynes' theory in favour of another one which grounds degrees of belief on logical relations of different types, we cannot be satisfied. For, once again, vague notions, as the justification of degrees of belief through logical relations, are involved.

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[33]cf. Keynes, Ch. I, § 10, 11

Ramsey and Peirce on probability

Ramsey in the latest years of his short life had a "pragmatist turn" and American pragmatists' ideas had a strong impact on him, especially the work of C. S. Peirce[34]. The collection of Peirce's works *Chance, love and logic* was published in UK in 1923, but it is probable that Ramsey already knew his work, as Misak (2016, p.157) suggests.

For my purposes, Peirce's work is fundamental for Ramsey's account of deductive and inductive reasonings[35] and general laws of mind (see next section). However, Ramsey employees different interpretations of probability depending on his particular aim, and I will here briefly argue that not all of them are inspired by Peirce, but that Ramsey's subjective interpretation of probability has nothing to do with Peirce's account of probability.

Indeed, Misak (2016, p.179) argues that «In 'The Fixation of Belief', he [Peirce] leaves us with the idea that the goal of inquiry is to reach stable beliefs that leave no room for doubt. This is a highly unrealistic hope. Thus Ramsey improves on Peirce's position by turning our attention away from full belief [...]». It is, however, really hard to establish whether Ramsey actually thought of his theory as an improvement of Peirce's idea. First, the idea of a calculus of probability grounded on the notion of degree of belief was hardly new – we have seen that Donkin explicitly says this – although no one before Ramsey had endorsed it systematically. So perhaps Ramsey saw his work as a further development within this tradition. Second, as suggested by Ramsey himself, and as explained by Zabell (1991) referring to a work on Borel by Knobloch, the idea of measuring degrees of belief through bets was not new at all, " the old-established way" (TP, 172). Knobloch notes that this idea was expressed, only two years before TP, by Borel in his review of Keynes' *Treatise* (1924), where he proposes the idea of measuring beliefs considering people's behaviour, of which, presumably, Ramsey was aware. Third, and more important, Peirce gives his own interpretation of probability, and it is completely different from Ramsey's.

Peirce (1998b, p.68) attaches probability to inferences, not to single propositions, and defines it as «the proportion of cases in which it carries

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[34]Cf. Misak (2016) and Misak (2020) for an exegetical and historical account of Ramsey's pragmatism and Peirce's influence, and, for a solid pragmatist interpretation of Ramsey's overall work, Dokic and Engel (2002) and Sahlin (1990)

[35]Or "analytic" and "synthetic", since for Peirce induction is only one type of synthetic reasoning, the other one being abduction.

truth with» so that «the probability consists of the fraction whose numerator is the number of times in which both A [premise of the inference] and B [conclusion of the inference] are true, and whose denominator is the total number of times in which A is true, whether B is so or not». Conditional probability, then, is for Peirce (p.68) the primitive notion, and he adds:

> Instead of speaking of this as the probability of the inference, there is not the slightest objection to calling it the probability that, if A happens, B happens. But to speak of the probability of the event B, without naming the condition, really has no meaning at all[36].

It is already to some extent evident that Peirce's conception of probability is strictly related to frequency and that his formulation, given also the notions he takes as primitive, is very different from Ramsey's approach.

In *The Probability of Induction* (1878), Peirce presents and discusses the two interpretations of probability: the materialist and the conceptualist, attributed to Venn and De Morgan respectively. The paper starts reminding us that (p.82):

> We have found that every argument derives its force from the general truth of the class of inferences to which it belongs; and that probability is the proportion of arguments carrying truth with them among those of any *genus.*

A short remark before continuing: in this conception the notions of habit and that of general principle play a crucial role. We discuss it in the next section and see how this deeply influences Ramsey's ideas about general rules governing our mind.

Peirce too, in this paper, introduces the notion of chance: whereas probability is the ratio of favorable cases to all cases, chance is the ratio of favorable cases to the unfavorable ones: e.g. when tossing a coin the probability that it lands on head (or tail) is $\frac{1}{2}$, its chance is $\frac{1}{1}$. The two notions of chance, Ramsey's and Peirce's, are completely different. Chance is related to a subjective aspect of beliefs in Peirce too[37], but the aspect of belief that Peirce

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[36]When the conditions are known, Peirce (p.68) adds, ellipses are permitted.

[37]The definition of the notion of chance in Ramsey's work raises some problems (see §1.2.2). But, even if claimed to be objective, it is nonetheless grounded on degrees of belief - a subjectivist concept.

connects to chance, and then to a measure, is feeling. When chance is high the feeling of belief is very intense, when it is low, so is the feeling and the intensity of the related belief. The mathematical tool which better represents all the features that feeling of belief has is the logarithm of chance.

We have seen that Ramsey denies repeatedly the possibility of measuring the intensity of belief and of using feelings as "thermometer"[38] of the intensity of belief, so also in this discussion about subjective aspects related to probability the differences between Ramsey and Peirce are clear. In Peirce we start from chance to get the intensity of beliefs, and not vice versa. As we have seen, the idea of measuring partial beliefs by the intensity of the feelings which (might) accompany beliefs is rejected by Ramsey as unfeasible[39].

Furthermore, as sketched before, Peirce endorses a materialistic, as he calls it, account of probability and we find this again a few pages later (p.89): «but probability, to have any value at all, must express a fact. It is, therefore, a thing to be inferred upon evidence». Probability should work in the long run, but it might well be that to a given chance does not correspond the same feeling of belief. Then, Peirce concludes, to express the degree of belief we need the probability inferred and the amount of knowledge from which that probability is inferred, i.e. how many times we have experienced a certain event. For these reasons, conceptualistic view is "quite inadequate" (p.91).

Finally, Misak (2016, p.179) argues that «[...] the most striking connection is that Ramsey adopts Peirce's conception of logic» and then, mentioning (p.176) Suppes (2006, p.45), that «Ramsey follows Peirce in distinguishing the kind of consistency involved in deductive logic from that involved in maintaining the consistency of your set of partial beliefs». Ramsey in TP (p.186) distinguishes between deductive and inductive logic, and he stresses that this distinction does not correspond to that between full and partial beliefs. Indeed, the logic of partial belief is «in fact a generalization of formal logic» and consistency regarding full beliefs is in no way different from that in partial beliefs.

The task of logic is not to tell us *what* to think, but simply how to be consistent and «this is simply bringing probability into the line with ordinary

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[38]Peirce (1998b, 87).

[39]Misak (2016, p.176) too acknowledges this feature of Ramsey's account, but she nonetheless thinks that there are more similarities than differences between Peirce and Ramsey concerning probability.

formal logic, which does not criticize premisses but merely declares that certain conclusions are the only ones consistent with them» (TP, p.189). This is why Ramsey rejects the principle of indifference: probability theory should not tell people how to distribute their degrees of belief among different options, as long as they are consistent.

If we add probability theory to formal logic, we obtain a calculus which preserves consistency, but looses truth. Whereas formal logic is considered a "body of objective tautology", the calculus of partial beliefs cannot, *unless* we recover the calculus of frequencies, to which partial beliefs are related. Indeed «the very idea of partial belief involves reference to a hypothetical or ideal frequency [...] belief of degree $\frac{m}{n}$ is the sort of belief which leads to the action which would be best if repeated n times in m of which the proposition is true [...].» (TP, p.188). In this way, we recover the correspondence with formal logic: from an objective point of view we have a body of tautology and the calculus of frequencies; from the subjective perspective we have the laws of consistent thought and a calculus of consistent partial belief.

There are not two types of consistency involved in full beliefs and partial beliefs, but – and this is how I interpret the passage of TP (p.184) quoted by Misak (2016, p.176)[40] – if we wonder what justifies our beliefs, we are obliged to cross the borders of deductive logic. The question Ramsey is here asking is not "*how* should we think?", but rather "*what* should we think?". The answer does not regard consistency, but what would be best for a person believe – and this has to do with the notion of habit. One thing is the distribution of truth values (or degrees of belief) among our beliefs, avoiding inconsistency; on the other hand, wondering when everyday inferences are justified inheres to inductive logic[41]. This latter is the *logic of truth* – as opposed to the former *logic of consistency* - and it does rely on Peirce's work. We turn to this in the next section.

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[40] «It may be said that we ought to think what is true, but in that sense we are told what to think by the whole of science and not merely by logic. Nor, in this sense, can any justification be found for partial belief; the ideally best thing is that we should have belief of degree 1 in all true propositions and belief of degree 0 in all false propositions. But this is too high a standard to expect of a mortal men, and we must agree that some degree of doubt or even of error may be humanly speaking justified.»

[41] Of course, this is Ramsey's point of view. Note that Keynes (1921) thinks that «valid deductive and inductive arguments are fundamentally alike». Clearly Ramsey does not accept this position (TP, 185).

1.1.2 Habits

We have seen that probability theory can be considered a part of logic, insofar as we ask ourselves how we should think (i.e. consistently)[42]. However, «we want our beliefs to be consistent not merely with one another but also with facts» (TP, p.191). In many circumstances, we are not able to decide the truth or falsity of a proposition (full belief), but we only entertain a degree of belief in it. This usually happens not on deductive grounds, but rather on inductive ones[43]. This is the logic of truth and it is the branch of logic that investigates and determines what beliefs (or degrees of belief) would be reasonable for a person to have.

Ramsey characterises reasonableness by frequency theory and the notion of habit. I focus on this notion first and then see how it relates to frequency. This part is explicitly based on Peirce's work (cf. fn. 2, p.194, TP).

Ramsey (TP, p.194) does not make any assumption about the nature of habits, whether they are acquired or innate; he uses the term to mean, very broadly, whatever «rule or law of behaviour, including instinct: I do not wish to distinguish acquired rules or habits in the narrow sense from innate rules or instincts, but purpose to call them habits alike.». Habits are the general rules, psychological regularities, that govern human's mind and behaviour. In evaluating degrees of belief we should look at the processes forming them, as suggested by Peirce. First, then, we have to evaluate the habit behind the belief «accordingly as the degree of belief it produces is near or far from the actual proportion in which the habit leads to truth» (TP, p.196). Consequently, the reasonable degree of belief - which is, of course, ideal - corresponds to the proportion of times in which the habit that has produced it has led to truth. Let us try to make it clearer through an ex-

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[42]Ramsey (TP, 191) actually says that «[...] human logic or the logic of truth, which tells men how they should think [...].». But this seems to contrast with what he says a few pages before (TP, p.184) - cf. here fn. 38. I think that Ramsey is right in the previous quotation and wrong in this one. Namely, if we ask *what*, it is clear that we should think *what* is true, and it is also clear that this cannot be achieved by deductive logic alone, since this requirement asks a reference to reality that logic does not have. In this sense, then, the logic of truth – i.e. inductive logic – is what we need, since it concerns the methods by which we acquire knowledge. On the other side, if the question is about *how*, it is obvious that "coherently" is a possible answer to this question, at least it is the answer that formal logic (with probability theory) – i.e. the logic of truth – gives.

[43]Here "inductive" should be understood broadly, it includes all those non-deductive processes which enrich our knowledge. Ramsey (TP, p.185) agrees with the traditional view that deductive inferences do not properly increase our knowledge, since the conclusions are contained in the premises.

ample: suppose the habit we want to evaluate is perception, in particular Jess' use of her sight. Suppose, then, that Jess trusts her eyes and that she believes in the truth of what she sees to a very high degree, say 0.95, and she acts accordingly. However, she suffers of visual hallucination and actually what she sees it true only 50% of times. In this case, perhaps a bit extreme, Jess' sight is not a good habit and she should rather lower her degree of belief in what she sees, because this degree of belief is totally unreasonable. Namely, according to Ramsey's frequentist account, the reasonable degree of belief she should hold is 0.5.

These considerations apply not only to perception, but also memory and inductive inferences. It is clear then, the best habits to adopt, the most reliable ways to form judgments, are those that in past experiences have (nearly) always driven us to true beliefs[44] have produced in us a corresponding certainty. This means that habits are judged «by whether they work» and this, of course, «is a kind of pragmatism» (TP, p.197).

This applies also to a peculiar habit like induction, which is the process of acquisition and evaluation of many other habits, and whose justification involves the application of itself. We use and trust induction because it is a useful habit, and would be unreasonable not to use it: when we use it we are, most of the time, led to true judgments[45].

Let us briefly focus on a problem that this view seems to face. If we need our past experiences to evaluate a habit, how do we start? How about those habits of we have never used so far, and therefore we cannot rely on? The answer can perhaps be found in instincts, which are listed by Ramsey amongst the habits. Indeed, there might be some habits which are innate and give rise to all the others – e.g. perceptions – and we cannot do anything else except trusting them. Also, we should perhaps count among our experiences other people's experiences we are aware of.

We will see in § 1.3.2, that this way of judging habits plays an important

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[44]However you want to define true beliefs. As I have already said, it does not really matter for the purposes of this work. You may believe that beliefs are true because they lead to successful actions, or that they lead to successful actions because they are true. As briefly explain a few pages before, in OT Ramsey explicitly adheres to the correspondentist tradition, rejecting the pragmatist view. Hence, I suggest Ramsey sees successful actions defined by true beliefs and not vice versa. What true beliefs are remain unsolved, but I will not attempt a solution here.

[45]Of course, there is also circularity here, although Ramsey claims that it is not a vicious circle. The same is said also of memory (TP, p.198): to evaluate it we use memory itself to remember past occurrences.

role in Ramsey's account of knowledge. Now, we turn to Ramsey's account of general propositions, of which habits are one of the two components.

1.2 Variable hypotheticals

In *General Propositions and Causality*[46] (1929) Ramsey introduces the notion of variable hypothetical[47]. After having abandoned the tractarian account of quantification[48], Ramsey lays down a non-propositional (i.e. no truth value is attached to them) account of general propositions[49].

There are two types of general propositions: those which have a limited – temporally and/or spatially – range of application, like "Everyone in Cambridge voted", and are in fact conjunctions; and those like "All men are mortal", *variable hypotheticals*, not limited and not conjunctions.

The reasons Ramsey (GPC, pp.237-8) gives to explain why variable hypotheticals cannot be treated as conjunctions all rely on the impossibility to actually handle them, and the uselessness such infinite propositions would have for a human mind. We cannot write down something infinite, which, as belief, would also be useless, having no degree attached to it (the degree of certainty in a generalisation relies only on a finite set of instances of it). There are some motivations explaining why we are led to think about them as conjunctions: they contain all their finite instances, and if we wonder about their truth conditions we are forced to look at them as conjunctions, which, however, we cannot express due to our expressive limits – we cannot actually utter an infinite sentence. Therefore, variable hypotheticals are not conjunctions, and, if they are not conjunctions, they are not propositions

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[46]In (Misak, 2016, p.190; p.196) it seems that GPC is primarily an analysis of conditionals, which includes also "open generalizations", and that conditionals are rules for judging. I think it is the other way around: the analysis is about general propositions, but it covers conditionals too since they are strictly related to them – they are expressed through conditionals.

[47]To my knowledge, this term is invented and first used by Ramsey himself, although the idea that general proposition are in fact no propositions at all, but rules for forming judgments is nothing new. For instance, it is very similar to H. Weyl's account in *Das Kontinuum*, see M. Sintonen in *Knowledge and Inquiry: Essays on Jaakko Hintikka's Epistemology and Philosophy of Science*, 1997 and M. Marion in *Wittgenstein, Finitism, and the Foundations of Mathematics* Oxford University Press, 1998.

[48]The idea that universal propositions are infinite conjunctions and existential ones are infinite disjunctions. See Methven (2015) and Methven (2018) for a discussion of the evolution of Ramsey's account of quantification and its relation to Wittgenstein.

[49]We will use "propositions" because this is the term Ramsey uses, although it might be questionable and perhaps a more suitable term could be found.

at all: we cannot attach truth values to them. Instead, they are «rules for judging» (GPC, p.241) of the type "If I meet a ϕ, I shall regard it as ψ". They express inferences we are at any time prepared to make, and go beyond our experiences. This means that we do not and cannot know all the men that have lived, live and will live, and whether they were, are or will be mortal, but we can nonetheless reasonably endorse "if I meet a man I shall judge him mortal" and use this as a rule for judgments.

We already know that beliefs involve habits, and so do variable hypotheticals. To endorse a variable hypothetical means having adopted «a habit of a singular belief» and believing a general enunciation – behind which there is a «psychological law» – presumably the habit of induction – which gives the meaning of "all" (p.241). Since habits are evaluated according to their frequency and variable hypotheticals are rules for judging, the former (habits) should be adopted as rules when they are useful (viz. they produce degrees of belief corresponding to the actual frequency with which the habits lead to truth).

Such general sentences «express cognitive attitudes without being propositions», but we can agree or disagree about them. Ramsey (GPC, p.140) enumerates five possible attitudes an agent can have towards a variable hypothetical. One case is believing it, but the other four concerns possible source of disagreement between two agents (say A and B) who have not both endorsed the general statement "All men are mortal". If A says "If x is a man, then x is mortal" and B answers "No, I don't think so" this might be because B believe in the existence of an immortal man or because B has not thought about it – viz. B does not endorse any variable hypothetical concerning men and mortality[50]. Note that this means that A and B have *different systems of belief to meet the future* – and this is essential to the understanding of Ramsey's account of conditionals, especially counterfactuals.

Variable hypotheticals can be of two types: laws and chances. Both laws and chances must be distinguished from accidental generalisations, which do not guide our actions and do not form the system by which we meet the future.

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[50]Actually, Ramsey (GPC, p.240) is more subtle, he includes also the cases where: *(i)* B does not believe it because it is unproven; *(ii)* B believes that a certain type of man would be immortal if existent.

1.2.1 Laws and accidental generalisations

In GPC Ramsey discusses laws and proposes a revision of the account he gives in *Universals of Law and of Fact* (1928). This paper is a response to Johnson's and Baithwaite's accounts of laws, as presented in *Logic. Part III*, (1924, ch. 1) and *The Idea of Necessary Connexion*[51] respectively[52]. Johnson identifies the difference between laws and accidental generalisations in the wider range of applicability of the former. Namely, a law brings us beyond actual experience, it states something about what is possible. Accidental generalisations, instead, assert only facts. Ramsey (ULF) points out that there cannot be anything wider than everything, therefore the difference between the two types of general propositions must be found somewhere else. This idea is kept in GPC too. Although the criteria of identification of laws change, they are not in any way related to the range of their applicability: both accidental generalisations and laws apply to infinite ranges.

But Ramsey's focus is on Braithwaite's theory and he gives several reasons to reject it. According to Braithwaite, accidental generalisations are believed on demonstrative grounds, whereas laws are not. But there are three counterexamples Ramsey (ULF, pp.140-1) offers to this account: the first concerns laws which are not believed at all (neither on demonstrative nor on non-demonstrative grounds). We might believe that something happens because of some unknown characteristics of its (supposed) causes. Second, some accidental generalisations are believed on non-demonstrative grounds (e.g. "everyone there was asleep" believed on testimony (p.141)). Lastly, some laws are believed on demonstrative grounds, like when a law is believed thanks to the observation of its instances.

As already said, the account of laws Ramsey holds here is rejected in GPC, but it has become famous thanks to Lewis (1973) as one of the sources of the "Best System Account" of lawhood. We first consider Ramsey (ULF) and Lewis (1973), and then see how Ramsey changes his position in 1929 (GPC).

Ramsey (ULF, pp.141-2) has a refined classification of generalisations that cannot be found in Lewis (1973):

> [...] let us classify universals a little more precisely; as we

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[51]Braithwaite (1927) and Braithwaite (1928).

[52]See also Sahlin (1990, 107-16) for a further discussion of universals of law and of fact and the comparison to Johnson and Braithwaite.

have the following classes:

1. the ultimate laws of nature

2. derivative laws of nature, i.e. general propositions deducible from the ultimate laws

3. what are called laws in a loose sense; i.e. general propositions deducible from the ultimate laws together with various facts of existence assumed to be known by everyone, e.g. bodies fall

4. universals of fact; but these cannot be sharply distinguished from (3); on a deterministic view all them could be deducible from the ultimate laws together with enough facts of existence.

Ramsey invokes "artificial arrangement" to distinguish 1 and 2, although the difference is clearly vague. As it is vague the difference between 3 and 4, which instead amounts to the quantity of facts they need to be deduced. Our knowledge is arranged into a deductive system[53], where 1 and 2 play the part of axioms from which 3 and 4 can be deduced if "particular facts of existence" are added. The axioms choice is bound to some extent to be arbitrary, but a simplicity criterion, as an "architectonic principle", selects the axioms and arrange the deductive system. Some other true generalisations will then only be able to be deduced from these together with particular facts of existence.

Although simplicity is admittedly a very vague notion, Ramsey (ULF, p.144) stresses once again that "the system is required to be as simple as possible". In Lewis (1973) we cannot find any sophisticated classifications of universals, and *strength* is an additional requirement the system must satisfy.

This is how Lewis (1973, p.73) reads Ramsey:

> We can restate Ramsey's 1928 theory of lawhood as follows: a contingent generalisation is a law of nature if and only if it appears as theorem (or axiom) in each of the true deductive systems that achieves a best combination of simplicity and strength. A generalisation is a law at world i, likewise, if and only if it appears in each of the best deductive system true at i

---

[53]Note that, according to Ramsey (ULF, p.143), even though we do not know everything so far, we nonetheless can arrange our knowledge in a deductive system. Furthermore, we can think how the system would be if we knew everything, with its axioms and laws.

We see that Lewis' characterisation of laws relies on a comparison among deductive systems, which must be true and satisfy the "architectonic" principles of simplicity and strength. In Ramsey (ULF) there is no direct reference to truth (of course, there is implicitly since he talks of knowledge) and strength, and not even to different deductive systems that should be compared for the identification of laws.

In GPC Ramsey presents a completely different account of laws in contrast to the one taken by Lewis as the starting point of his own theory. Ramsey rejects the idea that we could ever arrive at a point where, knowing everything, we could arrange our knowledge in a deductive system, laws playing the role of axioms in such system. Now laws are, following Braithwaite, those generalisations we trust - simplicity is no longer *the* criterion of individuation. Ramsey (GPC, p.249) identifies also a method to recognise *causal laws*: variable hypotheticals like $\forall x(\phi x \supset \psi x)$, whose instances are conditionals of the form $pr \supset q$, where r are facts and q describes events not earlier than those described in pr. This kind of conditionals are those where "if" introduces a *ratio essendi* like in "if p had happened, q would have happened". It is blatant the relation to counterfactual conditionals. Indeed, the counterfactuals a person accepts are those which are instances of causal laws, adhering to the temporal relation between the two clauses, as we will see in ch. 2.

Let us now consider the distinction among different types of variable hypotheticals which will have a crucial role in the study of conditionals: the distinction between laws and chances.

1.2.2 Laws and chances

Ramsey (GPC, p.251) distinguishes variable hypotheticals into laws and chances. The former are of the type "if ϕx, then ψx", while the latter "if ϕx, then probability α for ψx". Chances differ from laws for the probability relation connecting the antecedent with the consequent; indeed «a law is a chance unity», namely the probability relation in this case equals 1. Chances work as laws when we have no possibility of increasing probability to 1 by collecting additional evidence. The temporal restriction for the consequent with respect to the antecedent holds for chances too. Clearly, as laws are not propositions, so neither are chances.

Ramsey explains in his essay *Chance* (1928, p.207) that chances, together

with laws, form a system of beliefs:

> (4) This system of beliefs consists, firstly, of natural laws,
> which are in it believed for certain, although, of course, people
> are not really quite certain of them.
>
> (5) Besides these the system contains various things of this sort:
> when knowing ψx and nothing else relevant, always expect ϕx
> with degree of belief p (what is or is not relevant is also specific
> of the system); which is also written the chance of ϕ given ψ
> is p (if $p = 1$ it is the same of a law). These chances together
> with the laws form a deductive system according to the rules of
> probability, and the actual beliefs of a user of the system should
> approximate to those deduced from a combination of the system
> and the particular knowledge of fact possessed by the user, this
> last being (inexactly) taken as certain.

Chances differ from (known) frequencies in that they do not account for the
actual proportion with which an event has occurred. Namely, the chance of
a coin tossed falling tail is $\frac{1}{2}$, but its frequency might be 1 because it actually
fell tail yesterday.

In C, Ramsey is trying to ground objective probability into subjective
one; however, we have some perplexities about his success. Indeed, chances
are «defined by degrees of belief; but they do not correspond to anyone's
actual degrees of belief». And again, they are «degrees of belief within a
certain system of beliefs and degrees of belief; not those of any actual person,
but in a simplified system to which those of actual people, especially the
speaker, in part approximate». Furthermore, they are said to be objective «in
that everyone agrees about them» (p.208). However, they are also variable
hypotheticals, which can be sources of disagreement among people (GPC,
p.241):

> Variable hypotheticals or *causal laws*[54] form the system with
> which the speaker meets the future; [...] if we meet the future
> with different system we disagree even if the actual future agrees

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[54]My italics. Note also that Ramsey here identifies variable hypotheticals with causal
laws. However, if this were really the case, there would be no need to specify what
characterises causality (p.249). Furthermore, I cannot really see how "All men are mortal"
can be considered a causal law – it does not even respect the temporal restriction. I will
then continue distinguishing laws, causal laws and chances.

> with both so long as it *might* (logically) agree with one but not
> with the other, i.e. so long as we don't believe the same things.

How can everyone agree on chances and at the same time chances be sources
of possible disagreement among people? It might be that Ramsey means an
idealised system of beliefs. However, even though this is probably the case,
we do not see how disagreement could be explained on these grounds.

Ramsey (C, p.207) also suggests that:

> [...] chances together with the laws form a deductive system
> according to the rules of probability, and the actual beliefs of a
> user of the system should approximate to those deduced from a
> combination of the system and the particular knowledge of fact
> possessed by the user [...].

This seems to contradict what said before: here it seems that each "user"
actually has such deductive system, but not necessarily she is aware of it, her
beliefs are inferred from laws and chances together with additional factual
information. But still it is not clear in which sense, then, chances can be
objective. Alternatively, it could be that there is a deductive system shared
by all users, but this something I cannot accept. To my sensibility, the
deductive system an agent has must be subjective in the sense that it can
potentially differ – for its laws and chances – from person to person, and
this is how I will take it to be henceforth. Indeed, laws and chances might
differ according to different experiences, as habits – one of the components
of variable hypotheticals – do. This, however, does not imply that laws and
chances cannot in general be the same among human beings: habits can be
intended as including instincts, and it is plain to think that we do probably
find reasonable and useful many of the same habits, and consequently share
many of the same variable hypotheticals.

I now very briefly consider Ramsey's account of causality before moving
to knowledge, which will help us to better understand Ramsey's famous
footnote for conditionals.

1.2.3 Causality

In GPC (p.245), Ramsey faces «the main question – a question not of
psychological analysis but of metaphysics which is 'Is causation a reality

or a fiction; and, if a fiction, is it useful or misleading, arbitrary or indispensable?'». First, Ramsey discards Mill's idea that we can eliminate generalisations using instead singular propositions of the type "since A, B, C have died, D will also die". Although it might seem appropriate given that, eventually, singular beliefs are those which guide our actions, variable hypotheticals simplify our thought, and are also the grounds of praise and blame. In this sense, as we have seen, when we disagree we are applying different variable hypotheticals, which also determine our degrees of expectation of future events. This, together with Ramsey's subjective theory of probability, implies that the degrees of belief a person could have are limited by the system with which she meets the future, by the variable hypotheticals she holds.

It must still be explained where the idea of causality comes from and why our conducts are largely influenced by it. First, there is a characteristic of causality that, once clarified, could shed light on its peculiar role in our lives, namely why «the deduction of effect from cause is conceived as so radically different from that of cause from effect?» (GPC, p.249). The present can affect the future, but not the past. An explanation that invokes different laws, deriving effects from causes and causes from effects respectively, is not satisfying because, in attempting to explain causality we are involved with an *a priori*, while laws are obtained only *a posteriori*.

Ramsey adopts a Humean explanation of causality[55]: there seems to be this difference between future and past because *we* cannot affect our past. This impossibility to act on our past can be taken as a sign of the "existence" of the past. When we are about to make a decision, we consider first cause and then effect in this order, because this is how we act: «in sequence forward in time [...]. We can produce A or A' which produces B or B' which etc....; the probabilities of A, B are mutually dependent, but *we* come to A first from our present volition» (p.250). We attribute the same impossibility of affecting the past to other people for analogy, applying causal laws to their actions too, so that we can understand these as causes of what comes later.

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[55]Ramsey in endnote 4 of GPC acknowledges the similarity between his own account and Hume's one. Hume was right in arguing that in human minds there is only regularity and not necessity, but then wrong in seeking an "impression" coming from the external world to justify the "idea" of necessity. The point is that "being necessitated" is always a "figure of speech", there is only regularity, and «he [Hume] understood this very well, and gave his readers credit for more intelligence than they display in their literal interpretations».

We get, then, to the heart of the matter (GPC, p.251):

> On the view that we have been explaining, causal necessity
> is not a fact; when we assert a causal law we are asserting not a
> fact, not an infinite conjunction, nor a connection of universals,
> but a variable hypothetical which is not strictly a proposition at
> all, but a formula from which we derive propositions.

Ramsey prevents a possible objection of circularity due to the explanation
of the notion of causality through that of variable hypothetical which might
involve itself causality: there is no causal necessity in the world, but only
regularity. The fact that we assert causal laws, act accordingly, derive propo-
sitions from them, is our regular behaviour as part of the regularity of the
world, but «there is nothing in this beyond the regularity to be called causal-
ity». Therefore, the objection falls because there is in reality no such thing
as causality, but it is our mind that form the notion of causality from the
regularity of the world – our mind included[56].

In one of his notes stored in Pittsburgh[57] he says: «thus in world is
regularity; in mind not merely regularity but a particular sort of regularity
which is called the mind imputing regularity to the world». Note that in
asserting this we are stating another variable hypothetical and consider it as
an instance of causality. There is this feature that all human minds seem to
have, regularity, which gives rise to the idea of causality, and we must assume
that there are few exceptions to this – also because, reasoning causally has
proved so far to be a useful habit we have.

However, we have seen that we can arrive at different variable hypotheti-
cals and different systems. It seems that we can entertain different laws too,
but, again, this is limited by the efficacy of our laws, our habits. Indeed, a
crucial step to know we are "doing well", that we will be successful, and then
increase the relevance of our probabilities, is making experiments.

Judging to what extent Ramsey's explanation of causality is satisfying
is beyond the scope of this discussion, surely circularity - whether vicious or
not - is everywhere present in his explanation and it seems not possible to
get rid of it.

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[56]Whether this explanation is satisfying falls outside the scope of the present enquiry.

[57]*Reconsiderations on causality, probability, etc.*, [002-30-01], written in 1929, the same
year of GPC, in (Galavotti, 2006, 277-8).

This "realistic"[58] account of causality, to which does not correspond any fact in the outer world, will also explain why – according to our interpretation – conditionals are not truth-bearers in Ramsey's view – or, better, the way we use them goes beyond the simple material implication.

1.3   Knowledge

Ramsey endorses a reliabilist account of knowledge and he is often presented as one of the first – or *the* first – to advocate this approach[59]. There are a few papers that attempt to reconstruct his theory of knowledge and integrate it into the debate in contemporary epistemology [60], but it is worth analysing it, mainly for two reasons. First, Ramsey's theory of knowledge, as here presented, is strictly connected to the notions so far discussed (degrees of belief, habits, variable hypotheticals), which, indeed, find a precise and nice arrangement in it. Second, having an account of knowledge will help in outlining Ramsey's account of conditionals, strictly related to variable hypotheticals, and, of course, his epistemology. Moreover, the term "knowledge" appears in Ramsey's footnote on conditionals[61].

Unfortunately, we cannot find a fully developed theory of knowledge in Ramsey's work, not even an entire paper on the topic. However, there are many fragmented pieces which, if put together, can help us to understand his ideas and obtain a satisfying outline of what his theory might have been.

Here we focus specifically on reliability as presented in the note *Knowledge* (1929) and in the draft of the book *On Truth* (1927-1929), trying to elaborate it along the lines sketched by Ramsey. Indeed, in characterising reliability, Ramsey refers also to other concepts which he discusses in other papers, like in TP. We think an interesting account results if we sort all these fragments out.

First, we sketch Ramsey's account of knowledge as given in K and OT,

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[58]This is how Ramsey (GPC, p.252) defines his approach to causality. A pervasive aspect of Ramsey's attitude towards philosophy, as stressed by Methven (2015).

[59]cf. Goldman (1986, 44) and Goldman and Beddor (2016).

[60]Cf. Sahlin (1991) for a detailed reconstruction, Grandy (1980) for a comparison to more recent (reliabilist) theories and Olsson (2004) for some objections to Ramsey's account.

[61]This does not mean that we are committed to interpret "adding *p* hypothetically to their stock of knowledge" literally - it might well be the case that "stock of knowledge" would be better understood as "stock of belief", but we cannot *a priori* discard the possibility that the antecedent of a conditional should be hypothetically treated as knowledge.

trying to let it fit into the contemporary epistemological discussion and classification of epistemological theories. Then, we turn to reliability, analysing also those papers where Ramsey is not primarily concerned with knowledge, but where some useful concepts are introduced. Finally, we discuss two main problems Ramsey's theory, as here interpreted, faces and two famous problems it seems to solve.

In both K and OT, Ramsey lays down a tripartite definition of knowledge. But in K, an additional and very interesting conditional requirement (IV), which connects the (II) and the (III), conditions is stated. We then present this version.

To count as knowledge a belief

(I) must be true;

(II) must be certain;

(III) must be obtained by a reliable process.

Additionally

(IV) we must remain certain of our belief, and then we are allowed to consider it knowledge, if and only if were we to reflect on the way it has been obtained, we would think that way reliable.

Concerning the first requirement, we do not have a complete theory of truth and a clear statement of truth-conditions in Ramsey's work. For these reasons I leave it open to be filled with whatever truth-conditions one desires[62].

The second condition concerns certainty: a belief is knowledge if, beyond being true, the subject is certain of it. However, it is not necessary that the degree of belief equals 1, it can also be slightly lower. Ramsey talks about "practical certainty" (OT, p.63), a certainty that is not complete since our ways to obtain beliefs, and then knowledge, may be fallible and sometimes lead to falsity. This second condition is strictly related to the third one, because Ramsey connects the degree of certainty a subject should have in a judgment to the reliability of the method by which it is obtained[63].

The reliability requirement is discussed more in depth in the next section, then a brief explanation is sufficient for the moment. "Reliable process" refers

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[62]I recall that I have briefly discussed truth in §1.1.

[63]Point (ii) might be problematic, as stressed by Methven and Sisti (2020), who propose an alternative where the second requirement asks only to have a degree of belief > 0.5.

to all different possible processes of acquiring beliefs recognised by Ramsey in OT, TP, but also in note [004-10-01] in Galavotti (2006, 104-22): perception, memory and inference[64]. Processes are reliable in that, very roughly, they lead to truth most of the times, and they are causal, trains of causation (cf. K, p.258), caused not by beliefs but by perceptual experiences («what are not beliefs in a way» – this is our interpretation of this highly ambiguous sentence) and involving – if any – exclusively true beliefs. This is a very approximate explanation, but we shall take it as such for the moment.

Ramsey's account can be classified as a causal-reliabilist one, given that the belief considered knowledge must be *caused* by perceptual experience, and obtained through reliable causal processes. This also throws light on another implicit - in K, but explicit in OT - assumption: there are forms of knowledge for which no justification is needed[65]. Ramsey distinguishes between *direct* knowledge, namely not justified by argument, and *indirect* knowledge, grounded on what we directly know and obtained by argument. But processes of acquiring direct knowledge can sometimes lead us to false belief and error, as when someone has hallucinations. Consequently indirect knowledge, which, as said, is ultimately based on direct knowledge, is fallible too[66].

Ramsey's account can then be considered a fallibilist and foundationalist one: foundationalist since he divides the beliefs (or judgments) into basic, not needing support of other beliefs, and non-basic, which, on the contrary, do need support from other beliefs. It is fallibilist because, as we have seen, the possibility of error is allowed: the processes – i.e. inference, memory or perception – are all fallible, therefore the judgments obtained through them

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[64] Actually in OT Ramsey considers also the "self-evidential truth" form of knowledge. It refers to truths like the axiom of parallels, or the uniqueness of time system (cf. OT, p.61). But since Ramsey ascribes absolute certainty to beliefs obtained by this method, we do not consider them here. Ramsey uses both "observation" and "perception", we choose to use this latter for its wider scope.

[65] cf. endnote 6, OT, 6. He holds this distinction, but it does not mean that reliability does not apply to them too. Here "justification" has to understood as "justified by argument".

[66] Ramsey debates this topic in OT because he wants to refute the identification of knowledge with apprehension, as claimed by J. Cook Wilson, *Statement and Inference* (1926), an Oxonian Professor of Philosophy, whose theory of knowledge is the object of Ramsey's strongest critiques. Apprehension is knowledge constituted only by infallible judgments, namely judgments that *cannot* be false, since «in them the mind is apprehending a fact, and were there is no such fact, there would be not a false judgment but no judgment at all» (OT, p.56).

can sometimes be false.

Olsson (2004, 554) argues that Ramsey is committed to fallibilism since he is primarily committed to corrigibilism. Namely, since we have to allow that people can reject what once taken to be known in the face of new collected evidence, *then* the certainty of requirement (II) must not be interpreted as full certainty (i.e. degree of belief equal to 1) – we are all accountable of errors. However, it might also be that, since reasonable degree of belief are defined as "proportion of cases in which the habit leads to truth" (RDB, p.199), there is no habit that leads to truth in every occasion. It seems plausible to hold that none of the habits used by humans grants 100% of success. Consequently, fallibilsm might be primarily justified by this assumption, and not by the endorsment of corrigibilism.

We still have to consider the additional condition (IV), which, as anticipated, ties together the requirements (II) and (III) tightly. This is the condition that distinguishes knowledge from simple certainty. Note that this condition does not require that the subject actually reflects, every time, on the reliability of the process, but only that, if she were to reflect on it, she would adjust her degrees of belief according to her evaluation of the reliability of the process used to obtain the belief[67].

This internalist addition clearly prevents the classification of Ramsey's account as externalist *simpliciter*. But what is really interesting is that Ramsey suggests how to evaluate processes and determine whether they are reliable or not. There are hints contained in OT and K which point at the notions of habit and variable hypothetical. These two notions are discussed in two papers respectively: TP and GPC.

Concerning scientific knowledge, Ramsey, when facing the problem of two agents' systems differing but fitting in the same way all the data, recalls Peirce's notion of truth (GPC, p.253)[68]:

> We do, however, believe that the system is uniquely determined and that long enough investigation will lead us all to it.

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[67]One might ask whether this "has been obtained" refers to the way the belief has actually been obtained or the way we believe it has been obtained. This point is really subtle and it is also really hard to distinguish between the two options, viz. the "actual way" and the way someone thinks his belief has been obtained. I think that the second option is less problematic as an interpretation of Ramsey's words, as the use of the same subject «we say [...] if we did reflect [...] we should remain certain [...] if, and only if we thought our way reliable» (K, p.258) seems to suggest – cf. also next section.).

[68]Whether Peirce actually held this view it is not relevant for the present discussion.

> This is Peirce' notion of truth as what everyone will believe in
> the end; it does not apply to the truthful statements of matters
> of fact, but to the 'true scientific system'.

This passage comes after an example explaining the importance of carrying on doing experiments to obtain more correct rules of judgements and better working systems of beliefs. We already know that habits are evaluated according to how they work, hence, between two agents having two different systems to meet the future, the one who has collected more evidences in favour of his system would probably be more successful in his actions[69], or at least we must think so and act accordingly, as this were a normative principle[70]. This could explain also those cases in which we consider people silly for what they believe or when we simply disagree with someone – we would simply be referring to different systems and to different variable hypotheticals.

1.3.1   Reliability

Unfortunately, the works where Ramsey directly faces knowledge and its features are all incomplete. But fortunately, the characters attributed to knowledge are the same throughout these fragments, as the idea that reliability of methods is related to probability – not to the subjective interpretation of probability for which Ramsey is known, but to the frequentist approach.

We have seen that Ramsey's account is fallibilist, namely there is the possibility that what we consider knowledge turns out, at a certain point, false, because the methods by which we obtain it are themselves fallible [71]. As Ramsey (OT, p.58) puts it:

> The truth is that we accept as giving knowledge any argument
> *of sufficiently high probability*: a confident judgment based on

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[69]Assuming that he is reasonable. Indeed, this would mean that his methods are more reliable.

[70]Namely, we must believe that there will be only one system as the "true scientific system" and that collecting evidence will lead us to it. Ideally, we will arrive at it once we are answered all possible questions.

[71]A special case, however, is that of mathematical and logical judgments (self-evidential truths): the fact that they are tautologies let stand these two disciplines apart from all other forms and judgments of knowledge. For this reason, we do not focus on them here.

> such an argument from *known premises*[72] is regarded as knowl-
> edge when, *as is usually the case*, it is true[73].

And as endnote to "sufficiently high probability" Ramsey (endnote 7, Ch. IV) writes : «what is meant by an argument of high probability will be discusses in Ch. ...[74] Roughly it is an argument of a kind which when applied to true premisses *nearly always* gives true conclusions.» .

Probability is introduced and, clearly, is not subjective probability, as the adverb "usually" points out. Indeed, in RDB (p.202) this adverb is connected to the idea of reasonableness: «would it be reasonable to think p?» means, Ramsey explains, «Is p what *usually*[75] happens in such case?». Reasonable degrees of belief are defined by the frequency with which a habit leads to true judgments. The term "usually" is then used as a synonym of "reasonable". Clearly "reasonable" is a vague term, because it depends on what a person think to be relevant and it is, then, extremely subjective. Indeed, the thinker selects automatically what he considers relevant and cannot dismiss it, as he cannot use what he "feels" irrelevant (p. 203). This fact highlights one of the problems of Ramsey's account of reliability, and knowledge, which we discuss in the next section. But there is an intuitive objective sense in which we use "usually" as referring to frequencies.

There are two other expressions used by Ramsey in the aforementioned passage from OT which are worth considering. The first is "known premises": the premises, from which our reliable process moves, must be known, and this is important in order to avoid all the cases where knowledge is ascribed "accidentally". Namely, cases that we, following common sense, would not consider knowledge but which satisfy the requirements[76]. If we add that the premises must not only be certain but also true and obtained through a reliable process involving only true beliefs, this cannot happen. There is no infinite regress because, as we have seen in the previous section, Ramsey divides knowledge in direct and indirect and the direct one needs no support from other beliefs to be justified.

However, this should not suggest that the same evaluation of reliabil-

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[72]The "known premises" should not be intended exclusively as a result of direct knowledge, they can be whatever we already know, also obtained by argument. In any case, all knowledge is ultimately grounded on direct one.

[73]All italics are mine

[74]This is a reference to a chapter which Ramsey had not time to write.

[75]My italics

[76]E.g. Gettier's examples – see next section.

ity does not apply to these types of knowledge[77]; the "proportion of cases" provides a justification for their reliability too, justification which involves the notions of habit and that of variable hypothetical. Indeed «to think the way reliable is simply to formulate in a *variable hypothetical* the *habit*[78] of following the way» (K, p.258).

Let us focus on this short sentence. First, as we already know, all the ways, reliable or not, by which we obtain beliefs are habits, processes we habitually perform to acquire new beliefs. And habits are evaluated for how they work, depending on whether the degrees of belief they produce reflect the proportion of cases in which they have led to truth[79]. A reasonable habit would then be one which produces an exact correspondence between frequency and degree of belief, and, since reliable are those habits which usually lead to truth, they also are expected to produce a degree of belief very close to one. Second, the habits we think reliable are "translated" into variable hypotheticals, rules for judging. Then, reliable habits should assume, in a person's mind, this structure: "if I meet a ϕ I shall judge it a ψ".

There can be two interpretations of the meaning of "formulate" used in K (p.258). Olsson (2004, 550) holds that – in order to maintain consistency with Ramsey's (IV) requirement, we are forced to interpret "formulate" as "judging" and not merely as "thinking", because «to judge something reliable cannot, therefore, be merely to formulate a habit». Olsson is right in claiming that "formulate" cannot mean "thinking", but wrong in holding that that is what Ramsey incorrectly means. Indeed, if we recall how variable hypotheticals are defined and what their features are, we find out that they are the source of disagreement. This means that in order to considering a way reliable the agent must have endorsed the corresponding variable hypothetical – not even just have judged it reliable. Namely, she must have adopted the habit and, given its reliability[80], have transformed (consciously

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[77]For instance, (OT, p.63): «does the fact that men are *occasionally* the victims of illusions mean that I have no right to be certain that what I see is indeed a book case? [...] illusions are so *infrequent* that it is far best for men to be certain that their judgments of perception are true, and act accordingly» (Italics mine). But also, in TP (p. 196) after having explained how habits are evaluated: «This account can be applied not only to habits of inference but also to habits of observation and memory».

[78]My italics

[79]Consider also that induction is said (TP, p.197) to be "a reliable process" because «the world is so constituted that inductive arguments lead on the whole to true opinions».

[80]I am always considering a fully rational – or reasonable – (ideal) thinker. This account of knowledge is not descriptive, but normative.

or unconsciously) it into a rule for judging, part of the system through which she meets the future. I suggest that the agent must not necessarily be aware of the rules she has adopted, since the fact that she has adopted them and that she is rational imply their reliability – condition (IV) is expressed using subjunctive mood. Moreover, it seems that one has to endorse a habit to judge it reliable, otherwise he would presumably disagree on its results (beliefs it produces in someone who, instead, has endorsed it). Not even in this case, though, the endorsement must be conscious. Indeed: «It is possible that what determines how we should act determines us also directly and indirectly to have a correct opinion as to how we should act, without its ever coming to consciousness» (TP, p.171).

Considering all of the above and our discussion of variable hypotheticals in the previous chapter, a nice distinction between variable hypotheticals that lead to beliefs and those which lead to knowledge can be proposed. A habit is evaluated according to the number of cases in which it has produced true beliefs in the past, or, alternatively according to the degree of belief it produces and whether it reflects the frequency that habit actually led to truth. If the degree of belief has to be very high (close to 1) to satisfy the second requirement of knowledge, then the habit must quite always have led to truth. We know that a chance of a ψ being a ϕ equals a real number, but it equals 1 in the case it is a law[81]. This means that the reliable ways to acquire knowledge are those variable hypotheticals which express laws or chances where the probability relation is very close to 1. All the other variable hypotheticals give rise to beliefs[82].

1.3.2 Problems

In this section two main problems of Ramsey's theory of knowledge as here presented are discussed. I only suggest possible solutions, since I am not here primarily concerned with Ramsey's theory of knowledge, but I need it is a good framework for Ramsey's account of conditionals.

On the other hand, I show that two famous problems, Gettier's coun-

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[81]Note, however, that Ramsey (C, p.207) holds that not even laws are believed for certain: «people are not really quite certain of the [laws]».

[82]Since Methven and Sisti (2020) characterise the second requirement differently, viz. not certainty is required but a degree of belief over 0.5, this distinction does not apply to this version of the theory – reliable methods can simply be chances where the probability relation is > 0.5.

terexample and BonJour's Norman case, seem avoided. The former concerns theories of knowledge as true justified belief, the latter externalist theories.

The first problem this theory faces concerns reliability. Collected evidence seems necessary for a process to count as reliable, but this might be problematic. Namely, if a habit is defined as reliable only in relation to past experience, what if we have no past experience of that habit[83]? Can we ascribe knowledge to a new born, who clearly cannot have sufficient collected evidence to evaluate his ways of forming beliefs? Let us consider what Ramsey (TP, p.196) says about the habits of observation and memory:

> This account can be applied not only to habits of inference but also to habits of observation and memory; when we have a certain feeling in connection with an image we think the image represents something which actually happened to us, but we may not be sure about it; the degree of direct confidence in our memory varies. If we ask what is the best degree of confidence to place in a certain specific memory feeling, the answer must depend on how often when that feeling occurs the event whose image it attaches to has actually taken place.

It is suggested that for each different feeling of memory there should be past experience in order to evaluate it, but of course there can be feelings[84] we have never experienced before. Probably Ramsey in TP is not really worried about the practical evaluation of habits. He acknowledges the possible general difficulty in finding the actual proportion of cases, but he proposes a solution that seems to complicate the situation. Indeed, in RDB (p.199) Ramsey says that when it is impossible to take the actual habit «we then look to wider habit of forming such a habit», those «very general habits of which there are so many instances». The question remains and now we have also a regress which we do not know how to stop: we need general habits to

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[83]The fact that it is not necessary for the agent to reflect on the habit to judge it reliable and adopt it does not solve the problem. Indeed, given that he is rational, the fact that he has adopted it means that – even unconsciously – it has led to truth in the past.

[84]I do not believe that there are, or at least I do not see, all these different feelings of memory Ramsey sees: if each memory is different and relies on a different habit, remembering what you eat today would then be different from remembering when Italy won the World cup in 2006. I do not see any difference between these memories, except from the content and the feelings that accompany the two; feelings which, however, I think are not the ones Ramsey is referring to when he speaks of "feeling of memory" – this rather seems a way to talk about the act of remembering *tout court*.

evaluate other habits, but how do we evaluate those general habits? Moreover, how do we know which are the more general habits?

One possible solution is taking some methods as not needing a justification for their reliability and directly giving knowledge. For instance, we could say that perception is reliable *tout court*, without reflecting on collected experience, because it is somehow instinctive. But we have seen that Ramsey applies the same criteria of evaluation to the reliability of those habits that produce direct knowledge, and there would be no point in doing so if they were reliable at first. Second, if they would need no justification for their reliability, the (IV) condition should be read differently according to different possible methods. Namely, we should hold that, in some cases, requirement (IV) starts to count from a later, undefined, moment.

In endnote 6 in OT (p.65) Ramsey discusses the idea of having no justification for the reliability of direct knowledge: «this term [well-grounded] is meant to include so-called direct knowledge for which no grounds are supposed to be needed; it might be more accurate to say 'not insufficiently grounded', but this seems a needless pedantry.[85]». It is not clear if Ramsey is here referring to his own or to someone else's idea. However, also in this work Ramsey makes examples which appeal to past experiences to justify the reliability of our perceptions[86].

We then have two options: we may think that direct knowledge needs no justification, and ignore what Ramsey says about past experiences and habits of memory and observation; or we may consider the possibility that knowledge can be ascribed only after a while, and that a baby does not have knowledge since he has not collected enough experiences. This dilemma is faced by Ramsey in note [004-10-01, 106], though here he is primarily concerned with our knowledge about other people's mental states:

> For if a baby can see its mother smile, and know she is pleased,
> as perhaps it can, we can hardly suppose this to be causally dependent on past observations of itself smiling when pleased, for
> it would only notice what it feels like to smile, and we should
> have to credit it with *instinctive knowledge*[87] of what sort of visual appearance was correlated with the feeling of smiling. Why

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[85]The term "well-grounded" corresponds to the condition (III) and the idea of reliable process of K (endnote 6, OT, p. 65)

[86]e.g. OT (p.63).

[87]My italics.

should the baby not connect instinctively certain feelings and
visual sense data? But even if the baby's belief is not depen-
dent on past observations then it is unjustified ∴ not knowledge
∴ not what we are talking about. Then you must hold that the
justification comes later [...][88]

It is not totally clear what position Ramsey is here holding, but if we allow
for no justification on past experience for certain types of knowledge his
account splits into two accounts. For this reason, we think that the idea
of later justification would give a nicer and unified account, closer to our
intuition, and coherent through Ramsey's works.

Along the same lines, Ramsey (004-10-01) argues for knowledge of other
people. Suppose that you hear a noise and see that Ellen is angry: in this
case your belief "Ellen is angry" is caused by the noise and based on your
seeing her[89]. So once you know what you see, you can *infer* from that that
Ellen is angry. This constitutes knowledge of her anger if your belief is true,
you are (almost) certain of it, and the process you used to arrive at it is
reliable. If your inferred beliefs in past occasions have revealed to be true
(whatever true might mean) then you can say that you know other people's
mental states – in particular that Ellen is angry. The idea is to «use my
experience to forecast their action» ([005-18-02], 68). Ramsey's refutation of
solipsism revolves around the vagueness of the term "me": for a solipsist it
must have a «precise and fundamental use», which, in fact, it cannot have.
Indeed, the definition of " "me" includes three elements: physical identity,
memory and temporal continuity of experience; and we use the term vaguely
or definitely, sometimes meaning the first element, sometimes the others.

However, there is another problem related to the fact that reliability is
based on past experience, which might push Ramsey's account towards a
certain kind of solipsism. This is the second problem this theory faces. It
seems that each person is allowed to have different habits and consequently
different reliable ways to arrive at knowledge, which would all be justified.
Since a reliable way is one that in the past has led to truth, whatever process
has led to truth in the experience of an individual can be classified as reliable.

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[88]This last argument can maybe also be interpreted as Ramsey making a distinction
between propositional and non-propositional knowledge – the baby not having the former
type. I thank S.Methven for this suggestion.

[89]Ramsey attempts an explanation of "based on", but it is not conclusive and rather not
satisfying. I then just leave it as it is.

Consider this example:

> Billie has a 12 years old cat called Mr Umbrella. She is also
> a great supporter of Liverpool football team - she never misses a
> match. Billie feeds Mr Umbrella in the morning, always offering
> him two options: fish or meat - Mr Umbrella is a really choosy
> and spoilt cat. Some years ago, she started noticing a correla-
> tion between Mr Umbrella's choices and the Liverpool results.
> Whenever Mr Umbrella ate meat in the morning of the day of
> a Liverpool match, Liverpool usually won. When, instead, he
> ate fish Liverpool lost. But, as said, Mr Umbrella is a spoilt
> cat, so he sometimes ate both. When that happened Liverpool
> drew. After observing many occasions when this happened, Billie
> thought that her cat had peculiar capacities and trusted him so
> much that she started gambling on Liverpool results, following
> his food preferences on the morning of the match. So far, she
> has won 90% of these bets. For Billie, Mr Umbrella's behaviour
> has proved to be a reliable way to know the results of Liverpool
> matches in advance.

It seems that for Billie, according to Ramsey's account, Mr Umbrella's
food preferences are a reliable way to obtain knowledge. She is certain of
it because, even if she were to reflect on her past experiences, she would
find that in the large majority of cases Mr umbrella's behaviour led her to
truth. Of course, this can explain very well why people believe and consider
knowledge beliefs that it is hard to accept as such[90] or why we believed in
Aristotle's astronomy.

Thus, the definition of knowledge and the evaluation of reliability that
or interpretation of Ramsey's work suggests are strictly, excessively, related
to personal experience, forcing us to consider as knowledge beliefs that in-
tuitively we would not[91]. Probably, to Ramsey this would not sound as a

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[90]Another nice example would be that of the "modern flat Earth theories". We say that
they believe the Earth is flat, but they probably would say they *know* it is, since their
experience proves it – like our common sense seems to suggest. There could be ways to
show that they are justified in doing so following Ramsey's theory.

[91]This is related to Wittgenstein's idea that to obey a rule is not something private
(Wittgenstein, 1953, §202). Also, for a discussion of Wittgenstein's "rule-following" com-
pared to Ramsey's "rules for judging" we refer to Methven (2015, pp.45-49; pp.232-35)
and Holton and Price (2003).

real problem; for instance, he does not exclude that there can be more useful habits than those we have[92]. It is also true that our similarity as human beings might in some sense guarantee the development of the same habits and reliable ways to acquire knowledge.

One possible way out from this problem is to argue that Billie is not acting reasonably because she does not take into account other people's experiences, which must constitute part of her own experience. Indeed, as Ramsey ([005-18-02], p.75) points out

> Other people's experiences are [real], almost as much as my own. Thought of them determines my action as much as thought about my own future. Is it not clear? They are on the level of my own past and future; or shall we say future for I cannot remember them. If I can expect, I can think of others[93].

Hence, Billie is evaluating the reliability of her method in a spoilt way, not considering that it would be one of the few cases (if not the only one) in history where a cat forecasts the results of football matches.

We now arrive at the problems this theory solves. Sahlin (1990, p.93) shows how Ramsey's theory of knowledge overcomes some types of Gettier problems. We briefly discuss Gettier's Smith-case to see why Sahlin is right.

The Smith example in Gettier (1963) is not a case of knowledge because in the causal chain which leads Smith to infer and believe (h) "either Jones owns a Ford or Brown is in Barcelona" false beliefs occur. More precisely, one of the premise of the inference is false[94]: Jones does not own a Ford.

However, Ramsey's theory as here presented does not overcome Russell's example of the stopped clock. Indeed, given how we have defined reliability, the clock and the subject's observation have to be considered reliable in this case – unless there had been previous cases of the clock malfunctioning or of the person having visual hallucinations, but this is another story. Furthermore, there is no (explicit) false belief involved in the process that leads our subject to believe that what he sees is true, although the clock is actually broken. Of course, there must be an implicit belief involved about the clock

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[92]Consider the idea, discussed in TP, that a person without induction would be unreasonable in the sense that he would not have a very useful habit.

[93]Note that this could be intended also as an argument against solipsism.

[94]If we want to be even stricter, remember that Ramsey claims that the premises of an inference must be *known.*

being well-functioning – which would clearly be false. In this case, the example would be blocked. But, as it is, there are not enough information to prevent it.

Finally, we turn to BonJour (1980, p.62)'s Norman example.

> Norman, under certain conditions that usually obtain, is a completely reliable clairvoyant with respect to certain kinds of subject matter. He possesses no evidence or reasons of any kind for or against the general possibility of such a cognitive power, or for or against the thesis that he possesses it. One day Norman comes to believe that the President is in New York City, though he has no evidence either for or against this belief. In fact the belief is true and results from his clairvoyant power, under circumstances in which it is completely reliable.

There is one main problem in this example according to Ramsey's theory of knowledge. Although it is said that Norman is a *reliable* clairvoyant, it is also said that he has no reason for or against clairvoyance. But in this case, the (IV) requirement is not satisfied, because if Norman were to reflect on the method by which he has arrived at his belief that the President is in New York, he would find that he has no reason to judge it reliable. Indeed, from the example, it seems that he has no collected evidence in favour of its reliability since he also does not have any evidence of having it. Therefore, the belief would be true, believed at a high degree and perhaps obtained by a reliable process, but, if Norman had reflected on this latter, he would have lowered his degree of belief or dismissed it, because he would not have enough evidence for its reliability. Hence, we conclude that Norman does not know that the President is in New York City.

Chapter summary

In this chapter I have presented Ramsey's epistemology, from his account of belief to his theory of knowledge. Through an analysis of his texts, we have seen that although pragmatism has a strong influence on his thought, many of his choices are motivated by an attitude towards philosophy he has always displayed. In general, I think that too quickly many labels have been traditionally, but sometimes wrongly, attached to him, perhaps due to an attempt to settle an on-going and restless thought, too often briefly sketched

in some notes.

The results of this chapter, essential for the understanding of what follows, concern mainly the subjectivist characterisation of degrees of belief and, in particular, of conditional probability; the frequentist evaluation of habits and the role of variable hypotheticals as rules for judging and source of agreement and disagreement; and the reliabilist account of knowledge, where reliability is defined through habits and variable hypotheticals.

Chapter 2

Ramsey on conditionals

In the previous chapter I presented Ramsey's epistemology, within which Ramsey's account of conditionals is set.

In the literature on conditionals, the *Ramsey test* denotes a procedure to evaluate conditional sentences and, more recently, a recipe to revise beliefs. All the versions of the test are based on a footnote in GPC (fn.1, p.247).

The first time Ramsey's footnote has been mentioned in a work on conditionals is in a paper on counterfactuals by Chisholm (1946, p.298). Chisholm cites the first sentence of the footnote «If two people are arguing 'If p will q?' and are both in doubt as to p, they are adding p hypothetically to their stock of knowledge and arguing on that basis about q». However, what has become the "orthodox" interpretation[1] reads the footnote as proposing a procedure to evaluate *only* and *solely* indicative conditionals, which does not rely on material implication. Given this, it is commonly believed that Ramsey does not attach truth values to conditional statements and that he does not have a theory of counterfactual conditionals. In this chapter I show that both these assumptions are ungrounded.

I start by considering the famous footnote in GPC and the notions there involved. Conditional probability is one of these, and, since it also the main argument for the orthodox interpretation, I go back to TP where it is first defined. This definition requires to abandon the idea that, in Ramsey, conditional probability covers indicatives *tout court*, in order to prevent an inconsistency between GPC and TP. Moreover, it suggests that Ramsey does not discard the material implication analysis of conditional statements. With

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[1]From the Sixties on, see the next section.

additional textual evidence, I show that our interpretation is in fact coherent throughout Ramsey's work.

I then consider the context where the famous footnote is introduced, what I call "the cake example". In this example, Ramsey shows how two agents can disagree on what will happen or would have happened, given certain circumstances, although the same material implication is true for both. Counterfactuals, in particular, are very often asserted to express praise or blame. But they also have a tight relation with causal laws.

I continue the discussion of Ramsey's account of counterfactuals resorting to another note, *The meaning of hypothetical propositions* (MHP), that, to our knowledge, has never been considered before – neither in the literature on conditionals nor in works on Ramsey's philosophy. What emerges is a developed account of some types of conditional sentences.

Finally, MHP gives us also the chance to discuss the distinction between indicative and subjunctive conditionals, that seems not to play a role in Ramsey. But he gives an explanation of the linguistic difference, providing an Oswald-Kennedy type example.

Before starting with the analysis of the footnote, there are a few remarks to make with respect to some words and symbols employed in this chapter. First, I will use the term "meaning" in a broad sense, because this is the word Ramsey uses for his analysis of conditionals – i.e. it is the analysis of their meaning. This, of course, does not coincide classically with the truth conditions of conditionals. It roughly expresses the information and the beliefs a speaker conveys in asserting a conditional. Second, I will use "⊃" for the formalisation of both variable hypotheticals and conditionals, following Ramsey's notation. However, this does not represent the material implication, since both variable hypotheticals (as we know) and conditional sentences do not express classical propositions[2]. Third, we will use "doubtful" interchangeably with "uncertain" referring to propositions. By "being uncertain" or "being doubtful" we mean that the degree of belief in a given proposition is neither 0 nor 1, but something in between.

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[2]Actually, conditional sentences can be regarded as propositions if we are interested in their truth values. But, in general, they do not coincide with material implication - consider the fact that we accept some counterfactuals and reject others, although they are all classically true.

2.1 The footnote

The name of Frank Ramsey in conditional studies is associated with the so-called *Ramsey test*, a procedure to evaluate conditionals. Different versions have been proposed through the years, but they are all based on this footnote in GPC (p.247):

> If two people are arguing 'If p will q?' and are both in doubt as to p, they are adding p hypothetically to their stock of knowledge and arguing on that basis about q; so that in a sense 'If p, q' and 'If p, $\overline{q}$' are contradictories. We can say they are fixing their degrees of belief of belief in q given p. If p turns out false, their degrees of belief are rendered *void*. If either party believes $\overline{p}$ for certain, the question ceases to mean anything to him except as a question about what follows from certain laws and hypotheses.

In the literature on conditionals, however, the footnote is rarely cited entirely, the focus is usually on the first two sentences. If we follow this path, we are naturally lead to think that Ramsey proposes a probabilistic account for (indicative) conditionals. Consider, for instance, Adams (1975, p.3):

> The fundamental assumption of this work is: *the probability of an indicative conditional of the form "if A is the case then B is the case" is a conditional probability.* This assumption, which has been suggested and then apparently abandoned[3] by such authors as Ramsey and Jeffrey, is that the probability of "if A then B" should equal the *ratio* of the probability of "A and B" of the probability of A (ratio of conjunction of antecedent and consequent to antecedent).

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Adams takes Ramsey's suggestion concerning degrees of belief seriously and develops a probabilistic logic, where an indicative conditional "if p then q" is accepted by an agent if his degree of belief in q given p is high, close to 1. The "degree of belief in q given p" is defined by conditional probability:

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[3]It is not clear what Adams is here referring to. *General propositions and causality* is one of the last paper written by Ramsey and, to my knowledge, the last one where he discusses conditional sentences. I do not know where he proved to have changed his mind.

$$P(q \mid p) = \frac{P(p \wedge q)}{P(p)}, \text{ if } P(p) > 0.$$

Indeed, in TP (p.180) Ramsey introduces conditional probability to define "the degree of belief in q given p"[4].

According to Adams' reading, we have that[5]:

$$P(\text{if } p \text{ then } q) = P(q \mid p)$$

It follows that whenever the antecedent p has probability equal to 0, namely is known to be false, the conditional probability is undefined. This feature clearly excludes counterfactuals, whose antecedents are "contrary-to-fact"[6].

Following Adams, Edgington (1995, p.264) too cites part of the footnote to show that Ramsey supports what is today known as *the Thesis* or *the Equation* – i.e. $P(\text{if } p \text{ then } q) = P(q \mid p)$. The fact that conditional probability is undefined when the probability of the antecedent equals zero is thus supposed to be a specific feature of indicatives – viz. we do not use the indicative mood to express counterfactual situation. She also stresses, Edgington (1995, 2005), that Ramsey's footnote covers solely cases of uncertainty, which occur very often in every day life. She embraces Adams' idea that conditional probability determines the acceptability of indicatives, which means that the footnote must be extended if we want it to cover also other cases[7].

Stalnaker (1968, p.101) restates Ramsey's footnote in this way: «add the antecedent (hypothetically) to your stock of knowledge (or beliefs), and

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[4]I have discussed this in ch. 1, §1.1.1.

[5]Sometimes it is also written as $Bel(\text{if } p \text{ then } q) = P(q \mid p)$, where Bel stands for "degree of belief". However, we have seen from the previous quotation that Adams speaks of probability of an indicative conditional", so I decided to conform to his formulation.

[6]There are several attempts to extend the probabilistic approach to cover also counterfactuals, e.g. Skyrms (1981) introduces prior propensities instead of present subjective probabilities. Leitgeb (2012a,b) adopts Popper's view and makes conditional probability a primitive notion expressing objective chance for singular cases. Adams (1975) uses prior probabilities.

[7]The label "indicatives" includes also cases other than the totally uncertain ones. Indeed, the antecedent might be uncertain and the consequent true, false or uncertain. Or, the antecedent might be true and the consequent, again, true, false or uncertain. Notice that, although grammatically the subjunctive form is usually preferred (at least in English and Italian), counterfactuals are sometimes expressed in the indicative mood, usually to stress the absurdity of the antecedent, e.g. "if you are a philosopher, then I am a wizard".

then consider whether or not the consequent is true»; however «Ramsey's suggestion covers only the situation in which you have no opinion about the truth value of the antecedent.». He then needs to develop a possible world semantics in order to evaluate all conditional sentences, including counterfactuals.

Lewis (1973, fn.2, p.70) says that «F.P. Ramsey in *Foundations* (Routledge & Kegan Paul: London, 1978): 143, mentions such thought experiments, but he seems to have in mind assertability conditions for indicative conditionals rather than counterfactuals».

More recently, the footnote has been used also as a recipe for belief revision. This is the version proposed by Gärdenfors (1986, p.81)

> Accept a proposition of the form 'if A then C' in a state of belief K if and only if the minimal change of K needed to accept A also requires accepting C.

Despite the theories developed are different, they all have in common these assumptions: first, Ramsey and Ramsey's footnote cover only one specific type of conditionals (whether indicatives or indicatives with uncertain antecedents depends on the interpretation). In this chapter I reject this idea, showing that Ramsey does not discuss only one type of conditionals, neither in his works nor even in the footnote. The second assumption is that there is not much to be found in Ramsey and in his footnote about counterfactuals. For instance, Bennett (2003, pp.29-30) claims that «Ramsey test thesis does not hold for subjunctive conditionals» and Edgington, in MacBride et al. (2019), «there are a few remarks about counterfactuals in Ramsey's paper but no settled view of them is presented». This is wrong, and I show that an account of counterfactuals can be recovered from Ramsey's works. Third, due to the reference to conditional probability, Ramsey is considered a supporter of a no-truth-value approach to conditionals. I think this is too strong, Ramsey does not reject the classical material implication but he understands that it is insufficient to account for the epistemology and pragmatics of conditionals. This clearly does not mean that truth values cannot or should not be attached to conditional statements, they should be regarded as material implications if we are interested in evaluating their truth. These three points define what I call the "orthodox interpretation".

Taken alone, the footnote is vague and open to different interpretations.

Nonetheless, I think that it contains in a nutshell Ramsey's account of conditionals, of all types[8]. My aim in the next section is to clarify the first part of it, focusing on the application of conditional probability.

2.1.1   Conditional probability

I here discuss the first part of Ramsey's footnote, the one concerning conditional probability. As we have seen, this is the part usually cited and the reason why the supporters of the probabilistic approach to indicative conditionals see Ramsey as their predecessor.

The situation described in the footnote is about two people wondering "If p will q?", who are «both in doubt as to p». Namely, none of them has an idea concerning the truth value of p, none of them knows whether p is true or false. This suggests the reading first pointed out by Stalnaker (1968, p.101), where the test, as it is, applies only to conditionals with uncertain antecedents.

Ramsey goes on explaining how people *decide* whether "if p then q" will be the case: «they are adding p hypothetically to their stock of knowledge and arguing on that basis about q». If the truth value of p is uncertain, the only way to proceed is to treat it *as if* it were known – which means, according to the characterisation of knowledge we have given in ch.1, that p is *supposed* to be true, certain and obtained by a reliable process. Furthermore, if the subject were to reflect on the process he would remain certain of p, only if he judged the process reliable. Notice that p is added *hypothetically*, it is *supposed* to be known[9]. This casts doubts on the belief-revision use of Ramsey's footnote, as Edgington, in MacBride et al. (2019), points out. Indeed, in belief revision theories like Gärdenfors', the Ramsey test is interpreted as assessing that a conditional "if p then q" is accepted if *accepting* the antecedent implies accepting the consequent (See ch.4).

The two people in the footnote are reasoning on whether, once assumed p, q follows or $\neg q$. In this sense «'If p, q' and 'If p, $\overline{q}$' are contradictories». McCall (2012) has argued that this can be read as a statement of *Boethius' thesis*: $\neg((p \supset q) \wedge (p \supset \neg q))$. I do not think that this is what Ramsey has

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[8]The distinction indicatives/subjunctives does not really work to describe Ramsey's approach, as it will become clear – see §2.3

[9]At the moment, it is not relevant whether knowledge plays a fundamental role, or belief is sufficient.

in mind. A few pages earlier (GPC, p.240), he claims that: «as can be seen from the above example[10], it [ordinary hypothetical] asserts something for the case when the protatis is true: we apply the Law of Excluded Middle not to the whole thing but to the consequence only». I then assume that also in the footnote Ramsey is referring to the Conditional Excluded Middle (CEM) $((p \supset q) \lor (p \supset \neg q))$[11].

Finally, the introduction of conditional probability: «We can say they are fixing their degrees of belief in q given p». In fact, the notion of conditional probability has been already introduced in GPC (p.247):

> Besides definite answer 'If p, q will result', we often get ones 'If p, q might result' or 'q would probably result'. Here the degree of probability is clearly not a degree of belief in 'Not-p or q', but a degree of belief in q given p, which is evidently possible to have without a definite degree in p, p not being an intellectual problem. And our conduct is largely determined by these degrees of hypothetical belief.

Here, we read "intellectual problem" as simply meaning that p does not contradict any of the beliefs already held[12]. This is also suggested, once again, by the footnote, which excludes the applicability of conditional probability when the antecedent «turns out false». Indeed, we have seen that conditional probability is defined as the ratio of the probability of the conjunction of antecedent and consequent to the probability of the antecedent. Clearly, if the antecedent is false, i.e. its probability equals zero, the ratio is undefined[13].

The passage above from GPC (p.247) also suggests that q is uncertain too, in the sense that its truth value is unknown. This is what Edgington's interpretation points to when she says that Ramsey's footnote, and hence conditional probability, covers uncertain conditionals. I think this is right for what concerns what the footnote says about conditional probability.

I now go back to TP and to the introduction of the «very useful new idea» of conditional probability, looking for further clarifications of the footnote.

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[10]GPC, p.239: «If B says 'If I eat this mince pie I shall have a stomach-ache' and A says 'No, you won't', he is not really contradicting B's proposition – at least if this is taken as a material implication».

[11]In ch. 3 I explain why this holds and how it applies to probabilistic cases too.

[12]It could also be read in a stronger way, meaning that p is not impossible. i.e. contrary to a law, cf. MHP (fn.1, p.238). I reckon that "not contradicting any of the beliefs already held" is sufficient in this context.

[13]In the footnote Ramsey uses the term "void".

2.1.2   From GPC to TP and back

As we already know (see ch.1, §1.1), Ramsey defines conditional probability in TP (p.180). The passage is worth our attention because, at a first glance, it seems to contradict the established view that Ramsey adopts a probabilistic approach for indicative conditionals.

> We are also able to define a very useful new idea – 'the degree of belief in $p[q]$ given $q[p]$'. *This does not mean the degree of belief in 'If p then q', or that in 'p entails q', or that which the subject would have in p [q] if he knew q [p], or that which he ought to have*[14]. It roughly expresses the odds at which he would now bet on p [q], the bet only to be valid if q [p] is true[15].

Here conditional probability is not identified with the degree of belief in 'if p then q'. But this is exactly the opposite of what the famous footnote suggests.

There are two possible ways to explain this passage: the first is simply to dismiss the apparent inconsistency between the two texts, arguing that Ramsey changed his mind in the three years between TP (1926) and GPC (1929). Of course this is possible, but definitely less interesting. The second possible way, which is the one I follow, is to try to solve this apparent inconsistency, by finding an explanation in the two texts involved.

Edgington (Read and Edgington, 1995, pp.68-9) argues that here Ramsey is stressing once again the suppositional aspect of the Ramsey test, and she uses this against the readings of the footnote which proposes a different account of conditionals[16]. She claims that in TP Ramsey is warning us about the difference between *supposing* and *believing* that p. This difference is explained by R. Thomason in his example reported in van Fraassen (1980, p.50): John might have a high degree in believing that if his wife cheats on him he will never find out. However, if John actually comes to believe that

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[14]My italics.

[15]Ignore the confusion about the letters p and q which are often swapped – to our knowledge this should amount to an error in Ramsey's original text, since this is how it has always been reprinted.

[16]For non-suppositional account here we mean one in which the antecedent is simply *added* to the stock of knowledge, and not *hypothetically added*. Namely, the antecedent p is "implemented" in a state of beliefs (or knowledge) and the consequent q is there evaluated, judging whether it follows or not from the state of beliefs obtained after the implementation. This is the Ramsey test in belief revision theories.

his wife actually cheats on him, he cannot believe at the same time that he will never find it out.

The same type of explanation is reported by Edgington in MacBride et al. (2019). I believe that the suppositional interpretation is the correct way to read Ramsey's footnote. Indeed on the same page (TP, p.180) Ramsey adds:

> This is not the same as the degree to which he would believe p [q], if he believed q [p] for certain; for knowledge of q [p] might for psychological reasons profoundly alter his whole system of beliefs[17].

However, I also think that Edgington's explanation is not complete. Assuming, as she does, that Ramsey thinks that conditional probability works for indicative conditionals, it is not explained why Ramsey denies that the degree of belief in q given p is the same as the degree of belief in 'if p then q'. After all, 'if p then q' can harmfully represent an indicative conditional. Edgington (Read and Edgington, 1995, p.68) argues that Ramsey does not discuss cases where at least one of the two clauses (whether the antecedent and/or the consequent) are true, not because they are not covered by conditional probability, but simply because «conditionals cease to be interesting when their antecedents and consequents are certainties». This might well be the case, but, as she acknowledges (p.69), we still can believe or utter them. She thinks that even if Ramsey does not explicitly cover those cases, his suggestion about conditional probability can deal with them. This is perfectly fine, but still it does not explain Ramsey's remark in TP.

In fact, I want to suggest that this is not what Ramsey means in both TP ad GPC. It should be noticed that, in the passages of TP mentioned above, the sentence 'if p then q' is treated as 'p entails q' and as the subjunctive case – what the subject would believe if he knew p. This suggests that conditional probability does not cover all indicatives, since the 'if p then q' in TP can clearly represent an indicative. I take this and what stated in GPC concerning antecedent and consequent of a conditional as limiting the application of conditional probability to the uncertain cases, where both antecedent and consequent differ from 0 and 1. Claiming that indicatives are usually or meaningfully uttered only when uncertain is not a good explana-

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[17]Here again I have substituted the right letters to make it coherent. Notice the here Ramsey speaks of knowledge of the antecedent, which is clearly different from supposing it to be known.

tion.

Let us now return to GPC. In this paper, it is worth pointing it out again, Ramsey is concerned with general propositions and "unfulfilled conditionals" (i.e. counterfactuals) that strictly depend on them. The meaning of these unfulfilled conditionals goes far behind the one provided by the material implication. And this holds for the meaning of almost all conditionals statements in general (GPC, p.248):

> In order to deal with this question[18] let us begin with *hypotheticals in general*[19].
>
> 'If p then q' can in no sense be true unless the material implication $p \supset q$ is true; but in generally means that $p \supset q$ is not only true but deducible or discoverable in some particular way not explicitly stated. This is always evident when 'if p then q' or 'Because p, q' (*because* is merely a variant on *if*, when p is known to be true) is thought worth stating even when it is already known either that p is false or that q is true.

There are two important things in this passage: first, Ramsey does not discard material implication. Instead, he underlines that a conditional statement is true if and only if the correspondent material implication is. However, it is well known that material implication is inappropriate to account for the use of conditionals in scientific contexts and in our every day life. Ramsey is well aware of this, when he claims that the meaning of conditional sentences is not exhausted by the classical logical tool. It is a question of epistemology and pragmatic that Ramsey is here addressing, what happens and what information are conveyed in the assertion of a conditional.

Second, Ramsey observes that in many cases conditionals are worth stating although we know the antecedent to be false, or the consequent *and* the antecedent (the case of because) to be true. This raises doubts about the idea, held by Edgington, that Ramsey does not discuss the less interesting cases, for instance where both clauses are believed true. It also suggests that the way he thinks to manage them is not with conditional probability. This

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[18]The question concerns causal laws and what distinguish them from other variable hypotheticals, they «are an important *but not the only type* of variable hypothetical». The fact that they are not the only type of variable hypotheticals will be relevant in ch. 3.

[19]My italics. It is clear that here Ramsey is not making any distinction among different types of conditionals.

contradicts Edgington (Read and Edgington, 1995, p.68-9): «But plenty of acceptable judgements are uninteresting 'p or q' when p and q are certain, say. And it follows from Ramsey's statement of one of the 'fundamental laws of probable beliefs', *degree of belief in (p and q) = degree of belief in p × degree of belief in q given p* (TP, p.181) that if you are certain that both p and q are true, you are in a position to be certain that q given p.». It does follow, but it is not what Ramsey suggests in GPC. He rather seems to have in mind a different analysis for this type of conditionals. To understand how conditional probability fits in this framework we have to go back a few pages in GPC.

Ramsey (GPC, p.246) distinguishes among the possible answers that can be given when we are considering possible future courses of events,

> If we give a definite answer of the form 'If I do p, q will result', this can properly be regarded as a material implication or disjunction 'Either not-p or q'.

The difference with an ordinary material implication is that it is «in our power to make true or false» the antecedent – remember that here Ramsey is discussing possible results of future actions. However, very often, we do not have such definite answer, but something like «'If p, q will result' or 'q will probably result'». In such cases

> the degree of probability is clearly not a degree of probability in 'Not-p or q', but a degree of belief in q given p, which is evidently possible to have without a definite degree of belief in p, p not being and intellectual problem[20]. And our conduct is largely determined by these degrees of hypothetical belief.

I conclude that conditional probability – «the degree of belief in q given p» – does not cover all indicatives, but only specific cases. In fact, it would be better to abandon this label because Ramsey's analysis does not rely on the moods of the verbs (see §2.3). Moreover, it seems that degrees of belief are involved only when a subject is "making a decision" about future events – viz. she is deciding whether q will follow if p happens. More precisely, it is in these occasions that the "meaning" of a conditional is captured by the degree of belief in q given p.

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[20]I take "intellectual problem" to mean that p is not known to be false.

This is why in TP, right after the introduction of conditional probability, Ramsey adds that disclaimer. In TP, with 'if p then q' Ramsey is referring to conditional statements in general (whether indicative or counterfactual) which do not need conditional probability, and which do not express bets. Namely, not all conditionals express actual hypothetical beliefs which can be interpreted and evaluated through conditional probability.

It might be argued that it would be sufficient to have an uncertain antecedent to apply conditional probability. This might be a reading of Ramsey, but it is not the one I am going for. By taking into account also another note by Ramsey (MHP), a more complex picture results, where one case of uncertain antecedent is not covered by conditional probability (see §2.2.1 and ch.3).

In order to strengthen my interpretation, I now turn to an impressively good example that Ramsey presents in GPC (pp.246-7). Here we find material implication and conditional probability, but also counterfactuals. Notably, it is in this example that the famous footnote appears.

2.1.3   The cake example

Suppose that a man has a cake but he decides not to eat it because he thinks he will get a stomachache. According to Ramsey, the man's belief, on which he acts, is the conditional "if I eat the cake I will have a stomach ache". This should be taken as the material implication "either I don't eat the cake or I will have a stomach ache" (p.246).

We think, instead, that the man is wrong, if he eats the cake he will not have a stomach ache. Technically, Ramsey argues, we are not contradicting him. We know that the material implication is true: we have no reason to think that he will eat the cake before the event, and after we know he did not. Then, the question is why we disagree, «since he [the man] thinks nothing false, why do we dispute with him or condemn him?» (p.247). Because, according to Ramsey, before the event we entertain different degrees of belief in q given p. The man has a very high degree in q (stomach ache) given p (eating the cake). Let us suppose that he is certain. This means that $P(q|p) = 1$. Since $P(q|p) + P(\neg q|p) = 1$, $P(\neg q|p) = 0$. This amounts to $\frac{P(p \wedge \neg q)}{P(p)} = 0$. We know that $P(p) > 0$, since $P(q|p)$ is not undefined. Then $P(p \wedge \neg q) = 0$, which is equivalent to $1 - P(\neg(p \wedge \neg q)) = 0$. Then $P(\neg(p \wedge \neg q))$, equivalent to $P(\neg p \vee q)$, equals 1. Namely, $P(p \supset q) = 1$.

This is our explanation of why Ramsey says that the man acts on the belief that the material implication is true.

On the other hand, our degree of belief in q given p is quite low. We are pretty sure – but not totally sure – that the man will not eat the cake, hence we believe that "either he will not eat the cake or he will get a stomach ache" is true. We think that $P(\neg q|p) > P(q|p)$, but we also believe that the material implication (before the event) is very likely. It is possible that $P(q|p)$ and $P(p \supset q)$ diverge greatly when $P(\neg p)$ is really high, like in this case[21], i.e. we do believe likely that the man will not eat the cake. Take $P(\neg p) = 0.96$, $P(p \wedge q) = 0.01$ and $P(p \wedge \neg q) = 0.03$. Then $P(q|p) = 0.25$ whereas $P(p \supset q) = 0.97$. In this particular case then we would have that $P(q|p) = 0.25$ and $P(\neg q|p) = 0.75$, i.e. $P(\neg q|p) > P(q|p)$.

> Before the event we do differ from him in a quite clear way: it is not that he believes p, we $\overline{p}$; but he has a different degree of belief in q given p from ours; and we can obviously try to convert him to our view.

Here comes the famous footnote, at the end of the last line cited above. To apply conditional probability, it is essential that the event has not happened yet, namely that we are uncertain about the truth value of p and q respectively. Ramsey claims that «we have no reason to contradict this proposition [the material implication]», because «before the event we have no reason to think he will eat it». Indeed, I have shown that, if we think very probable that the man will not eat the cake, the probability of the material implication is very high, while our degree of belief in him having a stomachache given that he eats the cake is low. In ch.1 §1.3 we have seen that knowledge for Ramsey requires what he calls "practical certainty". Namely, to be certain of a proposition does not mean to have a degree of belief in it exactly equal to one, it might be slightly lower. Therefore we take our 0.97 in the example above to satisfy this requirement and we say that we know[22] that "either he does not eat the cake or he will have a stomach ache". In this sense we cannot contradict him.

For us it is possible to have a degree of belief in q given p that differs from the degree of belief in the material implication. We are not totally

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[21] This is shown, for instance in Edgington (2005, p.40).

[22] Assuming that not only certainty, but also all the other requirements for knowledge listed in §1.3 are satisfied.

sure, and that allows us to set a proper bet. The man decides not to eat the cake, there is no margin of uncertainty. For him 'if I do not eat the cake I will not have a stomach ache' is simply true[23]. After the not-eating-the-cake event, our degrees of belief «are rendered *void*», because p has turned out false (viz. our degree of belief in it equals 0).

According to Ramsey then, the conditional probability represents the decision to make, a bet to set, but it does not cover, it is not the meaning of, all the possible conditional statements. It does not matter whether they are indicatives or subjunctives, the 'if p then q' represents a generic conditional statement, that can express an indicative, a counterfactual, or an entailment relation. This means that the reading according to which Ramsey proposes conditional probability to account for indicatives is incorrect.

Again, conditional probability may well handle more cases than just the uncertain conditional one, but there is no proof in the text that this is Ramsey's idea. On the contrary, there seems to be proofs that it is not.

Let us go back to cake example. We can disagree also *after* the event. In this case we both know, the man and us, that he did not eat the cake and that he is not ill. However the man believes that if he had eaten the cake he would have had a stomach ache. We, instead, still think that if he had eaten it he would not have had a stomach ache. Two people may differ in their beliefs although they both agree about all facts. This is because they have different systems of beliefs and different rules for judging.

> The meaning of these assertions about unfulfilled conditions,
> and the fact that whether the conditions are fulfilled or not makes
> no difference to the difference between us, the common basis, as
> we may say, of the dispute lies in the fact that we think in general
> terms. We each of us have variable hypotheticals (or, in the case
> of uncertainty, chances) which we apply to any such problem;
> and the difference between us is a difference in regard to this.

Ramsey (GPC, p.247) is here introducing counterfactuals, the topic of the next section.

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[23]Recall the passage in GPC (p.246): «when we deliberate about a possible action [...] If we give a definite answer of the form 'If I do p, q will result' this can properly be regarded as a material implication [...]».

2.2 Counterfactuals

The last part of Ramsey's footnote has been usually ignored in the literature on conditionals. However, it contains an explicit reference to counterfactuals: «If either party believes $\bar{p}$ for certain, the question ceases to mean anything to him except as question about what follows from certain laws or hypotheses». This would already be enough to challenge the widespread idea that Ramsey does not talk about this type of conditionals. And more can be found in GPC and other works.

As shown in the previous section, the footnote comes within an example discussing (also) counterfactuals. As for other conditionals, their meaning goes behind mere material implication[24]. Conditionals depend on the variable hypotheticals we endorse and consequently reveal the rules we adopt and the general beliefs we hold. Counterfactuals do the same, but perhaps in an even more blatant way, since they are often used to express also praise or blame (GPC, p.246):

> That we think explicitly in general terms is at the root of all praise and blame and much discussion. We cannot blame a man except by considering what would have happened if he had acted otherwise, and this kind of unfulfilled conditional cannot be interpreted as a material implication, but depends essentially on variable hypotheticals.

In order to evaluate what would have happened, «we are apt to introduce any fact we know, whether he [the person we are disagreeing with] did or could know it» (GPC, p.247).

Indeed, we have already seen in §2.1.2 that for Ramsey to assert a conditional means that the consequent is *inferrible* from the antecedent together with «certain facts and laws not stated but in some way indicated by the context» (GPC, p.248).

Ramsey repeats (GPC, p.249) this idea in an even more explicit way, focusing on a particular type of conditionals related to causal laws. This type is usually expressed, but perhaps not exclusively[25], in a counterfactual

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[24]This, again, does not mean that material implication is simply discarded. If we are interested in truth values of a conditionals, we should look at it. It is clear that, especially in the case of counterfactuals, material implication trivialise them and their use.

[25]Ramsey is not clear in this passage because he uses a counterfactual as example , saying that this is «the normal one [case]», which suggests that there might be other

form and introduces what Ramsey calls a *ratio cognoscendi*, but also a *ratio essendi*.

> In this case in which is e.g. the normal one when we say 'if p
> had happened q would have happened', $p \supset q$ must follow from
> a hypothetical $(x).\phi x \supset \psi x$ and facts r, $pr \supset q$ being an instance
> of $\phi x \supset \psi x$ and q describing events not earlier than any of those
> described in pr. A variable hypothetical of this sort we call a
> *causal law*.

The fact that here (GPC, p.249) Ramsey uses the horseshoe, as if both the variable hypothetical and the counterfactual were properly formalised by the material implication is misleading. We have seen in ch.1, §1.2 that variable hypotheticals are *not* propositions. Neither are «ordinary hypotheticals»[26]. Ramsey's formalisation should be then taken in a very loose way. I will come back to this in ch.3, when I will present my versions of Ramsey's account and substitute the horseshoe with a more appropriate symbol. In this chapter I will stick to Ramsey's notation.

Conditionals like "if p had happened q would have happened" are instances of variable hypotheticals $\forall x(\psi(x) \supset \phi(x))$. However, to infer q from p some additional facts rs, «indicated by context», are needed. r can be also «composed of propositions in a secondary system». The secondary system in Ramsey's work (cf. *Theories*, written in the same year of GPC) is the system composed by theoretical terms; the primary contains observational terms expressing facts and laws. To see how the two systems interact and form a scientific theory see Cruse (2005), Sahlin (1990, ch. 5) and Psillos (2006).

Those conditionals where q describes «events not earlier than any of those described in $p \wedge r$» – which is usually the case with counterfactuals – are instances of causal laws. In this way Ramsey establishes a tight connection between counterfactuals and causality. Unfulfilled conditionals are quite often supported by, and express, causal laws.

The role of r and the temporal restriction just stated are discussed also in

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cases, perhaps less frequent. In fact, I think this may apply not only to counterfactuals, but I will explain why in the next section.

[26] «Many sentences express cognitive attitudes without being propositions; and the difference between saying yes or no to them is not a difference between saying yes or no to a proposition. This is even true of the ordinary hypothetical [...] and much more of the variable hypothetical.» GPC, p.239.

a note written by Ramsey in 1928, *The meaning of hypothetical propositions.* This note, which as far as I know has never been considered in conditional studies before, offers a deep analysis of counterfactuals and distinctly shows that Ramsey does have an account of this type of conditionals. Furthermore, it provides further evidence for my argument that conditional probability is not meant to cover all indicative conditionals, and that this category is almost nonsense in Ramsey's work.

In the next section I examine this note in detail.

2.2.1 *The meaning of hypothetical propositions*

The Meaning of Hypothetical Propositions (MHP) is one of the notes stored in Pittsburgh[27]. Written in March 1928, it focuses on conditional sentences. On top of the manuscript of MHP, R. Braithwaite, the editor of the first collection of Ramsey's paper (1931) and Ramsey's close friend, writes «Notes related to the material in *General propositions and causality* published in both editions of *Foundations* 1931 p.237 1978 p.133[28]». The similarities between the two texts are indeed striking[29], and this additional remark allows me to reject the possible objection that Ramsey might have changed his mind in the year between MHP and GPC. I then take MHP as completing the account of conditionals sketched in GPC.

In MHP Ramsey analyses the cases where the meaning of a conditional is not captured by material implication. The first considered is the *logical* meaning (p.237), when q follows logically from p. Then we have *causal* conditionals (pp.237-9), which usually present the temporal restriction on r and p, and are hence supported by causal laws. This type includes those conditionals which are «thought worth stating» (GPC, p.248) although their

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[27]It is note [005 - 19 - 01] published in Ramsey, F. P. 1991a.

[28]The page numbers refer to where GPC is positioned respectively in the 1931 edition and the the 1978 edition of the collection of Ramsey's papers.

[29]To mention some: the formalisation of laws is the same in both texts, i.e. as variable hypothetical. In MHP (p.238), as in GPC (p.246), it is said that material implication is often the meaning of sentences "If p then q". The temporal restriction I sketched in the previous section referring to GPC (p.249) can be found also in MHP (pp.238-9). We find the same account of "because" in GPC (p.248) and in MHP (p.239) and the same characterisation of r as «in some way indicated by the context» (GPC, p.248) or «of a kind implied by the context» (MHP, p.238). The general account of counterfactuals is the same. The only thing that really differs is that in MHP there is no reference to probability. I have already suggested the hypothesis that in Ramsey conditional probability only applies to the case where both clauses are uncertain – case indeed not mentioned in MHP. But I will return to this briefly in §2.3 and 2.4 and more extensively in §3.1.

antecedent is false or their consequent true – hence the corresponding material implication is true. Those thought worth stating although the falsity of their antecedents are counterfactuals.

Ramsey (MHP, p.236) classifies counterfactuals as to whether their consequent is known to be false, true or doubtful[30]. He offers one example each:

- (a) If it had rained, he wouldn't have come;

- (b) if it had rained, he would have come all the same;

- (c) if it had rained, he wouldn't have come (but as it is I don't know).

After having discarded the possibility that the conditional sentence 'if p then q' is an instance of a true general proposition (not enough) and that of being directly an instance of a law (too much), Ramsey (p.238) introduces the additional r:

> It is clear, however, that we are concerned with an instance of a law, but that this instance is not in general $p \supset q$ but of the form $p \wedge r \supset q$, so that 'if p then q' means that $(\exists r) : p \wedge r \supset q$ is an instance of a law, and the something further about r. (Law taken to include tautology).

It is important to stress again the distinction between laws and chances. The former are «chance unity» (GPC, p.251), which means that the relation of probability between the antecedent and the consequent is equal to 1[31]. The relation of probability in chances is obviously between 0 and 1. The account outlined in the citation above is then the same as the one proposed in GPC. But in MHP we find additional requirements for r specified. First, r must be true[32]. r must be a conjunction of propositions not containing $\vee, \supset, \exists$ and $\neg$. It can however contain $\forall$, since r can be itself a law (or a

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[30]i.e. $0 < P(q) < 1$, uncertain – different from 0 and 1. Recall also that knowledge requires "practical certainty", truth and reliability. The reference to knowledge highlights the epistemic connotation of this analysis.

[31]For instance, natural laws might be included if they satisfy such requirement. Of course, Ramsey is probably thinking about scientific theories in many passages of GPC. But the fact that he proposes also examples from everyday life (e.g. the cake example and the three sentences above) allows me to extend his reasonings to all such cases.

[32]Ramsey does not specify whether r must be true or must be believed as true. I consider the first option more plausible and also more useful since stricter for the development of an account of acceptability of conditionals – see ch.3.

general proposition) (cf. GPC, fn.1, p.248). Furthermore, r should not be incompatible with p[33]. This means (MHP, p.238) that $\neg(p \wedge r)$ should not be an instance of any law.

Disjunction is excluded because it might be that the true alternative, which makes the disjunction true, is incompatible with p. Implication because if we take $r = p \supset q$ then, given that p and q are compatible, the conditional would be trivial. Existential quantifier because it would introduce disjunction again. Negation is excluded too simply because r must be composed solely of atomic propositions[34]. As we already know, r is usually implied by the context and should refer to events not later to those stated in q, as well as p[35]. Consider: "if she were coming tonight, she would have called yesterday". In this case, it is clear that the consequent refers to events earlier than those described in the antecedent.

Before proposing some examples to clarify this account, let us look at Ramsey's discussion of his own examples (a), (b) and (c).

In the case of (a), r does not need temporal restrictions, whereas in (b) and (c) it does. Indeed, «we must somehow prevent our taking r to be, e.g. his presence here now, which is clearly not intended. r must evidently be about the events previous to his actual or possible setting out.» (MHP, p.239).

Ramsey (MHP, p.239) also points out that in general, unless r is limited far beyond the temporal restriction only, it is possible for both "if p then q" and "if p then not-q' to be *true*[36]. Indeed, we have seen in GPC that

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[33]If p is contrary to a law then anything can follow. Of course some counterfactuals have such "impossible" antecedents, but many do not, like in the cake example.

[34]This may be because Ramsey wants to avoid all the reference problems that, for instance, we know worried Russell with negation.

[35]Here in MHP, both r and p may sometimes refer to events not necessarily earlier than those stated in q. In my interpretation this simply suggests that not all counterfactuals are instances of *causal* laws. The same is suggested in GPC (p.249), when, to explain the *ratio essendi* that "if" sometimes introduces, Ramsey uses a counterfactual as a *normal case* in which this happens. This may imply that not all counterfactuals express and are supported by causal laws.

[36]Ramsey uses this term in this specific context (MHP, p.239). Indeed they are true, if considered as material implication (even with the additional proposition r), since the p is false. I do not know in which sense Ramsey is here using this term, but if taken formally (i.e. as in classical logic) it jeopardises the account, flattening the difference between classical logic and this more sophisticated account. For this, in ch.3, I suggest the term "acceptability" instead of "truth", to distinguish the fact that counterfactuals *are* classically true from their having a meaning that is not captured by the simple material implication. This meaning, I argue, determines also their acceptability conditions.

counterfactuals are often used to express disagreement. Let us then return to the cake example to see whether by following Ramsey's explanation here in MHP I can clarify it.

Recall the situation. A man has a cake and decides not to eat it because he thinks he will have a stomach ache. He does not it eat, and, after this not-eating-the-cake event, he thinks that if he had eaten it he would have had a stomach ache. We disagree. The man's conditional is:

1. If I had eaten the cake I would have been ill.

Formally, we can represent it as

1. $E(m, c) \supset I(m)$

where E and I stand for "eating" and "ill" respectively and m and c are constants for the man and the cake[37].

According to Ramsey, we have to find the r which triggers the variable hypothetical of which the conditional is an instance. Suppose, then, that the man knows that the thing he is staring at is in fact a cake but also that it is rotten (all true). Quite safely we can also assume that he knows that he is a person. The variable hypothetical he believes and which drives him to infer that he will be ill could be "if a person eats a rotten cake he/she will be ill". For a conditional $p \wedge r \supset q$ to be an instance of a variable hypothetical $\forall x(\psi x \supset \phi x)$ means that $p \wedge r = \psi$ and $q = \phi$. Let us try to unfold this. The variable hypothetical "if a person eat a rotten cake he/she will be ill" can be rewritten as $\forall x, y(P(x) \wedge C(y) \wedge R(y) \wedge E(x, y) \supset I(x))$. P stands for being a person, C for "being a cake", R for "being rotten" and E and I, as before, for "eating" and "being ill". r in this case is a conjunction $r_1 \wedge r_2 \wedge r_3$, where $r_1 = P(m)$ and $r_2 = C(c)$ and $r_3 = R(c)$. Thus the man believes $(P(m) \wedge C(c) \wedge R(c) \wedge E(m, c))$, which corresponds to $p \wedge r$ and is an instance of the variable hypothetical $\forall x, y(P(x) \wedge C(y) \wedge R(y) \wedge E(x, y) \supset I(x))$. This is then triggered and lets the man infer (by MP) that he will be ill, i.e. $I(a)$[38]. This is a very simplified example, but it is a glimpse of how Ramsey's account works.

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[37]In this rough formalisation I use first order logic. This choice is harmless and useful to get the idea of what "being an instance of law" could mean more precisely. Moreover, it is justified by the fact that Ramsey allows r to contain universal quantifiers. This also suggests, as we have already argued, that the formalisation Ramsey adopts is approximate – for p and q as well as for the horseshoe.

[38]I thank P. Egré for useful conversations on this.

We have now to consider our case. We disagree with the man, and the sources of disagreement are variable hypotheticals[39]. Namely, the variable hypotheticals triggered in this situation are different between the man and us.

Notice that, in general, people can share some of the same variable hypotheticals (as it might be the case with some laws of nature), but in some circumstances different information – all true – might be available to each one and then different variable hypotheticals might be triggered.

Notice also that there can be two ways of disagreeing: first, we can disagree by endorsing the antithetical $\forall x(\psi x \supset \neg \phi x)$. This can be the case even if we share the same information with the man (e.g. the thing he is looking at is a cake and is rotten and he is a person). Although this might sound a bit unlikely, it is still plausible that someone believes "if a person eats a rotten cake he/she will not be ill". The second way we might disagree is by having different information available, which trigger a different variable hypothetical.

For instance, we might not know that that cake is rotten, but know that it is a chocolate cake ($r_1 = CH(c)$) and simply think that "If a person eats chocolate he/she will be good" (for it helps to produce serotonin). We also know that that man is a person ($r_2 = P(m)$). The variable hypothetical triggered might then be $\forall x, y(P(x) \land CH(y) \land E(x,y) \supset G(x))$ [40]. We would disagree with the man saying that "if he had eaten the cake he would not have been ill" (i.e. $E(m,c) \supset \neg I(m)$) and we take "being good" to be the contrary of "being ill", i.e. $G(x) = \neg I(x)$. Then, $p \land r_1 \land r_2 \land r_3 = E(m,c) \land CH(c) \land P(m)$ and $q = G(m) = \neg I(m)$. This is how our counterfactual is supported and this is how disagreement is explained along Ramsey's lines.

Ramsey (MHP, p.239) applies this "enthymematic" account with the additional r also to those conditionals whose consequent is known to be true. Ramsey is clearly considering the cases where the corresponding material

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[39]Recall GPC (p.247) «we each of us have variable hypotheticals [...] which we apply to any such problem; and the difference between us is a difference in regard to these», and that (p.241) variable hypotheticals «form the system with which the speaker meets the future».

[40]Of course, this is really simplified for the sake of the discussion. It means that if there is something which is chocolate $CH(z)$ and something else which is a cake ($C(y)$), and the latter contains the former $H(y,z)$ and a person $P(x)$ eats the chocolate cake $E(x,y)$, and he/she will be good $G(x)$.

implication is true. When the consequent is known to be true, there are three options for the antecedent, as there were for the consequent in the counterfactual case: true, false and doubtful. When p is know to be false we have one of the cases already discussed. When both clauses are known to be true, the conditional is not introduce by "if", but by "because" (MHP, p.239): "because p then q" means "$p \wedge q \wedge$ if p then q", where this conditional sentence is analysed in the usual way, i.e. $p \wedge r \supset q$[41]. The same explanation is given in GPC (p.248), when arguing that we consider conditional sentences worth stating even when we know the antecedent to be false or the consequent to be true: « [...] $p \supset q$ is not only true but deducible or discoverable in some particular way not explicitly stated. This is always evident when 'If p then q' or ' Because p then q' (*because* is merely a variant on *if*, when p is known to be true) is thought worth stating even when it is already known either that p is false or that q is true ».

When the antecedent is doubtful, we follow the same reasoning: if someone asserts such a conditional, it means that she knows information r that, together with p, are an instance of the antecedent of a variable hypothetical she holds, which leads her to infer q. For instance, suppose that Marianna has arrived in Paris this morning, and that in the week before her arrival she did not check the weather forecasts. Today it is raining and she says: "if it rained yesterday in Paris (but I don't know), it would have rained today in any case"[42].

The way this last case is handled in MHP might be unexpected, since from the famous footnote we would be lead to conclude that whenever the antecedent is doubtful («and are both in doubt as to p»), conditional probability must be used. But in MHP we have the enthymematic approach at work in this case. Although this could be interpreted as a discrepancy between the two texts, I think it is not. The cases covered in MHP are those where the corresponding material implication is true: either the antecedent p is false or the consequent q is true. In this latter case, it does not really matter whether the antecedent will turn out true or false, because the consequent is already known to be true, i.e. the corresponding material implication *is* true. In this case, the meaning of the conditional assertion

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[41]I.e. "because p then q" is $p \wedge q \wedge (p \wedge r \supset q)$.

[42]To my sensibility, this conditional would sound better introduced by "even if". Ramsey (MHP, p. 239) however does not acknowledge this particular form.

cannot then be that expressed by conditional probability. We discuss and analyse this in depth in ch. 3, where all the pieces of our interpretation will tessellate, conditional probability included.

The example Ramsey proposes for the doubtful antecedent-true consequent case highlights also another feature[43] of this account: contraposition $(p \supset q \therefore \neg q \supset \neg p)$ fails. To say (MHP, p.239) «('He has not come') 'Not necessarily, because he would anyhow (= if he came) have gone by now'» is clearly not equivalent to "if he had not gone by now, he would not have come" (MHP, fn.6, p.239). In this case the failure of contraposition is particularly evident, because the fact that he is still here presupposes that he first came[44]. In general, I suggest, contraposition fails because in order for the two conditionals to be equivalent, the variable hypothetical supporting it and the r should be the same in both cases. For instance, consider the cake example once again: "if I had eaten the cake I would have been ill", believes the man. The contraposed conditional would be "if I had not been ill, I would not have eaten the cake"[45], which is perfectly fine, but it is not equivalent to the first conditional – it does have not the same meaning in Ramsey's sense. Namely, it is not supported by the variable hypothetical "if a person eats a rotten cake he/she will be ill", which is clearly not triggered, even if we add the information in r to the antecedent not-q. If temporal restrictions are taken into account this is even more evident, since r refers to events earlier than those described in q. In the cake example, again, you would have 'if I had not been ill, I would not have eaten the cake'. The temporal relation is a different one, and the r involved in this case cannot be the conjunction "the man is a person and the thing he is staring at is a cake, and the cake is rotten". We cannot infer $\neg p$ from $\neg q \wedge r$[46]. The contraposed conditional

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[43]We have seen that conditional excluded middle holds, in the sense that if a person states $p \supset q$ and hence endorses the corresponding variable hypothetical, he cannot accept and state (he disagrees with) $p \supset \neg q$.

[44]For further details see ch.3. The failure of contraposition is a common feature of many contemporary theories of conditionals – see ch.4.

[45]Or "if I were not ill, I would not have eaten the cake", which, at least to me, seems as odd as the other, even if slightly different in meaning.

[46]If we move both p and r to the consequent, obtaining $\neg q \supset \neg(p \wedge r)$, we face other problems. It is still not an instance of the same variable hypothetical, but now we also have $\neg(p \wedge r)$, which is equivalent to $p \supset \neg r$, so p and r are incompatible. This implies that we are not talking about the same conditional "if p then q". We would instead have the conditional "if the man had not been ill then it would have not been the case that the man would have eaten the cake and he would have been a person and the thing he was staring at would have been a cake and the cake would have been rotten", which is clearly

might well be acceptable to whom has additional information triggering a variable hypothetical that supports it. But these two (information and variable hypothetical) cannot be the same of the original, "non-contraposed", conditional. This means that, given the same context, a conditional is not equivalent to its contraposed.

I end this section discussing the last part of MHP, where Ramsey introduces other types of conditionals. The first one is what he calls the "epistemic"[47]. The conditional has an «*epistemic* sense» (MHP, p.240) when:

> q was or might have been or ought to have been inferred from
> p either by a given person on a given occasion or by any person of
> a certain sort in any occasion of a certain sort. Instances of this
> are; "if he had had a mole on his wrist, he would have been the
> murderer"; "his having a mole implied that he was the murderer",
> "because he had a mole, he was the murderer"[48].

As before, Ramsey does not make any distinction based on the mood of the verbs involved in conditional statements, whether it is indicative or subjunctive.

This type of conditionals expresses that $p \supset q$ was known or was a logical consequence of things known (not including p) together with some general propositions expressing «our correct habits of inference» (MHP, p.77)[49]. In this latter case Ramsey says that the implication was "virtually known". But also that $p \supset q$ might have been known or virtually known, where "might" here suggests that the subject had not enough information (for instance, he does not know something that «everyone is expected to know» (MHP, p.240)) to infer the conditional.

Although in this last part of MHP, Ramsey is not completely clear, I suggest that an epistemic conditional is a conditional which failed to be asserted at the right moment, but which, given what the subject knew or should have known, should have been inferred. However, this epistemic conditional is

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not intended.

[47]The "enthymematic" analysis just proposed is for "causal" conditionals. The other two types are the "logical" (entailment) and the "material" (material implication). (MHP, p.240)

[48]Recall that the "ought" case is one of the cases listed in TP (p.180) that the degree of belief in q given p does not cover. This seems again to support my interpretation that the conditionals listed there are distinguished because they require a different analysis, this inferential analysis.

[49]Recall how habits are evaluated. See ch. 1, §1.1.2.

analysed in the same way as the causal is, viz. through the enthymematic approach seen before[50]. For this reason I do not discuss it further[51].

In the last part of MHP (pp.241-2), after having discussed some positions on conditionals held by other philosophers, like Bradley, Mill and Johnson, Ramsey (p.242) briefly focuses on the different ways language may signal the type of a conditional statement (i.e. whether it is causal, material etc.). Here again we see that Ramsey does not simply reject the material implication account, but refines it carrying out the additional meaning conditional statements often have.

> Language has subtle ways of distinguishing the different senses of "if"; consider for instance
> Everyone voted for it
> So if he was there, he *must* have voted for it (material only)
> But if he was there, he *would* have voted against it (material also causal)
> ∴ he was not there.

As we showed in §2.1.2, indicative conditionals too are, for Ramsey, often represented by material implication and express the material meaning, contrary to what it is or has been usually claimed in the relevant literature on conditionals. Furthermore, this example is repeated in GPC (p.249), with a few variations which make it a proper Oswald-Kennedy example, as Edgington (in MacBride et al. (2019)) notices. Here Ramsey offers his explanation of the indicative/subjunctive distinction, and gives us the chance to talk about it.

2.3 The indicative/subjunctive distinction

Philosophical studies usually divide conditional sentences into two groups, according to their morphology: indicatives and subjunctives. In general, it is assumed that they have different truth conditions or acceptability conditions

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[50] «To say '$p \supset q$' might have been known, is, if the implied conditions are suitably chosen, very much the same as to say "if p then q" where the if is causal.» (MHP, p.241).

[51] Ramsey (MHP, p.241) introduces also a type of conditional which is not really hypothetical, but has the form of it. It is called *spurious* and means that $p \supset q$ follows from an r, like in 'if anyone says p says truly', which, according to Ramsey, simply means p. Since these conditionals are not proper conditionals, I do not consider them.

and deserve different analyses. One of the most famous argument for this is the Oswald-Kennedy pair (Adams (1970)):

1. if Oswald hadn't shot Kennedy, then no one else would have;

2. if Oswald didn't shot Kennedy, then no one else did.

We are inclined to accept the first (or to say that it is true) and reject the second (or to say that it is false). Adams explains this difference by the different degree of support they need by evidence. He does not identify subjunctives with counterfactuals, but today this is a common practice (for instance, Edgington (2014) and Bennett (2003)), although it is well known, thanks to examples (e.g. Stalnaker (1975) and Anderson (1951)), that overlapping the two categories is incorrect and misleading.

We know from the previous section that Ramsey does not distinguish conditionals on the basis of the mood of the verbs appearing in them. Nor he seems to propose a different treatment for the case where the antecedent is false, the case where it is true, and the case where it is doubtful, given that the consequent is true[52]. He does however recognise that "unfulfilled" conditionals, usually expressed by the subjunctive-conditional moods, have peculiar features: they are usually preferred to express praise or blame, laws and causal laws. In fact, in GPC (p.249) the difference of the moods employed is explained through the different variable hypotheticals and facts (rs) involved:

> Corresponding to the kind of laws or facts intended we get
> various subtle syntactical variations. For instance, 'If he was
> there, he must have voted for it (for it was passed unanimously),
> but if he had been there, he would have voted against it (such
> being his nature)'. [In this, law = variable hypothetical][53]

Let us try, then, to explain the Oswald-Kennedy example following Ramsey. Why Adams' counterfactual (1) above is intuitively accepted and the indicative (2) rejected can be easily clarified. Indeed, it is sufficient to find additional facts or laws r, implied by the context, that, together with the

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[52]The cases where the consequent is false, but the antecedent is not, is not mentioned in MHP. When it is doubtful, and also the antecedent is, we know from §2.1 that conditional probability is used. In ch. 3 we consider the options we have to cover all the cases not mentioned neither in MHP nor in GPC, and to recover a unified account of conditionals.

[53]The square brackets are Ramsey's.

antecedent of the conditional, trigger a variable hypothetical (or does not) that makes it possible to infer the consequent. For instance, the counterfactual "if Oswald hadn't shot Kennedy, then no one else would have" suggests that, to our knowledge, no one other than Oswald would have had good reason to kill Kennedy (of course, it is easy to see that someone might disagree with us) or that Oswald was the only suspect, and also that we know that Kennedy was as a matter of fact killed. We can then suppose that the variable hypothetical triggered is something like "if someone is killed and no one had good reason to kill him except the suspect, then no one else has killed him". This is a toy example and the variable hypothetical is unsophisticated, but this is meant to show that, in principle, this account can explain what is going on in Adams' example. The second conditional "if Oswald didn't killed Kennedy, then no one else did" is difficult to accept, because, as before, we know that Kennedy was killed. But in this case, contrary to the previous one, the indicative mood suggest only to focus on the fact that Kennedy was killed. For the information we have so far, then if Oswald did not do it, someone else did, because Kennedy was shot. Namely, the information that Kennedy was shot triggers another variable hypothetical, different from the one supporting the counterfactual case, which leads us to conclude that someone else did it and reject (2). The variable hypothetical involved could be "if a man is shot and it is proved that the suspect has not done it, then someone else has".

These examples suggest that the speaker uses different mood to convey different information – that could be identified by r – and to express different general beliefs. They also show that the notion of "variable hypothetical" is a useful tool, which can easily account for this kind of differences.

The fact that Ramsey does not distinguish conditionals according to the mood of their verbs, but rather solely on the truth value of the two clauses involved, points to a possible way for a unified treatment of conditionals. The possible strategies to obtain it will be discussed in the next chapter.

2.4 Chapter summary

In this chapter, I started by discussing the influence that a simple footnote has had in the development of a trend of studies. I have presented how different scholars have spelled out Ramsey's suggestion. Although the inter-

pretations differ consistently, they all agree that the procedure described by
Ramsey in the footnote does not apply to counterfactuals. This is mainly
because the focus has been driven to the first part of the footnote, ignoring
the last one. From this, the belief that there is no account of counterfactuals
in Ramsey, but only a probabilistic treatment of very specific conditionals,
has spread.

From the footnote and its comparison with other Ramsey's works (like
TP), I have arrived at the conclusion that conditional probability is not
meant to cover all cases of indicative conditionals; rather, there is evidence
only for the uncertain case where both clauses in the conditional are un-
certain. I have also shown that Ramsey does not, in fact, reject material
implication – the truth of a conditional sentence *is* the truth of the corre-
sponding material implication. However, conditionals in natural language
usually convey more than what is captured by the material implication.

Ramsey in GPC discusses a situation that exemplifies his view on con-
ditionals, as well as the role of material implication. This is what I have
called "the cake example", which is also the part of GPC where the renowned
footnote appears. This example shows how disagreement can be expressed
through conditional sentences before and after an event, even if all the sub-
jects involved are aware of what conditional, from a logical point of view, is
true and which is not. Always in GPC (p.249) Ramsey discusses the relation
between counterfactuals and causal laws. Counterfactuals "if p then q" are
often instances of causal laws, namely $p \wedge r \supset q$ – where r expresses facts
usually indicated by the context – is an instance of a variable hypothetical
$\forall x(\phi x \supset \psi x)$ and q refers to events later than those described in p and r.

I have proved that the same approach can be found in a note of the
previous year, which has never been considered before. In *The Meaning of
Hypothetical Propositions*, Ramsey applies the account with the additional r,
that here I call the "inferential" or "enthymematic" account, to other condi-
tionals too and not only to counterfactuals. I conclude that the cases covered
by this "missing proposition" approach are those cases where the material
implication corresponding to the conditional in consideration is known to
be true, either because the antecedent is false or because the consequent is
true.

From this reconstruction, it is clear that in Ramsey there is no clas-
sification of conditionals according to the moods of the verbs. Hence, no

indicative/subjunctive distinction. It seems that what formally explains the acceptance of a conditional really depends on the truth value of its corresponding material implication – whether it is known or not, settled or not. However, Ramsey is well aware of the differences of moods in this type of sentences, and he ascribes it to the different types of variable hypotheticals conditionals are instances of. Through this additional refinement of the theory, it is possible to explain the famous Oswald-Kennedy case.

We end this chapter with two accounts of conditionals emerging from Ramsey's texts: one uses conditional probability, but applies only to uncertain cases; the other adds information to the antecedent to infer the consequent, but is at work only when the material implication is known to be true. Some cases are lefts out of the picture (true antecedent and false consequent, true antecedent and uncertain consequent, uncertain antecedent and false consequent) and we have to find a solution to account for them too, if we want a theory of conditionals. There are two possible different paths to follow in order to cover these missing cases. But, since the two accounts do not seem to overlap, it would be desirable to be able to unify both into a single theory for all types of conditionals. In the next chapter I propose two possible solutions to achieve these goals.

Part II

Chapter 3

Towards a unified account

In the previous chapter I recovered Ramsey's account of conditionals by putting together the fragments spread throughout his writings. Now, there is an analysis of the meaning of conditional sentences based on contextual information and variable hypotheticals, which applies to counterfactuals. But there is also conditional probability, employed, at least, in conditionals where both clauses are uncertain. It would be reasonable to expect conditional probability at work whenever the antecedent is uncertain. But this is not the case, at least when the consequent is true (cf. MHP, p.240). The two accounts seem at first glance incompatible.

A unified treatment of all types of conditionals is desirable, and this is the aim of this chapter. I propose two ways to achieve this: the first, that I call theoretical, relies on the notion of variable hypothetical and uses both additional proposition(s) and conditional probability as tools. The second, called formal, extends the probabilistic approach to counterfactuals by substituting conditional probability with *imaging*, a probability updating rule first introduced by Lewis (1976).

In both accounts, following what I take Ramsey's intentions to be, I do not treat conditional sentences as propositions, I do not attach truth values to them. I rather speak of acceptability conditions. Although possible world semantics usually attach truth values to conditional sentences, I will replace truth conditions with acceptability conditions.

The first account I introduce uses both methods presented by Ramsey: conditional probability and additional proposition(s) r. I move from the cases explicitly covered by these two methods in MHP and GPC. From an

accurate analysis, it emerges that the cases in MHP, where the meaning of a conditional sentence is explained by means of variable hypotheticals, coincide with the cases where the corresponding material implication is true. Hence, it is natural to extend conditional probability to all the other cases, except to the one when the material conditional is false: a conditional sentence has no meaning in this circumstance and no conditional can be asserted or accepted.

Then, I propose to unify the two sub-accounts by introducing the additional r also in the probability cases and making them too instances of variable hypotheticals endorsed by the agent. I then give a criterion for the acceptability of conditionals which follows the idea that contextual information and beliefs a person have play a relevant role in determining what conditionals are accepted and what rejected. Thus, it is also possible to outline a validity criterion for inferences involving conditionals. Although the formulation of this criterion is quite informal, it is sufficient to discuss some controversial inference patterns for conditionals, and to reject or accept them. It results a new and original proposal for a unified theory of conditionals, based on the notion of contextual information and the preservation of them. I believe that this new theory draws the attention to some intuitive aspects of our acceptance of conditional sentences that have been often overlooked.

The second way for a unified theory is based on a comparison of Ramsey's inferential account with one of the most famous contemporary theory of counterfactuals: Stalnaker's possible world semantics[1]. I show many similarities that relate the two accounts and which make it possible to translate Ramsey's account into Stalnaker's setting. This process of "translation" will also highlight that Ramsey's notions like variable hypotheticals and contextual information could improve possible world semantics, by specifying and characterising some features usually quite obscure, like closeness of worlds.

Since Ramsey uses also conditional probability to deal with a certain type of conditionals, it seems that a part of his account cannot be implemented into Stalnaker's framework. For, conditional probability cannot be applied to counterfactuals. The solution I propose is to substitute conditional probability with Lewis' imaging, which can be easily applied to counterfactuals. Finally, I briefly discuss some properties of this interpretation and develop-

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[1]This is a joint work with Mario Günther, Günter and Sisti (2020).

ment of Ramsey. This will also be the topic of a section of the next chapter, where I will compare more closely Ramsey and Stalnaker, but also Ramsey with Lewis.

A short remark concerning the notation I use. As we have seen in the previous chapter, Ramsey uses the horseshoe $\supset$ also when he is not strictly speaking of material implication. For instance, although he explicitly says that variable hypotheticals are not propositions and they cannot be negated but only disagreed[2], he formalises this way: $\forall x(\phi x \supset \psi x)$. The same for conditional sentences: when Ramsey explains their meaning, both in MHP and GPC, he always formalises them using $\supset$. However, this cannot be correct because it would be meaningless if, for instance, the inferential account were to be reduced to the material implication with a conjunction as antecedent. This is particularly clear if we consider counterfactuals: given that the antecedent of a counterfactual is false by definition[3], the corresponding material implication is always true. Even adding r but reading the conditional as a material implication would not change anything, the conditional would still be always true (since $p \wedge r$, the new antecedent, would be false). This would foil Ramsey's purpose to explain why we can disagree about counterfactuals while agreeing on all facts. I will here substitute $\supset$ with $\to$ in all these cases. I will use $\supset$ only when I strictly refer to material conditional.

I will also use the symbol $>$ in the second part of this chapter, to talk about Stalnaker's conditionals. I will do this only when I define it, because it is the symbol Stalnaker uses and to distinguish it from both $\to$ and $\supset$. When I speak of the final possible worlds account of Ramsey's conditional I will use $\to$ again.

3.1 The theoretical approach

The unified theory of conditionals I am here presenting aims at adhering, as much as possible, to Ramsey's intuitions about conditional sentences and human mind. Indeed, the strategy I am now going to outline is meant to be a development of Ramsey's view on epistemology and conditionals, as I have presented it in ch.1 and ch.2.

My proposal relies to a great extent on the suggestion that «the human

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[2]In GPC. See ch.1 §1.2.

[3]Whether it is believed to be false or it is actually false and what, in case, the difference would be does not really matter for the present purposes.

mind works essentially according to general rules or habits» (TP, p.194). The core idea of this theory is very simple: variable hypotheticals endorsed by a person determine what conditionals are acceptable for that person. We accept a conditional whenever it is a instance of a variable hypothetical, triggered by the antecedent of that conditional together with some contextual information. The classification of variable hypotheticals into laws and chances[4] makes it possible to extend the account of MHP to cover also the conditional probability case(s). This move is justified by some observations Ramsey makes on laws and chances that I will recall in the next section. I believe that this strategy provides an original theory of conditionals, linking the meaning of conditional assertions to the classical truth conditions of implication, and, above all, it delivers a theory that fits into Ramsey's epistemology. It also stresses two relevant philosophical points: first, there can be no theory of conditionals without a theory of belief and knowledge; second, an account of the semantics of conditional sentences cannot stand alone without an investigation of the pragmatics of their use.

This is how I will proceed: I will shortly recall the results obtained in ch.2 concerning the *meaning* of conditional statements, as showed in table 3.1. Since some cases are not cover in this "extended" truth table, I put forward a proposal to complete the table of meaning (shown in Table 3.2). Since, the account is still divided in two sub-accounts, each one explaining the meaning of conditional assertions by different formal tools, I suggest to unify it by means of contextual information and variable hypotheticals, as Table 3.3 displays. From this "unified" theory of meaning of conditionals, I recover a common criterion of acceptability of conditionals and, finally, a validity criterion for inferences involving conditionals.

In ch.2, §2.2.1 I showed that in MHP five cases are covered: false antecedent and true consequent, false antecedent and false consequent, false antecedent and uncertain consequent, uncertain antecedent and true consequent, true antecedent and true consequent[5]. From GPC and TP, we know that conditional probability applies to the uncertain case (both p and q are uncertain) for sure. The choice of the analysis applied – whether the inferential one or the probabilistic – depends on the truth values of their components

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[4]See ch.1, §1.1.

[5]"Uncertain" always means $0 < P(p) < 1$.

and thus on the truth vale of the corresponding material implication. This is shown by the table below, where the results of ch.2 are displayed:

p	q	if p then q
T	T	"Because": $(p \wedge q \wedge (p \wedge r \rightarrow q))$
F	T	$p \wedge r \rightarrow q$
$?$	T	$p \wedge r \rightarrow q$
T	F	$*$
F	F	$p \wedge r \rightarrow q$
$?$	F	$*$
T	$?$	$*$
F	$?$	$p \wedge r \rightarrow q$
$?$	$?$	$P(q|p)$

Table 3.1: In this sort of truth-table the cases explicitly covered by Ramsey's texts are represented – the star means that the case is not considered by Ramsey. It is not a real truth table because in the right column is presented the meaning, according to Ramsey, of a conditional sentence "if p then q", given the truth values of its components. For instance, when both p and q are true (first line), we usually utter a "because" sentence, instead of a "if" – "because p then q". The utterance of this sentence means that the speaker knows that p and q are true and that there are information r that together with p imply q. When the truth values of both p and q are unknown, we set a bet on q given p (last line).

There are, then, some cases left out from these two different analyses, cases not explicitly mentioned by Ramsey and marked by $*$ in table 3.1 above. These are:

1. uncertain antecedent and false consequent,

2. true antecedent and false consequent,

3. true antecedent and uncertain consequent.

In ch. 2 (p.69) I have emphasised that cases covered by the "additional r analysis" in MHP are those where the corresponding material implication is true. Namely, given "if p, then q", whenever the corresponding material conditional is true, the inferential account is used to analyse the conditional sentence. I here follow this idea and generalise it. Whenever the antecedent is known to be false or the consequent known to be true, I apply the infer-

ential account of MHP[6]. When the truth value of the material implication corresponding to the conditional statement is not settled yet (viz. we do not know whether it is true or false), I apply conditional probability. This stipulation covers all the remaining cases, except, I suggest, the one when material implication is false: true antecedent and false consequent. I exclude this case (the false material implication) from this analysis, and consider it not-assertable and not-acceptable for anyone in any situation. This is justified because I am laying down a theory of conditionals whose analysis depends on the truth value of material implication. Since there is just one situation, in our table too, in which material implication is false, I suggest to consider this case as the case where the corresponding conditional sentence is not accepted nor asserted. Also, from a betting point of view, the one involving conditional probability, a bet is lost when the "if" part occurs, but the "then" does not. Recall that Ramsey (GPC, p.248) says that:

> 'if p then q' can in no sense be true unless the material implication $p \supset q$ is true; but it generally means that $p \supset q$ is not only true but deducible or discoverable in some particular way not explicitly stated.

Hence, the truth value of a conditional sentence is determined by the material implication, but its (pragmatical) meaning goes beyond its bare truth value – indeed, as in the cake example, we can disagree about them, although we agree about all facts.

Following this idea, I then propose to cover the remaining cases with conditional probability. Table 3.1 changes into the following Table 3.2:

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[6]Notice that "known to be true", which is the expression Ramsey uses, for how knowledge is defined in ch.1, imply "true" *tout court* – whatever it means – without the subjective connotation.

p	q	if p then q
T	T	"Because": $(p \wedge q \wedge (p \wedge r \rightarrow q))$
F	T	$p \wedge r \rightarrow q$
$?$	T	$p \wedge r \rightarrow q$
T	F	$\times$
F	F	$p \wedge r \rightarrow q$
$?$	F	$P(q\|p)$
T	$?$	$P(q\|p)$
F	$?$	$p \wedge r \rightarrow q$
$?$	$?$	$P(q\|p)$

Table 3.2: Notice that here, like in the previous Table, $\supset$, used by Ramsey in MHP, is replaced by $\rightarrow$. This is because it is not material implication I am talking about. Although truth values determine the analysis, what we are here considering is the "meaning" of ordinary hypotheticals. Furthermore, if in the counterfactual case the relation between antecedent and consequent were that expressed by material implication, the conditional would be trivialised and reducible to the simple material implication without r. Given that the antecedent of a counterfactual is false, the conjunction of it and r would be false, making all counterfactuals indiscriminately true. But this would not help in any way to explain why we disagree about them nor what it means to believe such sentences.

In Table 3.2, the T-F case is signalled with an $\times$ to mean that it is excluded and not considered: no analysis applies to that case. Notice also that when the antecedent is known to be true, conditional probability corresponds to the probability of the material implication[7].

This table represents an attempt to describe, with formal tools, what we convey in asserting a conditional. The meaning of a conditional assertion is determined by the agent's knowledge of facts, events involved in the conditional evaluated and described in p and q. If the corresponding material implication is false, the conditional is excluded as irrelevant. If the corresponding material implication (including the "non-standard" case ?-T), the meaning is captured by the inferential account. If truth value of the material implication is undetermined, the conditional meaning is expressed by

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[7]See, for instance, Edgington (2005).

conditional probability.

Given the account of knowledge in ch.1, the agent knows that p or that q, if he is certain about it, if his belief is true, if he has obtained that belief in a reliable way, and if, were he to reflect on the way he has obtained that belief, he would remain certain of it. If the agent's knowledge is enough to determine the truth value of the material implication corresponding to his conditional[8], the conditional sentence expresses that for the speaker the inference from the supposed (or, in one case, known) antecedent and contextual knowledge to the consequent follows from some general rules of judgment he has. If the truth value of the material implication is not settle, conditional probability represents the cognitive attitude we express through the conditional. The speaker expresses a high degree of belief in the consequent given the antecedent. Probability expresses possibility, but if the material implication is settled, there is no possibility to make room for. In some occasions, like for the man in the cake example, this possibility - of making the material implication true or false - directly depends on a person's actions - not-eating the cake. Hence, conditional probability in such circumstances really expresses a deliberation, a process of decision for future actions. In general, as Ramsey says in TP, conditional probability expresses a bet, which is meaningless if the condition has not happened – namely, the antecedent is false – or the consequence has already happened – namely, the consequent is true – or both, condition and consequence have already happened – namely both true.

Table 3.2 represents the semantics and pragmatics of conditional assertions, but it does not say anything about the epistemology of conditionals. Namely, it tells what the speaker conveys by asserting a conditional and how to represent this meaning with formal tools, but it does not say anything about, for instance, a listener accepting the conditional he asserts, hence agreeing with him. Indeed, as the meaning of a conditional is not covered by material implication, acceptability of a conditional cannot be determined by the truth of the material implication. And, although the meaning conveyed

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[8]Note that this does not mean he knows the truth value of both p and q since in some cases it is sufficient to know the truth value of just one of the two. Even if p and q are tautologies or contradictions the analysis remain the same, since it simply means, from the material implication point of view, that they are true or false. It does not change the meaning of the assertion of the conditional, but it could be that in some cases r is simply empty – this does not alter my general theory.

can be different, I would like to have a common criteria of acceptability for all types of conditionals.

As it is, the account is not unified yet. Although the two analyses do not overlap in our proposal, I have to explain how we can have a unique acceptability criterion. If this is not possible, I cannot claim to have a unified theory. My suggestion is that we can achieve these desiderata thanks to variable hypotheticals. I discuss this in the next section.

3.1.1 Variable hypotheticals, r, and acceptability

In §1.2 I presented variable hypotheticals, their relation to habits and the role they play in Ramsey's account of knowledge. I have also shown that Ramsey classifies them into laws and chances.

Let us quickly recall this classification. Chances are variable hypotheticals where there is a probabilistic relation between antecedents and consequents. Chances represent degrees of belief in an abstract, simple system, of an ideal thinker, to which degrees of belief of «actual people, especially the speaker[9]», approximate. Since chances are expressed by "generalised" conditionals (as all variable hypotheticals – $\forall x(\phi x \to \psi x)$) and involve degrees of belief, we can express them by conditional probability of the type $\forall x P(\psi x|\phi x) = a$ where $0 < a < 1$. Indeed (C, p.207):

> when knowing ψx and nothing else relevant, always expect ϕx with degree p[10] [...] which is also written the chance of ϕ given ψ is p (if $p = 1$ it is the same of a law).

We can represent chances by conditional probabilities because they are defined as idealised degrees of belief. We know from TP that degrees of belief in a proposition given another are determined by conditional probability (cf. TP, p.180 and, here, ch.2, §2.1.1). When the probability value relating the antecedent and the consequent of a variable hypothetical is 1, we have a law. This suggests that laws too express degrees of belief in a simple, abstract system. And, as such, laws can be represented this way: $\forall x P(\psi x|\phi x) = 1$. Again, in GPC (p.251), we find this same idea: «a law is a chance unity»[11].

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[9]C, p.206.

[10]Here p is the same as a above. I prefer the latter for it cannot be confused with the antecedent of a conditional or probability. Ramsey uses a in GPC (p.251).

[11]The "1" of the laws does not mean that people are actually totally certain that if ϕ happens ψ will occur. Again, this is a simplified system, but human certainty is what

Furthermore, «these chances together with the laws form a deductive system *according to the rules of probability*[12]». This suggests that the belief system of an ideal thinker is formed by laws, stating a lawful connection between the events described in the antecedent and those described in the consequent – the ideal thinker is certain that whenever ϕ occurs, ψ occurs too – and chances, general propositions asserting the degree of belief with which the ideal thinker expects the consequent ψ given the antecedent ϕ [13].

Given that conditionals are supported by variable hypotheticals, I propose that both chances and laws can support conditionals. As Ramsey (GPC, p.247) suggests at the end of the cake example:

> We each of us have variable hypotheticals (or, in the case of uncertainty, chances)[14] which we apply to any such problem; [...]. We have degrees of expectation, vague or clear, as to the outcome of any state of affairs whenever or wherever it may occur. Where there is apt to be ambiguity is in the definition of the state of affairs; for instance, in considering what would have happened if a man had acted differently, we are apt to introduce any fact we know, whether he did or could know it, e.g. the actual position of all the cards at bridge as opposed to their probabilities of position from his point of view. But what is clear is that our expectations are general; when the sort is clearly defined we expect with the same probabilities of the sort. If not, and we expected differently in every real case, expectation in an imaginary case could have no meaning.

The value of conditional probability for conditionals in table 3.2 is determined by the value stated in the chance of which the conditional is an in-

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Ramsey calls "practical certainty" (cf. ch.1 §1.3). This means that the actual degree of belief of a person in the consequent of a law given its antecedent can and usually is less than 1 – slightly less. Indeed «we do not believe laws for certain» (GPC, p.251).

[12]My italics.

[13]Recall that according to my interpretation of Ramsey's epistemology, laws produce knowledge, because they produce certainty. Chances, in turn, produce beliefs, because they cause degrees of belief lower than 1. Of course, in the ideal thinker the degree of belief (whether of 1 or lower) strictly reflects the actual proportion of times the event of the consequent has actually occurred given the antecedent (see ch. 1, §1.3).

[14]Here it seems like chances are not variable hypotheticals, but it is clearly a slip-up, since a few page later, where Ramsey introduces chances, he says (GPC, p.251): «We have some variable hypothetical of the form 'If ϕx, then ψx' with ψ later than ϕ, called causal laws: others of the form 'If ϕx, then probability of a for ψx' called a chance» as we know. Recall also that GPC is a note and has been published after Ramsey's death.

stance. If the conditional is an instance of law, then the degree of belief in the consequent of the conditional given its antecedent will be equal to 1. This means that if the degree of belief in q given p equals 1 is not because of the values of p and/or q (i.e. true or false), but because the conditional "if p then q" is an instance of a law (and not of a chance).

In the same way, cases where the corresponding material implication is true can be supported both by chances or laws. If they are supported by chances, there might be a linguistic signal in the consequent of the conditional, like an adverb as "likely" or a verb like "might", or even a probability value expressed.

For instance, suppose Alexandra is strolling in a park with a small lake where six swans live. She usually goes to this park and she knows that the majority of swans in the park are white, but there are also two black. Approaching the lake, she has a degree of belief in "if now I meet a swan, it will be white" equal to 0.8. We may suppose she endorses a chance of the type "For all x, if x is a swan in this park, there is an 80% probability that x is white". On the other hand, someone who has never been to that park but who still knows that swan can be white or black, although these latter are rarer, may expect white ones more than black. Someone who believes that all swans are white, also believes that, by entering the park, if he meet a swan, it will be white – his degree of belief in "white" given "swan" equals 1 – he endorses a law. But suppose also that Alexandra does not meet any swan during her walk in the park. Once at home, she thinks: "if I had met a swan, it likely would have been white", or even "if I had met a swan, there would have been 80% probability it would have been white".

This interpretation is supported also by what Ramsey says in GPC (p.247):

> the difference between us is that he thinks that if he had eaten it he would have been ill, whereas we think he would not. But this is *prima facie* not a difference of degrees of belief in any proposition, for we both agree as to all the facts.

Indeed, disagreement on counterfactuals does not involve degrees of belief *prima facie*, because the man and us both are aware of what is actually true (e.g. in the cake example, the man did not eat the cake and the material implication is thus true). But at a deeper analysis, it is clear that our

counterfactual disagreement involves, in fact, degrees of belief, since it involves variable hypotheticals. The difference between us is that the variable hypothetical the man's conditional is an instance of (together with some additional facts r) is a law, a variable hypothetical where antecedent and consequent are connected by probability equal to 1. Hence, the man is certain that if he eats the cake he will be ill, before the event, but he is also certain that if he had eaten the cake he would have been ill, after the event. The two conditionals are instances of the same variable hypothetical, but, before the event, probability is explicitly and genuinely involved, since the event (eating the cake) has not happened yet and it does not have a truth value attached. Compared to Table 3.2, before the event we have the ?-? case; after the event the F-F case – he did not eat the cake and he did not have a stomach ache. The same for us: the conditionals we accept before and after the events are instances of the same variable hypothetical, let us say a chance (to be coherent with my example in §2.1.3). Before the event, our degree of belief that the man will not be ill, given that he eats the cake is much higher than that in the conditional with the contrary consequent. Hence, we accept the conditional "if the man eats the cake, he will not be ill", before the event, and its subjunctive version after (the meaning of the conditional is always captured by the ?-? case before the event and by the F-T after, as displayed in Table 3.2). We accept these conditionals because the probability value a of $\neg\psi$ given ϕ is higher than that of ψ given ϕ.

The reason why degrees of belief are not directly involved in counterfactuals, but only inasmuch as they are instances of variable hypotheticals, can be traced back to Ramsey's idea of causation[15]. The fact is that we can affect the future, but we cannot affect the past: «that I cannot affect the past, is a way of saying something quite clearly true about my degrees of belief» (GPC, p.250). For this reason, before the truth value of the material conditional is settled, it is probability the proper tool to represent the meaning of a conditional statement. After the event, our counterfactual "if the man had eaten the cake he would have been ill" can still be supported by a chance, but the meaning of its assertion cannot be captured by conditional probability.

We have seen that chances can support counterfactuals. This is the case, for instance, of counterfactuals stating probabilistic judgements, as "if Marco

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[15]See ch.1 §1.2.3 for more details.

had listened to his friend he would have probably acted differently" or "if my mother had lived two centuries ago, she would have had 50% chance of surviving while giving birth". Probability values involved in the chances we endorse play a role in counterfactuals too[16]: they determine whether, according to the agent, a consequent would have been likely or unlikely, and to what extent, had the antecedent occurred. In the same way, the value of the conditional probability is determined by the chance or the law the conditional is supported by.

As in the case of laws, I consider chances to be triggered by additional contextual information r. This is indeed suggested by Ramsey in C (p.207):

> The actual beliefs of a user of the system should approximate to those deduced from a combination of the system and the particular knowledge of fact possessed by the user, this being (inexactly) taken as certain.

This, again, means that there are some facts r to be added to the antecedent of the conditional in order to trigger a variable hypothetical that allows the inference of the consequent. Indeed, in these types of evaluation «we are apt to introduce any fact we know, whether he [the man] did or could know it» (GPC, p.247).

Of course, the same restrictions presented in MHP hold: r must be true[17], contain, at most, conjunctions and universal quantifiers, is implied by the context and usually refers to events earlier than those stated in the consequent of the conditional[18]. Contextual information may change significantly before and after an event[19], and with them the variable hypotheticals triggered. The role of r in the probabilistic case can be seen as the "stock of knowledge" of Ramsey's famous footnote, to which the antecedent of the conditional should be hypothetically added. In the conditional probability

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[16]For all the other cases covered in MHP this is even clearer and more intuitive – recall that, concerning the analysis, there is no distinction between indicatives and subjunctives.

[17]So far, I have not been clear enough on the status of this r. Ramsey says it must be true, and I take it literally: it is not enough that the subject *believes* that it is true, she must know that it is true – which implies that it is actually true, according to Ramsey's account of knowledge in ch.1 – with a flavour of objectivity that the belief does not have.

[18]The temporal restriction usually applies, but not always, like in the example Ramsey gives in MHP (p.238) "if it had rained, he wouldn't have come", where both antecedent and consequent are false.

[19]For instance, suppose the man decided not to eat the cake, but, after his decision, he explained to us that the cake contained cream and was left out fridge for four days. We would probably agree with him that if he had eaten the cake he would have been ill.

case too, the same limitations on r are valid: true, implied by the context, compatible with p (the antecedent of the conditional), specific or categorical and usually preceding the events of the consequent. In the same way, the definition of causal law is preserved, but it is extended to include also what can called "causal chances". Whenever the r and the antecedent of a conditional describe events not later than those described in the consequent, the conditional is an instance of a *causal law* or a of *causal chance*.

Here it is my proposal: conditionals are supported by variable hypotheticals, whether they are chances or laws. When a speaker asserts a conditional, it means that he has contextual information, that, together with the antecedent of the conditional, trigger a variable hypothetical he endorses, of which the conditional is an instance. In the same way, the listener accepts the conditional if she has contextual information such that make the conditional an instance of a variable hypothetical she holds.

I then define acceptability of a conditional as follows:

Def. (**Acceptability**). A conditional is accepted by a person iff he has contextual information r, true, compatible with the antecedent of the conditional, containing only conjunctions and/or universal quantifiers[20], and usually referring to events earlier than those described in the consequent of the conditional, such that, if added to the antecedent of the conditional, makes the whole conditional an instance[21] of a variable hypothetical the person endorses.

I take this acceptability criterion to hold for all types of conditionals (indicatives, subjunctives and counterfactuals).

In the next section I present the final "truth table", that comes out from my proposal. I also give one example for each case of the table to see how and if this account works.

3.1.2   The Nine

The unified theory of conditionals outlined in the previous section goes as follows. A conditional $p \to q$ (indicative, subjunctive, counterfactual) is accepted by someone when he has additional contextual information r

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[20]I have not said this, but the number of r must be finite.

[21]I here use "being an instance of a variable hypothetical" referred to a conditional in the way I have explained it in ch. 2, §2.2.1.

that, together with the antecedent p of the conditional, trigger a variable hypothetical (a law or a chance) which allows to infer the consequent q. When this happens, we say that the conditional $p \wedge r \rightarrow q$ is an instance of the variable hypothetical triggered. As I already said, to r apply all the restrictions discussed in ch. 2 §2.2: it must be true and compatible with p (i.e. $\neg(p \wedge r)$ is not an instance of a law). r must not contain $\neg$, $\vee$ $\supset$, $\exists$. Very often, r refers to events earlier than those described in q. When p and r both refer to events earlier than those described in q, then the conditional is an instance of a *causal* law or of a *causal* chance.

Laws in real life are not necessarily believed for certain – i.e. our actual degrees of belief in them can be slightly < 1 (cf. GPC, p.251 and C, p.207). In this respect, there is not a significant difference between laws and chances. But our ideal thinker can sharply distinguish between laws an chances. I then stipulate that for an ideal thinker:

$$\forall x(\phi x \rightarrow \psi x) = \begin{cases} law & \text{if } P(\psi x|\phi x) = 1 \\ chance & \text{if } 0 < P(\psi x|\phi x) \leq 0.99 \end{cases}$$

Given that the ideal deductive system composed by laws and chances[22] works according to the rules of probability, if a person endorses the variable hypothetical $\forall x(P(\psi x|\phi x)) = a$, she is forced – if rational – to endorse also $\forall x(P(\neg \psi x|\phi x)) = 1 - a$. If the variable hypothetical the person endorses is a law $\forall x(\phi x \rightarrow \psi x)$, she is forced to a degree of belief in $\forall x(\phi x \rightarrow \neg \psi x)$ equal to 0. For this reason, CEM (conditional excluded middle) holds[23].

If someone's degree of belief in q given $p \wedge r$ is low, it is because it is the

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[22]Recall, from ch.1 §1.2.3, that Ramsey in GPC rejects the idea that causal laws are consequences of the axioms of such deductive system, because «it is impossible to know everything and organise it in a deductive system» (GPC, p.242). However, this does not go against the idea that laws and chances constitute an ideal deductive system according to the rules of probability (C, p.207). Furthermore, in this system, laws and chances are not consequences of axioms plus facts, but rather, laws (or chances) plus facts give the actual degrees of belief a person has. Indeed, Ramsey himself in GPC refers to his essay C, when talking about causal laws and introducing chances. This suggests that what he proposes in C in 1928 is still valid in GPC in 1929, although his account of causality has changed.

[23]In ch.1 §1.1.1 I argued that Ramsey in TP assumes that a person has an opinion on everything by introducing ethically neutral propositions, propositions towards the agent is indifferent in the sense that his degrees of belief in them is $1/2$. In principle it might be the case that an agent has a degree of belief equal to $1/2$ in q given p and the same degree of belief in $\neg q$ given p. However, I exclude this possibility because Ramsey explicitly refers to CEM in GPC (p, 240), but also because I am here already talking about an idealised thinker whose degrees of belief are determined precisely by the chances and laws he endorse – which is an ideal situation, of course.

instance of a chance that he endorses, which states that the probability a
that a x is a ψ given that it is a ϕ is low. And, since we are talking about an
ideal system «according to the law of probability» of an ideal thinker, this
same person also endorses a chance giving a very high probability (namely,
$1 - a$) of a x being a $\neg\psi$ given that it is a ϕ. This means that such person
accepts "if p, then $\neg q$", because he endorses a chances that gives a high de-
gree of belief in $\neg q$ given p, while he rejects "if p, then q", since by endorsing
the contrary chance, he must assign a low probability to this conditional.

I showed in ch.2 that there are two ways people can disagree: one is by en-
dorsing antithetical variable hypotheticals, another by endorsing no variable
hypothetical concerning the specific situation in question. Regarding the
first possibility, when these variable hypotheticals are chances, two people
differ in the fact that while one as a high degree of belief in the conditional
object of the dispute, the other one has a high degree of belief in the contrary
conditional. Given the laws of probability, it is easy to see that this means
that one endorses $P(\psi x | \phi x) = a$ while the other $P(\neg\psi x | \phi x) = a$, where a
is ≥ 0.50 in both cases. Concerning the second case, i.e. endorsing neither
$\forall x(\phi x \rightarrow \psi x)$ nor $\forall x(\phi x \rightarrow \neg\psi x)$, I do not account for it here because I take
it to be due to epistemic ignorance. This is because I am talking about a
situation that is ideal, to a certain extent, as showed by my assumption that
a person's degrees of belief reflect the laws of judgments she holds. Even the
idea that all degrees of belief are expressible by numbers is a clear idealisa-
tion. Hence, I take CEM to be valid, given that a person has an opinion on
everything or that, if she were reflect on something she has not reflected on
yet, she would endorse either $\forall x(\phi x \rightarrow \psi x)$ or $\forall x(\phi x \rightarrow \neg\psi x)$.

I have argued, following Ramsey, that a conditional statement can have
different "meanings" according to the truth values of its clauses. In other
words, it can express different «cognitive attitudes», and different expecta-
tions about a future event, or about what we believe to follow «from certain
laws or hypotheses». But it does so because it is always supported by our
knowledge and beliefs - i.e. r. This is showed by the table below.

In order to see how this sort of truth table works and whether it can
account for the uses of conditional statements, I propose some simplified ex-
amples.

Let us consider again the cake example. However, this time suppose that
the man decides to eat the cake and finishes it. He had no reason to think it

p	q	if p then q
T	T	"Because": $(p \wedge q \wedge (p \wedge r \rightarrow q))$
F	T	$p \wedge r \rightarrow q$
$?$	T	$p \wedge r \rightarrow q$
T	F	$\times$
F	F	$p \wedge r \rightarrow q$
$?$	F	$P(q|p \wedge r)$
T	$?$	$P(q|p \wedge r)$
F	$?$	$p \wedge r \rightarrow q$
$?$	$?$	$P(q|p \wedge r)$

Table 3.3: Here I have added r also to the probabilistic cases.

was rotten. After a while, he starts feeling bad and wondering whether the cake was a bad one. But he knows that he had bad eggs for breakfast, he has checked the package after his stomach started hurting. In fact, the eggs are causing his stomach ache. All the following conditionals can be accepted by him, if he has the right contextual information triggering a variable hypothetical he endorses. These examples show that contextual information and a person's beliefs are essential for the acceptability of conditional statements.

1. Case T-T. "I got a stomach ache because I ate those eggs". According to the present analysis, if the man accepts this statement it means that he ate bad eggs and that he got ill, and that there are additional r such as: "and those eggs were bad", triggering a variable hypothetical endorsed.

2. Case T-?. "If the cake was not poisoned, I will be alive tomorrow". In this case, the man does not know the truth value of the consequent, he has to wait until tomorrow to discover it. This conditional explicitly expresses a degree of belief in the consequent given the antecedent. The man does not know whether the corresponding material implication is true or false. If the consequent will turn out false, the material implication will be false, true if the consequent will turn out true. The subject has a degree of belief given by a chance he endorses, of which the conditional (with the additional r in the antecedent) is an instance[24].

3. Case F-T. "If I had not eaten the cake, I would have got ill all the

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[24]It might also be a law, in which case the man's degree of belief would be $= 0.9$, according to our stipulation. When $P(p) = 1$, like in this case, $P(q|p) = P(\neg p \vee q)$, see, for instance, Edgington (2005)

same". This case is covered extensively in ch.2 and is acceptable, as usual, if the man add the right r. The r could be, for instance, that eggs were bad.

4. Case F-F "If the cake had contained arsenic, I would have been dead by now". This is acceptable simply by taking as r some information about arsenic, like how long it takes for its effects to appear.

5. Case F-?. "If the cake contained arsenic, I likely will be dead by tomorrow". As r can be taken, as before, some propositions describing the effects of arsenic. In this case, the variable hypothetical triggered is a chance and not a law (as the adverb "likely" signals).

6. Case ?-T. "If the cake was not rotten[25], I would have been ill all the same". In this case, whatever value the antecedent will get, the corresponding material implication is already true. For this reason, there is not anything the man can deliberate upon, hence no conditional probability. However, he can accept the conditional in virtue of what he knows and the general beliefs he holds (i.e. by finding the right r, like "the eggs were bad").

7. Case ?-F. "If I will be fine in an hour, then the eggs were not bad afterall". This is perhaps the most tricky case. In particular, it is difficult to see why the probabilistic account should be used. Technically, it is because the man does not and cannot know whether the corresponding material implication is true (see my explanation in the previous sections). If we reflect on the conditional, it is plausible that, although the man knows that the eggs were actually bad, he wonders about this possibility. The man can still wonder whether "if p then q" even if he knows that the consequent is false. After all, if the right r is found (perhaps something like " eating bad eggs causes nausea"), it could be reasonable for the man to consider what if he gets better soon.

8. Case ?-?. "If I'll be ill tomorrow, I shall call a doctor". This is the case explicitly covered by the footnote. Here the man simply fixes his degree of belief in q given p, after having added p hypothetically to his stock of knowledge. In other words, the man adds to p the r, related to the context, that he knows (viz. that are true, certain and obtained by a reliable process – see §1.3).

I think my proposal can satisfactorily cover these cases. It remains the false material implication case. It is difficult to think of contextual information

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[25]Recall that in this version of the example, the man and us do not know whether the cake was rotten or not.

that, in this circumstance, would make acceptable a conditional like:

9. Case T-F. "If I have eaten the cake, I am not ill" or "if I had eaten the cake, I would not have been ill". Hence, I reject it as not acceptable and not assertable.

3.1.3 Validity and Validities

In the previous sections, I have outlined a unified theory that explains the semantics that goes beyond material implication and the pragmatics of conditional sentences, providing also an epistemological insight with the acceptability criterion. It is a descriptive account of what it means for an agent to accept a conditional, and when she is allowed to do so. By understanding the conditions in which someone accepts and/or asserts a conditional, it is possible to give a first attempt of acceptability criterion, as I did in the previous section. Along these same lines, I will now try to give a validity criterion for inferences containing conditionals and I will present some notable validities of classical logic, whose validity is often debated in works on conditionals. I will informally discuss whether the theory at stake blocks them or not.

Let us start from the validity criterion.

Validity

I have said that a person accepts a conditional when she knows additional, contextual information r, that, if added to the antecedent of the conditional, make the conditional an instance of a variable hypothetical the person endorses, enabling the consequent to follow. We need to find a definition of validity for inferences that reflects this acceptability criterion.

First, the validity criterion we are looking for must take into account the role r plays. r is, in fact, part of the context in which the speaker, the agent, evaluates the conditional. Hence, it is plausible to require that in an inference, the r must remain stable, fixed, there must be no context shifting. I think this is reasonable for those inferences containing conditional(s) in the premises and/or in the conclusion, because we must assume that the acceptance of premises and conclusion should not require a different context of evaluation. It might be, that the conclusion requires the conjunctions of all the rs of the premises (since a conditional in the premises can require more

than one r or there can be more than one conditional among the premises). It should never be the case that the additional propositions required to accept the conclusion are different from or more than those of the premises. The additional information required for accepting the conditional in the conclusion can be, at most, the conjunction of all the additional propositions rs of the premises.

Variable hypotheticals of which the conclusion is an instance can be a combination (conjunction) of the variable hypotheticals of which the premises are instances, but they can be also different variable hypotheticals triggered by the antecedent of the conclusion and its r.

Def. (Validity). for inferences with conditionals[26]. An inference containing one or more conditionals in the premises and/or in the conclusion is *valid* iff the additional propositions rs needed to make the conclusion an instance of a variable hypothetical endorsed are exactly those of the premises and at most the conjunction of all of them.

This means that, given a set Γ of formulae ϕ and ψ as premises. Suppose they contain conditionals, each with just one additional r needed to be accepted, r' and r'' respectively, then the additional propositions for the agent to accept the conclusion are, at most, $r' \wedge r''$:

$$\frac{\phi(r') \quad \psi(r'')}{\chi(r' \wedge r'')}$$

Clearly, it is possible, that the conclusion needs just one between r' and r'' to be accepted. Also, the restrictions on r I have listed, and that Ramsey mentions in MHP, always apply[27].

In other words, an inference is valid if the contextual information needed to accept the premises containing conditionals, are sufficient to accept also the conclusion, making it an instance of a variable hypothetical the agent endorses. Namely, the contextual information, r_χ, needed to accept the conclusion is a subset of the set r_Γ of contextual information needed to accept the premises, i.e. $r_\chi \subseteq r_\Gamma$. Of course, if r_Γ is empty, and the conclusion contains conditionals, the inference is not valid.

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[26] I take validity for inferences without conditional sentences to be defined classically, as preservation of truth.

[27] See §3.1.1 and §2.2.1.

Def. (Validity). $\Gamma \models \chi$ iff $r_\chi \subseteq r_\Gamma$ and r_χ makes χ an instance of a variable hypothetical the agent endorses.

Now that we have defined our validity for inferences involving conditional statements, let us consider some problematic inferences, whose validity is often debated in the literature on conditionals.

Validities

I propose to start by the inference that Ramsey explicitly considers: *contraposition*:

$$\frac{p \to q}{\neg q \to \neg p} \ C$$

In MHP (p.239, fn.6), Ramsey says: «This brings out that in this ⟦ struck out: interpretation ⟧ meaning "if p then q" and "if $\overline{q}$ then $\overline{p}$" are not the same. We could not say instead of (d)[28] "if he were still here, he wouldn't have come"». Ramsey is explicit and gives a blatant counterexample to contraposition. However, this is a peculiar example, since it seems to involve also the presupposition that being somewhere presupposes to have gone there, first of all. Hence, the wanted r for the antecedent "if he were still here" could easily be taken to be, or at least to include as a conjunct: "and he came", viz. the negation of the consequent of the conditional "he wouldn't have come". Of course, this is sufficient to show that contraposition is not valid. But I can give another counterexample to it. Consider the cake example once more, as I presented it in ch.2 (pp.67-8): the man believes "If I had eaten the cake I would have been ill", and the additional r is the conjunction: "I am a person and that thing is a cake and the cake is rotten". The contraposed of the conditional would be: "if I hadn't been ill, I wouldn't have eaten the cake"[29]", which is perhaps acceptable *per se*, but the consequent "I didn't eat the cake" does not follow from "If I am not ill and I am a person and that thing is a cake and the cake is rotten" – I cannot think of a variable hypothetical triggered by this antecedent (especially with the conjunct saying that the cake is rotten). This means that the additional propositions for the acceptability of the contraposed conditional are not the same that make

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[28](d) is the case where the antecedent is doubtful and the consequent is true: «("He's not come") "Not necessarily, because he would anyhow (= if he came) have gone away by now"» (MHP, p.239).

[29]Or "If I weren't ill, I wouldn't have eaten the cake".

the non-contraposed conditional acceptable. Hence, contraposition does not satisfy the criterion for validity.

One of the biggest issue with material implication are the so-called *para-doxes of material implication*:

$$\frac{q}{p \to q} \; TC \qquad \frac{\neg p}{p \to q} \; FA$$

It is desirable, then, that an alternative account for natural language conditionals blocks these two inferences. It is evident that, since in the conclusion there is a conditional, but in the premises there is none, the number of r of the conclusion is greater than those in the premises. Hence, both these inferences are invalid in my account. I do not propose a counterexample because there are many in the literature. It is sufficient to take two propositions totally unrelated one to the other (like "the sun is blue" as p and "humans are bipedal" as q).

Then we have *modus ponens*, one of the most important and useful inference rule:

$$\frac{p \to q \quad p}{q} \; MP$$

Since in the conclusion there is no conditional, it is clear that the rs remain the same from premises to conclusion, and that they are exactly those needed to make the conditional $p \to q$ an instance of a law – namely, to accept it. This suggests that MP never requires a context shift. Consider this example: I accept "if my mum stops smoking, her cough will get better"[30]. Indeed, I also know that smoking causes breathing diseases, I know that my mother smokes and other specific propositions of this type – these are my rs – and I have a variable hypothetical this conditional is an instance of. Then, by believing that "my mums stops smoking", I am also forced to accept that

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[30]I decided to use this example, where I refer to something that might happen in the future, but which is not settled yet to show that it does not make any difference with respect to inferences. As I explained in §3.1.1, whether we apply the inferential explanation or the probabilistic one, the results is the same as far as we accept the conditional. This is because, first, these two tools explain the meaning of our assertions and nothing more; second, the acceptability of such conditional assertions relies on our knowledge: it depends on whether we have the additional information r. Hence, once I assume that I accept such a conditional – whatever the truth values of its components are (except T-F) – I can apply the inference by supposing the truth of the antecedent and hence the truth of the consequent.

"her cough gets better". In doing so, my information are the same, there is no need to increase or change them to arrive at the conclusion.

Another important inference is *transitivity*:

$$\frac{p \to q \quad q \to t}{p \to t} \ T$$

This case is quite problematic because it may look valid *prima facie*, at least for what concerns the number of rs the conclusion needs – it is plausible to think that by joining the rs of the premises it would be possible to infer the conclusion. Indeed, I think this happens in many occasions. However, I suspect that sometimes the rs involved for making acceptable the conclusion are not the same as those making the premises instances of variable hypotheticals. It is sufficient to find just one case to declare transitivity invalid in this account. Here it is my attempt: I accept "if you're responsible, you stay isolated at home", because I have this r: "we are in the middle of a pandemic", and I accept also "if you stay isolated at home, you are crazy", because my r is: "you always stay alone". However, I do not accept "If you're responsible, you are mad". The conclusion does not really follows from those premises and rs, because it seems that the rs implied by the first two conditionals do not support the last one. A context shift is occurring. According to my validity criterion then, this inference is not valid in this account in general, although there might be many cases where the additional propositions supporting the conclusion of a transitivity inference are exactly those of the premises or, at most, a conjunction of them[31].

However, *limited transitivity* seems a plausible option:

$$\frac{p \to q \quad p \wedge q \to t}{p \to t} \ LT$$

because the additional propositions supporting $p \wedge q \to t$ can possibly add information to make it possible to infer $p \to t$, since this latter is a sort of restriction of a conditional already accepted. The example above does not really work because I do not have such r that would make me accept the second premise of LT "If you are responsible and you stay isolated at home,

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[31]Consider also Rescher (2007, p.54): "if you lose your purse, then you are penniless", you accept it because your r is "all your pennies are in your purse". You also accept: "if you are penniless, then there is no money in your purse" and your r is "you are checking your purse". However, I bet that you do not accept "if you lose your purse, then there is no money in your purse" given "all your pennies are in your purse and you are checking your purse", but also with only one of the two rs.

then you are mad". My contextual information, added to the antecedent of
this conditional do not trigger any variable hypothetical I endorse. However,
I would accept this inference: from "if you're responsible, you stay isolated
at home" and "if you are responsible and stay isolated at home, you go
crazy" to "if you're responsible, you go crazy". Indeed, the acceptance of the
second conditional premise means that there are information that trigger a
variable hypothetical endorsed and make it possible to infer the consequent.
Presumably then, the information needed to accept the conclusion are the
same or even a subset of those needed for the second premise.

Let us now consider *antecedent strengthening*:

$$\frac{p \to q}{p \wedge t \to q} \; AS$$

This pattern is valid if it is always possible to accept the conclusion $p \wedge t \to q$
with only and solely the information needed to accept $p \to q$. Namely, it is
always possible to accept the conditional in the conclusion within the same
context of acceptability of the premise. Intuitively, this seems not always
possible. t could introduce whatever proposition, even totally unrelated to
the context of evaluation of "if p then q". Then, it should be easy to find a
counterexample to AS. Let us take q = "Alessandra is a lawyer" and p =
"Alessandra has studied Law". I also know that to become a lawyer in Italy
you need to study Law, but you also need a license to practice. Thus, I
accept the conditional "if Alessandra is a lawyer, she has studied Law", sup-
posing my r is "she has obtained a licence to practice". I also know that
whales are not fishes. However, from this context (i.e. the additional r: "she
has obtained a licence to practice") it is really hard to infer and accept: "if
Alessandra is a lawyer and whales are not fishes, she has studied Law". It
is hard to think of a variable hypothetical this conditional, given the addi-
tional information r here stated, can be an instance of. AT is not valid in
this account.

As in the case of transitivity and limited transitivity, *rational monotonic-
ity* seems more plausible:

$$\frac{p \to q \quad \neg(p \to \neg t)}{p \wedge t \to q} \; RM$$

The second premise recall the compatibility requirement for the additional
r, hence if it satisfies it, it is reasonable that t is added to p and together

imply q.

Finally, consider the *simplification of disjunctive antecedent*:

$$\frac{(p \vee t) \to q}{(p \to q) \wedge (t \to q)} \; SDA$$

SDA is perhaps a bit more complicated because its conclusion has two conjoined conditionals[32]. In this case too, the inference is valid if the rs needed to support the conclusion are the same of those needed for accepting the premise. This means that the r for each of the two conditionals in the conclusion can be at most the conjunction of the rs for the conditional in the premise. I will consider a famous example from Mckay and Inwagen (1977): "if Spain had fought with the Axis or with the Allies, she would have fought with the Axis". Accepting this should imply accepting "if Spain had fought with the Axis, she would have fought with the Axis" and "if Spain had fought with the Allies, she would have fought with the Axis". Suppose the r of the antecedent in the premise are: "the regime in Spain was inspired by Italian fascism and the Axis was composed by Germany, Italy and Japan". It seems that these additional propositions are enough to support the premise and the first conditional in the conclusion, but they do not suffice to support the second conditional in the conclusion. I think, however, as in other cases discussed above, that many instances of this pattern are acceptable and people use them quite often[33]. However, since I have a counterexample, SDA is invalid.

I have here presented a development of what I take to be Ramsey's account of conditionals. From the recollection of Ramsey's ideas spread in different texts done in ch.2, the picture of what it *means* to assert a conditional sentence was clear for some types of conditionals (like counterfactuals

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[32]I suggest to consider the conjunction accepted if both conditional conjuncts are. Perhaps this approach could be extended also to other connectives, reflecting their classic truth conditions in terms of acceptability, if conditional sentences are involved. However, this goes outside the scope of the present discussion.

[33]Honestly, I think that what is wrong with this inference in general is the formal analysis of it. It seems very odd to me to read the disjunction in the antecedent of the conditional premise as an inclusive disjunction. Intuitively I would read it as an *aut-aut*, although it is possible that Spain would have been two-faced. But in that case, again, it would depend on the context: if among the r in the premise there were also one stating that Spain had intention to play a double game with the Allies, then, perhaps, it would support the second conditional in the conclusion. But recall that r must be true – it should not be just a supposition.

and uncertain clauses) and more confused or absent for others (like true antecedent and uncertain consequent). I have argued that the cases Ramsey discusses in MHP are those where a true material implication corresponds to the conditional sentence. On the other hand, as argued in §2.1.2, conditional probability covers the uncertain case (uncertain antecedent and consequent). Naturally, then, I have here proposed to extend the application of conditional probability to all cases where the truth value of the corresponding material implication is not settled yet. Thus, this theory about the meaning of conditional sentences employs two formal tools.

In order to retrieve a unified epistemological theory and give an acceptability criterion for conditionals, I have used the additional r also with conditional probability. A conditional is accepted in this framework iff the agent has contextual information that make the conditional an instance of a variable hypothetical he endorses. Thanks to Ramsey's classification of variable hypotheticals into laws and chances, it is easy to see that conditionals can be supported by both, and this is what determines not only whether they are accepted or not, but also the degree of belief in them. Given the idealisation of a deductive system made of laws and chances, and assuming that if a person has no opinion on a conditional is because he is at the moment epistemically ignorant, I take CEM to be valid on this account. Finally, leaning on the additional information r, again, I have introduced a validity criterion for inferences containing conditionals. I have also discussed some controversial inference patterns for conditionals.

The account I have here proposed has, I think, several advantages. First, it is a unified account which aims at covering all types of conditionals, indicatives, subjunctives and counterfactuals. Second, it ties together and explains at the same time the semantics, the pragmatics and the epistemology of conditionals. A conditional sentence is true if the material implication corresponding to it is. However, what we convey with our conditional assertions cannot be explained by material implication alone. What we know and believe and the general rules that govern our judgments play a crucial role in choosing what conditionals we accept and assert. Third, my account does not reject material implication but extends classical logic, as probability calculus is presented as an extension of classical logic in TP. Indeed, the same requirement of coherence applies[34]. Fourth, it takes into account

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[34]See ch. 1 §1.1.

a very intuitive idea: we make inferences within the same context, viz. we move from premises to conclusion thanks to the same information and beliefs. This aspect, of course, is very similar to possible world semantics for conditionals, where possible worlds can be interpreted as information states. The theory I have here offered still lacks of a fully developed formal apparatus, and this can be for sure motivation for further and future work. In this sense, a comparison with well known semantics for conditionals, that resemble this account (like possible worlds), can be useful.

In the next section, I will propose another way to obtain a unified theory, which uses possible worlds and Lewis' *imaging*. The resulting account is a ready-to-use semantics, which, thanks to Ramsey's variable hypotheticals, improves contemporary accounts by specifying some notions they use.

3.2 The formal approach

In this second part of the chapter I propose another way to obtain a unified treatment of conditionals following Ramsey's suggestions[35]. This proposal is based on, as I mentioned before, the many similarities between Ramsey's inferential account and possible world semantics. Again, I move from the results of chapter 2, where there are two accounts: conditional probability and the inferential one. The core idea is that variable hypotheticals and the contextual information r play the same role possible worlds do. Namely, variable hypotheticals play the role similarity among worlds plays in Stalnaker's (Stalnaker (1968)) and Lewis' (Lewis (1973)) accounts do. In a sense, variable hypotheticals endorsed by a person establish the worlds ordering. On the other hand, r corresponds to the most similar world(s) with respect to the actual one, since, as we have seen, it carries the contextual information. Thanks to this parallelism, other similarities that Ramsey's inferential account has in common with Stalnaker's work come out, and they underline how close the two theories are. These results will make it possible to translate Ramsey's approach to counterfactual within the possible worlds framework.

However, a unified theory is the ultimate goal. To achieve this, I will show that it is sufficient to substitute, in this framework, conditional proba-

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[35]This account is the result of the joint work with Mario Günther (Mario.Gunther@anu.edu.au), Günter and Sisti (2020).

bility with Lewis' *imaging*. The final theory *à la* Ramsey is a theory that can compete with contemporary ones, but it is also an improvement of possible world semantics for conditionals, since it specifies the meaning of Stalnaker's selection function and Lewis' worlds ordering.

Before pointing out the common features that allow a translation of Ramsey's account into a possible world theory, let me briefly introduce Stalnaker's framework.

In ch.2, we have seen that many theories of conditionals have been developed based on Ramsey's footnote. What I call the orthodox interpretation is the common view that Ramsey's suggestion applies *only* to indicative conditionals. It is then not surprising that scholars like Stalnaker (1968, p.101) tried to extend Ramsey's suggestion to cover all cases of conditionals: «Ramsey's suggestion covers only the situation in which you have no opinion about the truth value of the antecedent. Can it be generalized?». His final, general, version of the Ramsey test is the following (Stalnaker, 1968, p.102):

> First, add the antecedent (hypothetically) to your stock of beliefs; second, make whatever adjustments are required to maintain consistency (without modifying the hypothetical belief in the antecedent); finally, consider whether or not the consequent is then true.

From here, Stalnaker (1968) develops a (well known) possible world semantics for conditionals. A possible world is a set of propositions, a possible way the world could be or could have been. This notion allows to move from belief conditions to truth conditions, using Kripke's framework for modal logic. In Stalnaker's terms, a possible world is «the ontological analogue of a stock of (hypothetical) beliefs» (1968, p.102). The modal structure is a triple $\mathcal{M} = \langle K, L, \lambda \rangle$, where K is the set of possible worlds, R is the relation of relative possibility: given $\alpha, \beta \in K$, $\alpha R \beta$ means that from the actual world α, β is possible. In Stalnaker (1968) the relation R is reflexive, but not transitive[36]. λ is an impossible world, from which no world is possible and which is not possible from any world. λ is added to deal with conditionals whose antecedents are impossible, so that they are all trivially true in λ. An agent believes as true the propositions true in all the possible worlds he

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[36]Cf. Stalnaker (1968, p.103). Transitivity, as well as symmetry, can be added if needed. With transitivity we obtain Lewis' S4, with transitivity and symmetry S5.

cannot epistemically exclude to be actual. The agent believes p if the worlds he cannot exclude to be actual are p-worlds.

In Stalnaker's semantics there is also a *selection function f* which picks, given the actual world and a proposition p, the most similar world relative to the actual one where p is true. The function takes as arguments propositions and worlds and gives as value a possible world ($f : W \times \mathcal{P}(W) \longrightarrow W$). This allows to handle conditionals: given an antecedent the function selects a possible world where it is true. Thus, a conditional is true if the possible world where the antecedent is true is also a world where the consequent is true. In Stalnaker's words (Stalnaker, 1968, p.103):

> $p > q$ is true in α if q is true in $f(p, \alpha)$[37]
> $p > q$ is false in α if q is false in $f(p, \alpha)$

Namely, a Stalnaker's conditional $p > q$ is true at a world w iff its most similar p-world (a possible world where p is true) is also a q-world (q is true in that world). An agent believes a conditional if the most similar world to the actual one that satisfies the antecedent of the conditional satisfies also its consequent[38].

An alternative to selection function is Lewis' similarity relation amongst worlds, which, form a given world (i.e. the actual one) establishes a weak ordering of possible worlds[39]. Since the similarity of worlds is the fundamental element of this framework that allows it to be adapted to Ramsey's theory, I will use this latter variant of possible world semantics which emphasises it[40]. Given a world w, the similarity relation assigns to it an ordering of worlds $\leqslant_w$. Hence, $v \leqslant_w u$ means that v is at least as similar to w as u. It is also possible to define a strict relation $<$. A strict relation $<$ is easily defined: $v <_w u$ iff it is not the case that $u \leqslant_w v$, for all w, v, u in W, the set of epistemically accessible possible worlds. This relation is transitive, connected and reflexive. The relation is also centered: for any world w and v, $w \in W$ is the most similar world to itself, $w <_w v$. Stalnaker makes a

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[37]I here use the symbol ">" to denote the possible worlds accounts of conditional. For Ramsey's version I will use $\rightarrow$. Also, Stalnaker's original text uses A and B as antecedent and consequent respectively, which I have substituted by p and q for coherence with the rest of the work.

[38]For the details of Stalnaker's semantics see Stalnaker and Thomason (1970).

[39]Cf. Lewis (1973, p.48).

[40]Lewis (1973), in section 2.7 and 3.4, shows a correspondence between the selection function and similarity orderings. The truth-conditions are equivalent.

further assumption, *uniqueness*, assessing that for any world w and a proposition p there is at most one most similar p-world, a world where p is true. For any non-contradiction p, there is a world v such that $v <_w u$, for all u that are p-worlds. v is said the unique most similar p-world under $\leq_w$, i.e. $v = min_{\leq_w}[p]$[41].

3.2.1   Variable hypotheticals and possible worlds

Having introduced the fundamental elements of Stalnaker's semantics, I will now insert Ramsey's account of conditionals, as presented in ch.2, into this framework. Stalnaker (1968, p.101) rephrases Ramsey's suggestion:

> add the antecedent (hypothetically) to your stock of knowledge (or beliefs), and then consider whether or not the consequent is true. Your belief about the conditional should be the same as your hypothetical belief, under this condition, about the consequent.

Recall that in Ramsey's inferential account a conditional is an instance of a variable hypothetical iff there is an r that, can be added to the antecedent p. This means that a conditional $p \to q$ is acceptable for an agent if there is an r such that $p \wedge r \to q$ is an instance of a variable hypothetical endorsed by the agent. On the other side, in Stalnaker's semantics a conditional $p \to q$ is true at the actual world $w_@$ iff the consequent q is true in the p-world most similar to $w_@$[42]. Let us see what these two accounts have in common.

First, in both accounts the antecedent is *supposed*; the evaluation of a conditional requires, in both cases, to suppose that p. In Ramsey's enthymematic account this is done by supposing p to be true. Indeed, whether the antecedent is actually true or false, in accepting a conditional like "if I had eaten the cake, I would have been ill", you suppose that you ate the cake. If this supposition plus your information trigger a variable hypothetical, you can infer the consequent q. Stalnaker "supposes" the antecedent by

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[41]Other restrictions can be applied to the similarity relation, but I do not need them here for the purposes of this chapter. I will discuss them in the next chapter, when comparing Ramsey's account to Lewis' and Stalnaker's systems.

[42]Stalnaker's semantics, as well as Lewis', gives truth conditions for conditionals. I propose to replace truth with acceptability, as it will become clear later on (see p. 111), since it does not seem problematic.

moving to the most similar world[43] in which the antecedent is true. If in that p-world the consequent is also true, the conditional is true.

Second, both accounts have definite elements to determine and give a structure to the possible. In Ramsey this is done by variable hypotheticals. The variable hypotheticals an agent accepts define the possibilities the agent contemplates about what would have happened had something gone differently, but they also define his expectation about future events. The order of similarity of worlds does the same in Stalnaker's account. Furthermore, it is possible to define the order of similarity through laws (namely, Ramsey's variable hypotheticals)[44]. For instance, consider the cake example again. The man believes "if I had eaten the cake I would have been ill", that means, as we know, that the man holds information and endorses a variable hypothetical that allow him to infer the consequent from the antecedent. This can easily be modelled in terms of possible worlds and similarity order: the variable hypothetical endorsed defines the similarity order among worlds. Namely, for the man, the worlds where he ate the cake and he had a stomach ache are more similar to the actual one (where he did not eat the cake) than those where he ate the cake and was not ill. Having enough variable hypotheticals, the man can properly order the worlds according to their similarity to the actual one.

One problem might be that, given Stalnaker's uniqueness assumption, an agent must be equipped with a number of variable hypotheticals that allows him to always identify *the* most similar world. In Ramsey's account maybe this is a bit tricky. In ch.2, I have shown that there are two ways two people can disagree: by endorsing opposite variable hypotheticals – i.e. $\forall x(\phi x \rightarrow \psi x)$ and $\forall x(\phi x \rightarrow \neg \psi x)$ – or by one person endorsing no variable hypothetical related to the matter – neither $\forall x(\phi x \rightarrow \psi x)$ nor $\forall x(\phi x \rightarrow \neg \psi x)$. This seems to suggest that it is possible, for Ramsey, that given a proposition p, an agent believes that neither q nor $\neg q$ will/would follow. In the previous section, in presenting what I have called the "theoretical approach", I assumed that, given the role material implication plays there and conditional probability, which, as introduced in TP, follows standard axioms of probability, the thinker was somewhat ideal, and that, if she

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[43]Clearly, given that in Stalnaker the most similar world to the actual one is always the actual world itself, when the antecedent of a conditional is true, the conditional is evaluated in the actual world.

[44]For order of similarity defined by laws see Lewis (1979) and Halpern (2013).

does not have an opinion on something, it is because of epistemic ignorance. On the contrary, in the current approach I suggest to account for a possible neutrality of the the agent[45]. This might be modelled by putting in the same order of similarity worlds where $p \to q$ is satisfied and worlds where $p \to \neg q$ is satisfied. In this case, the semantics more apt to represent Ramsey's account would be Lewis's sphere semantics (first presented in Lewis (1973)), where instead of a single most similar world, there is a set of most similar worlds. I will come back to this in the next chapter.

The third point of connection between Ramsey and Stalnaker concerns the information about the actuality, needed to evaluate a conditional. In Ramsey (true) information about states of affairs are represented by r. r is constrained by the supposed antecedent of the conditional considered, by the variable hypotheticals accepted, and by true facts of the actual setting out. In Stalnaker, the relevant information are encoded in the (or the set of) most similar world(s). Ramsey's r can be seen as the set of most similar worlds, which is defined by the meaning of the antecedent, by the similarity order – that we have seen can be determined by variable hypotheticals – and by the actual world, i.e. the true propositions.

Since r in Ramsey's inferential account must be true and a conjunction of atomic propositions, it can be seen as giving the information from actuality that should be carried in the hypothetical situation. It gives the context where p is supposed and the conditional evaluated. $p \wedge r$ then constitute the context where q, the consequent of the conditional, is considered. Thank to r, this suppositional context is similar to the actual one. Furthermore, p and r must be compatible, viz. $\neg(p \wedge r)$ should not be an instance of a law, hence $p \to \neg r$ should not be an instance of a variable hypothetical. Indeed, p should not lawfully imply $\neg r$, it should not be the case that $p \to \neg r$. r can import as many information as are compatible with p. This possibly wide context of evaluation $p \wedge r$ resembles the set of most similar possible p-worlds in Stalnaker/Lewis accounts, where the conditional is considered, and which differs minimally from the actual world. Hence, to move to the set of most similar worlds corresponds to importing information from the actual world (true propositions) and supposing the antecedent of the conditional

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[45]I think it is more appropriate to consider this possibility here because this account already moves away a bit from Ramsey's texts and because Lewis' system of spheres already deal with it.

to be true. The set of most similar possible worlds in Stalnaker's semantics can be seen as playing the same role the conjunction $p \wedge r$ does in Ramsey's account.

Consider, for instance, an agent who has an opinion on everything, a know-it-all. Thus, he has an opinion on any propositions, which means he believes that it is either true or false, for any p. In this case, he has no doubt on what the actual world is. Hence, accepting a conditional $p \rightarrow q$ for him reduces to the classical truth conditions for a conditional in his actual world $w_@$. Given this, he clearly satisfies the law of conditional excluded middle, he accepts either $p \rightarrow q$ or $p \rightarrow \neg q$. Unless p is a contradiction, in which case both $p \rightarrow q$ and $p \rightarrow \neg q$ are true, in the agent's actual world either q or $\neg q$ holds. Conditional excluded middle in this case is validated both in Stalnaker's semantics and in Ramsey's account. On the contrary, a person who has doubts about some propositions p cannot exclude as actual those worlds where p is true but also those where $\neg p$ is true. This means that he believes neither p nor $\neg p$. In conditional cases, it might be that some of the most similar p-worlds from the actual one (where, for instance, p is false) are some worlds where q is true and some others are $\neg q$-worlds. In this circumstance, the agent does not believe either $p \rightarrow q$ or $p \rightarrow \neg q$. Ramsey can account for this case, since people can endorse a conditional (and hence a variable hypothetical) or its contrary, but can also endorse none of the two, as we know.

Hence, in Ramsey's account, if you accept "if p then q" it means that you have contextual information r that, together with the antecedent p, trigger a variable hypothetical that let you infer q. Translated into Stalnaker's theory, accepting the conditional "if p then q" means that the most similar p-world(s) – and q-worlds – share contextual information r with the actual world. If you believe p to be the case, r imports information from the actual context and the most similar p-world is the actual world itself. This reflects Stalnaker's constrain that the most similar world to a world w is the world w itself – if p is true in it, then $min_{\leq w}[p] = w$.

If, on the other side, you believe $\neg p$ to be true, r must be restricted for the evaluation of the conditional "if p then q". Since you believe $\neg p$, in supposing the antecedent of the conditional, r should not contain $\neg p$. Hence, in this situation, the set of p-worlds (or the p-world) where the conditional has to be evaluated is disjoint from the set of $\neg p$-worlds. Indeed, the first set

is the set of hypothetical beliefs, the second that of the actual beliefs. This is obvious, since you are supposing what would happen or would have happened if something, that in fact you believe did not happen, had occurred. Variable hypotheticals, or the similarity order, determine what you believe to be possible. This is another evidence of the similarities between Ramsey and Stalnaker, both equipped to treat possibilities, and not only actuality.

Finally, Ramsey's and Stalnaker's accounts both invalidate contraposition. In the previous section, as well as in ch.2 §2.2.1, I have argued, following Ramsey, that contraposition usually fails because it requires a context shift, viz. r needs to change. In the same way, if conditional "if I had eaten the cake I would have been ill" is accepted in Stalnaker's framework it means that all the possible most similar worlds where I ate the cake are also worlds where I am ill. However, this does not imply that the most similar worlds where I was not ill are also worlds where I do not eat the cake, for the most similar "eating-the-cake"-worlds do not say anything about this possibility. If there is no context shift contraposition holds, both in Ramsey and Stalnaker. When a conditional "if p then q" is believed to be *true* (i.e. we are in the actual world), it implies the corresponding material implication $\neg p \vee q$, hence contraposition in this case holds ($\neg q \supset \neg p$ is equivalent).

All these similarities can be visualised through possible world graphs, and by implementing Ramsey's notions into them.

Let us consider the situation where an agent holds a variable hypothetical $\forall x(\phi x \rightarrow \psi x)$. In Stalnaker's terms, this amounts to having as most similar ϕ-world(s), from any world that cannot be excluded to be actual, all worlds which are also ψ-world(s), as the following picture shows[46]

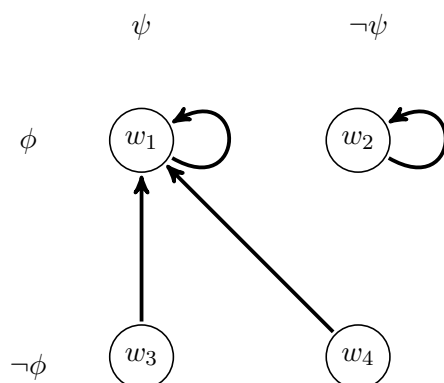[46]For simplicity all other propositions are omitted.

Figure 3.1: This graph represents a toy model with four worlds w_1, w_2, w_3, w_4. The arrows represent the most similar ϕ-worlds for each world the arrows originate from. Only world w_2 is a ϕ-world where $\neg\psi$ holds, hence, since the variable hypothetical endorsed is $\forall x(\phi x \rightarrow \psi x)$, w_2 is not candidate as the actual world.

So, here it is the situation: at the very beginning, the agent cannot exclude any of the four worlds to be actual. However, he endorses the variable hypothetical $\forall x(\phi x \rightarrow \psi x)$, hence he considers worlds where ϕ and ψ are true more similar to the actual one than those where ϕ and $\neg\psi$ hold. Hence the agent can exclude w_2 to be the actual world because its most similar world is itself, a $\phi \wedge \neg\psi$-world. In the situation modelled above, then the conditional accepted is an instance of $\forall x(\phi x \rightarrow \psi x)$ and is accepted in w_1, w_3, w_4, each of which is candidate as the actual world.

Let us consider another case, where the agent accepts the variable hypothetical $\forall(\phi x \rightarrow \neg\psi x)$. Again, the variable hypothetical explains the order of similarity among worlds and why, if a subject accepts a given variable hypothetical, he accepts a conditional that is an instance of it.
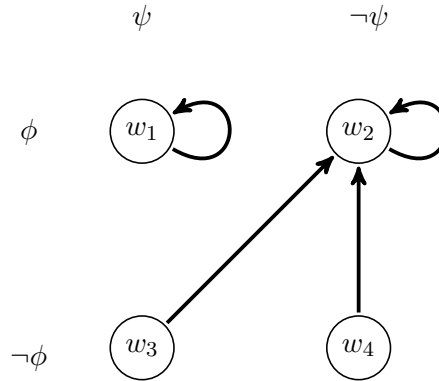
Figure 3.2: This picture models the acceptance of the variable hypothetical $\forall x(\phi x \rightarrow \neg\psi x)$. As in the former model, the arrows indicates the most similar world for the worlds they originate from.

In figure 3.2, the ϕ-world that is also a $\neg\psi$-world is w_2. From $\neg\phi$-worlds, w_3 and w_4, the closest ϕ-world is w_2, which is also a $\neg\psi$. From w_2, in turn, the closest ϕ-world is w_2 itself. The same happens to w_1, its own most similar ϕ-world, due to reflexivity. However, accepting the variable hypothetical $\forall x(\phi x \rightarrow \neg\psi x)$ excludes w_1 as the actual world.

Finally, we know that there is another possible attitude towards variable hypothetical: believing neither $\forall x(\phi x \rightarrow \psi x)$ nor $\forall x(\phi x \rightarrow \psi x)$. This state of belief is represented by the following figure:
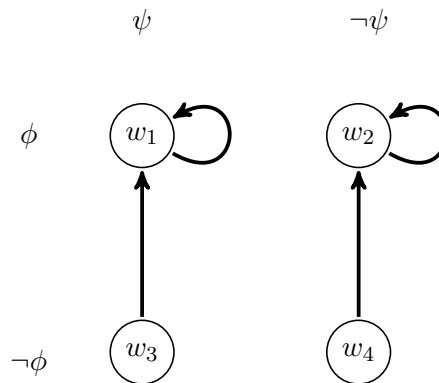

Figure 3.3: This model represents a situation where the agent accepts neither $\forall x(\phi x \rightarrow \psi x)$ nor $\forall x(\phi x \rightarrow \neg\psi x)$. Again, the arrows represent the respective most similar world for the worlds they originate from.

In this case, $\neg\phi$-worlds are divided: w_3 has, as its most similar ϕ-world, w_1, which is also a ψ-world, and thus violates the constrain imposed by

$\forall x(\phi x \rightarrow \neg\psi x)$. On the other hand, from the other $\neg\phi$-world, w_4, the most similar ϕ-world is w_2, a $\phi \wedge \neg\psi$-world, against the constrain given by $\forall x(\phi x \rightarrow \psi x)$.

With the three figures above we can represent the two ways two agents can disagree: the first is that one of the two endorses the variable hypothetical $\forall x(\phi x \rightarrow \psi x)$, and his state of belief is hence represented by figure 3.1 above. The other agent endorses the variable hypothetical $\forall x(\phi x \rightarrow \neg\psi x)$ and his state of belief is represented by figure 3.2. The second case of disagreement is when one agent endorses, for instance, the variable hypothetical $\forall x(\phi x \rightarrow \psi x)$, as before, but the other endorses none of $\forall x(\phi x \rightarrow \psi x)$ and $\forall x(\phi x \rightarrow \neg\psi x)$, his state of belief being represented by figure 3.3.

In order to understand how the translation of Ramsey's account into Stalnaker's semantics works, and how the latter can account for disagreement, let us try to model Ramsey's cake example. There is a man with a cake and he decides not to eat it. After he has not eaten it, he thinks "if I had eaten the cake I would have been ill". We, in contrast, believe that "if the man had eaten the cake, he would not have been ill". We both know, the man and us, that he did not eat the cake. In Stalnaker's terms, this means that we both agree that the actual world is a world where the man did not eat the cake, i.e. it is a $\neg E$-world. However, we disagree on what would have followed, had he eaten the cake, viz. our most similar E-world is different from the man's one. This is exemplified in picture 3.4.
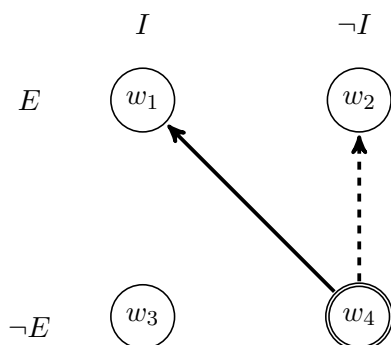

Figure 3.4: This figure models the cake example. The continuous arrow represents the man's beliefs of what would have happened. The dashed arrow represent our beliefs.

This model clearly exemplifies that, although we both agree on the actual world, which, in this case, is w_4, we disagree about what would have

happened, about the possible. We both know that the material implication $E \supset I$ is true, but the man accepts the conditional $E \rightarrow I$, and we accept $E \rightarrow \neg I$. For the man the most similar E-world to the actual one is w_1, for us is w_2.

The possibility of translating and representing Ramsey's account within Stalnaker's theory is a proof that the possible world semantics for conditionals has more similarities with Ramsey's ideas than it has been usually ackowledged. The suppositional aspect is preserved, and the introduction of variable hypotheticals into this framework gives a nice characterisation of worlds ordering in terms of general beliefs an agent possesses. This goes against Sahlin (1990, p.123) remark:

> Ramsey's theory [of conditionals and general propositions] also shows us how wrong most of the 'possible world' semantics are. The similarity relation that, according to these theories, exists between different possible worlds is assumed to be quite disconnected from whichever general proposition we accept for the moment. But the above reasoning suggests that to obtain a reasonable system this similarity relation must be linked with a system of laws.

The similarities between Ramsey and Stalnaker show that, first, the usual reading of Ramsey's suggestions as leading exclusively to a probabilistic semantics for conditionals is spoiled by not taking into account Ramsey's ideas on counterfactuals. Second, that not only general propositions can play a role in possible world semantics, but also that they improve the semantics by grounding the order of similarity of worlds on the variable hypotheticals an agent has.

3.2.2   Imaging

In his well known paper *Probabilities of Conditionals and Conditional Probabilities* (1976), Lewis proves that the probability of a conditional cannot equal conditional probability – i.e. *the Equation* $P(\text{if } p \text{ then } q) = P(q|p)$ is not valid. More precisely, given two mutually exclusive, but not exhaustive events, p and q, such that $P(p \wedge q)$ and $P(p \wedge \bar{q})$ are both positive, and

$\rightarrow$ being a universal probability conditional[47], Lewis' first triviality result shows that $P(q|p)$ reduces to $P(q)$. Namely, given any two propositions p and q, they must be probabilistically independent, if $P(p \wedge q)$ and $P(p \wedge \overline{q})$ are both positive, which is absurd. Lewis (1976, p.300) concludes that «we have proved this theorem: *any language having a universal probability conditional is a trivial language*». For the second triviality result, Lewis gives up the assumption that $\rightarrow$ is a universal probability conditional, since this is not a necessary requirement to represent an agent's belief system. The task is to see whether $\rightarrow$ is a probability conditional for the class of probability functions that can represent belief systems. Assuming that it is and that the class of probability functions is closed under conditionalization[48], we obtain the result that there cannot be, in our language, three pairwise mutually exclusive sentences. Hence our language is again trivial, even with the weaker assumptions. And the probability functions in the class can have at most four values, since they cannot assign positive values to more than two exclusive sentences. Lewis (1976, p.302) has proven that: «if a class of probability functions is closed under conditionalizing, then there can be no probability conditional for that class unless the class consists entirely of trivial probability functions[49]».

These results cast serious doubts on Adams' claim that the acceptability of a (indicative) conditional goes with conditional probability of the consequent given the antecedent. It seems that conditional probability is not the best tool to handle conditionals. Fortunately, in the same paper, Lewis proposes an alternative: *imaging*. If we want to avoid triviality results and we are also seeking a unified treatment of conditionals, which conditional probability cannot give us for it cannot be applied to counterfactuals, we should try to substitute conditional probability with imaging. I have shown that it is possible to read Ramsey's account in a Stalnaker's possible world semantics. This also allows to replace in the same framework conditional

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[47]$\rightarrow$ is a *universal probability conditional* iff $\rightarrow$ is a probability conditional for all probability function, such that, for any probability function P and sentences p and q, $P(p \rightarrow q) = P(q|p)$ holds – if $P(p) > 0$. Cf. Lewis (1976, p.299).

[48]Conditionalization is a probabilistic updating rule for belief, used in particular in Bayesian epistemology: given that P_i is prior probability, if an agent becomes certain of a statement E, she has to rationally change her belief in S in face of the new evidence, from prior probability $P_i(S)$ to posterior probability $P_f(S)$ by conditionalizing on E, i.e. $P_f(S) = P_i(S|E)$.

[49]In Lewis (1976) this is in italic.

probability with imaging. Indeed, Lewis also shows that the probability of
a Stalnaker conditional $p > q$ equals the probability of the consequent after
imaging on the antecedent. This is Lewis (1976, p.310) definition:

Imaging (df.).   For each probability function P over a finite set of
worlds, and each formula p, there is a probability function P^p such that, for
each world w', we have:

$$P^p(w') = \sum_{w \in W} P(w) \cdot \left\{ \begin{array}{ll} 1 & \text{if } w_p = w' \\ 0 & \text{otherwise} \end{array} \right\}$$

P^p is obtained by imaging P on p, and P^p is called the image of P on p.

Imaging on a proposition p shifts the probability of all $\neg p$-worlds to
the closest (or most similar) p-world. And the probability of a Stalnaker
conditional $p > q$ equals the probability of the consequent after imaging on
the antecedent:

$$P(p > q) = P^p(q), \text{ given that } p \text{ is possible.}$$

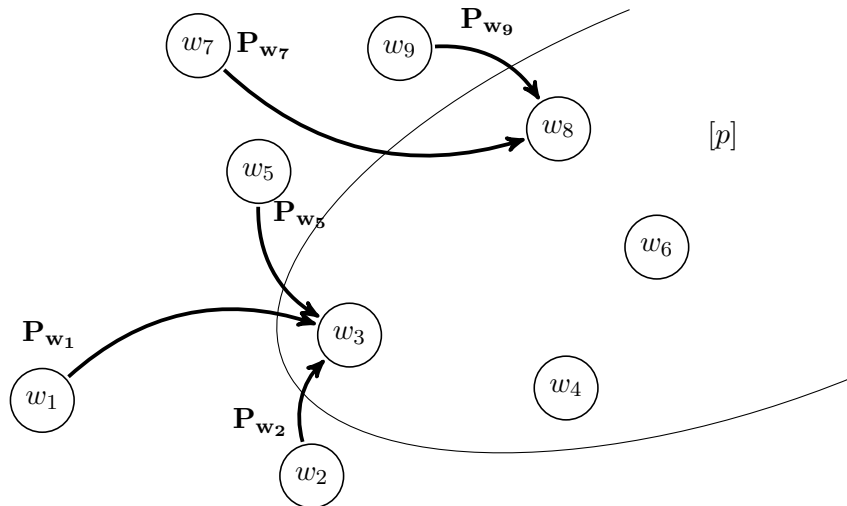In the following picture it is shown how imaging works in practice.

Figure 3.5: This picture represents a set of possible worlds: worlds w_3, w_4,
w_6, w_8 are p-worlds, w_1, w_2, w_5, w_7 and w_9 are $\neg p$-worlds. The arrows
represent the shift of probability shares from $\neg p$-worlds to their respectively
closest p-world – the distance amongst worlds represents their similarity.

We have seen that there are affinities between Ramsey's account and Stalnaker's, and that the former can be adapted to possible world semantics. Since we know that the probability of a Stalnaker conditionals equals the probability of its consequent after imaging on its antecedent, the road towards a unified treatment of conditionals is straightforward. An agent accepts "if p, then q" ($p \to q$) iff $p > q$ is true at each world the agent cannot exclude to be actual, and the supposition of the antecedent is given by imaging[50]. Let us clarify this by mean of the cake example again.

In figure 3.4, we accept $E \to \neg I$, "if the man eats the cake he will not be ill". This means that, for us, the closest possible world to the actual one, where the man eats the cake is also a world where the man is not ill. Namely, imaging on E yields: $P^E(\neg I) = P^E(w_1) = P(w_4) = 1$, our degree of belief in $\neg I$ given E equals 1. Notice that this works for counterfactuals. For, after the event, we know that the man did not eat the cake and was not ill; however, we can still suppose what would have happened if he had eaten it. We transfer the probability of our $\neg E$ world to the closest (for us) E world, we shift probability from w_4 to w_2. On the other hand, the man closest possible E-world is one where had he eaten the cake he would have been ill, i.e. a I-world. In this case then, imaging on E moves the probability of w_4 world to w_1 world. And the man's probability in $(E \wedge \neg I)$ equals 0.

In the cake example, Ramsey shows how it is possible for two people to disagree even if they are both aware of the truth value of certain propositions. In particular, the man and us both know $\neg E$ – the man did not eat the cake. Their degrees of belief are «rendered *void*», for there is no proper deliberation the two can make - $\neg E$ *is* true. Nonetheless it is still meaningful to think what would have happened, had $\neg E$ been false, and each of us has a definite answer. This case, involving a zero-probability antecedent (i.e. E), cannot be handled by conditional probability and Ramsey's suggestion about degrees of belief must clearly be restricted to indicative conditionals. By substituting conditional probability with imaging we can easily overcome this difficulty and get a single account that covers all types of conditionals, counterfactuals included.

With respect to the account I have proposed in the first half of this chapter, this approach is ready to use. Indeed, the similarities with Stalnaker's

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[50]Notice that the first is a Ramsey conditional, the second a Stalnaker one, which is true in the actual world iff in the closest p-world to the actual one is also a q-world.

conditional allow us to borrow that semantic framework. This account can deal with counterfactuals with uncertain relation between the antecedent and the consequent. For instance, consider "if the man had eaten the cake, it is far more likely than not that he would not have had a stomach ache". This is easily explained in this account. Suppose we believe none of E, $\neg E$, I, $\neg I$, but we accept $E \to \neg I$. We believe the conterfactual iff $P^E(I) = 1/5$, there are some worlds where the man ate the cake and he is not ill.

Another advantage of using imaging is that it can handle nested conditionals, whereas conditional probability cannot. The acceptability of $p \to q \to t$ is defined by imaging on the conditional $p \to q$: $P^{p \to q}(t)$.

On the other end, this account is based on Ramsey's texts, but it develops emending his proposal and moving away from it. Whether this is a relevant problem depends on the perspective we are taking – if we are interested more in Ramsey's own view or in a ready to use unified formal system, whose properties are well known and which can compete with contemporary theories.

3.2.3   Some features

As I have already claimed here, this account, as my previous proposal[51], follows Ramsey's suggestions and does not validate contraposition ($p \to q$) $\therefore$ ($\neg q \to \neg p$) - as Stalnaker's account does not. Furthermore, I suggested that it does not validate CEM, because, as we know, an agent can endorse none between two antithetical variable hypoticals $\forall x(\phi x \to \psi x)$ and $\forall x(\phi x \to \neg \psi x)$. Whether we take this as epistemic ignorance, like in my previous account, or as invalidating CEM it is a matter of sensibility and preference. For this account, I propose to speak about a "weak" form of CEM. Namely, CEM is valid when an agent has already accepted either $\forall x(\phi x \to \psi x)$ or $\forall x(\phi x \to \neg \psi x)$. However, the agent might have no opinion about the two variable hypoticals, and he simply does not accept either of the two.

As I explained for the theoretical approach, CEM applies when an agent has endorsed one of the two contrary variable hypoticals, but there the impossibility to always do that was attributed to the agent's ignorance. However, in this case, given that in this "formal account" there is no material

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[51]Cf. §3.1.

implication directly involved and it already distances itself from Ramsey's original works, I propose to abandon CEM and claim that, in general, in Ramsey's possible world semantics for conditionals, it is invalid. Although Ramsey explicitly mentions it (GPC, p.240), CEM could be replaced by *Boethius thesis*[52]: $(p \rightarrow q) \rightarrow \neg(p \rightarrow \neg q)$. It seems reasonable, since *if* the agent accepts a conditional, then he is forced to reject the conditional with the negated consequent. In ch.2 I said that authors like McCall (2012) were wrong in attributing to Ramsey the endorsement of *Boethius thesis*. I still think this is right: Ramsey explicitly speaks of CEM. However, this seems not to account for the possibility that none of the two contrary variable hypotheticals is accepted, a possibility that is plausible to admit, given Ramsey's framework. For this reason I propose to reject CEM and accept *Boethius thesis*.

But it must be said that Lewis' imaging applies to Stalnaker's conditional, for which CEM is valid, hence, if we want a unified treatment of all types of conditional sentences, CEM must hold[53]. If we get rid of CEM and endorse *Boethius thesis* we obtain a system that is more similar to Lewis than to Stalnaker, but we loose probability. If, instead, we want to retain probability, hence imaging, we must retain CEM, and the system would then be more similar to Stalnaker's.

Notably, transitivity $((\phi \rightarrow \psi) \wedge (\psi \rightarrow \chi)) \rightarrow (\psi \rightarrow \chi)$ is not valid in the Ramsey-Stalnaker account, because the closest ϕ-world that is also a ψ-world, might not be a χ-world. In other terms, the r which makes $\phi \rightarrow \psi$ an instance of a law, might not be the same working for $\phi \rightarrow \chi$, which then would be an instance of another law or maybe not.

In the same way, antecedent strengthening – $(\phi \rightarrow \psi) \rightarrow (\phi \wedge \chi \rightarrow \psi)$ – does not hold, because by adding any χ the set of closest possible $\phi \wedge \chi$-worlds, represented by Ramsey's r, might change, and not coincide with the set of closest ϕ-world. These are good news, because it means that, in this version too, Ramsey's conditional is not monotonic. Monotonicity has many counterexample in natural language and the development of conditional logic(s) is strictly related to the development of non-monotonic logic. In the next chapter, I will discuss further the validities that Ramsey's possi-

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[52]*Boethius thesis* is one of the two formulae characterising connexive logic. The other one is *Aristotle thesis:* $\neg(p \rightarrow \neg p)$.

[53]Imaging moves the probability shares of the worlds where the antecedent is false to *the* world where the antecedent is true.

ble world semantics for conditionals has in common with the other possible world semantics, like Stalnaker's and Lewis', as well as the differences. In particular, I will discuss some assumptions which characterise these semantics, like the *limit assumption* and the *uniqueness assumption* for Stalnaker, and *centering* for Lewis.

3.3   Chapter summary

In this chapter I presented and discussed two possible solutions to unify Ramsey's account of conditionals and obtain two updated theories that can compete with contemporary ones.

The "theoretical" account aims at staying as close as possible to Ramsey's suggestions on conditionals. Indeed, it uses both analyses, the inferential and the probabilistic one, and, thanks to other elements of Ramsey's epistemology, like variable hypotheticals, I have shown that it is possible to give a unified reading of all types of conditional sentences. Moreover, it is also possible to give a unique acceptability criterion as well as a unique validity criterion.

There are several advantages of this theory. First, it does not reject material implication, saving classical logic. For, it does not put truth against acceptability, but it makes them compatible within the same theory. Hence, the truth conditions of a conditional sentence are those established by classical logic: either the antecedent is false or the consequent is true. However, classical logic alone cannot explain the *use* of conditional sentences in everyday life, it cannot account for the information we convey by asserting them which clearly bypass the truth values of material implication. The meaning of conditionals goes behind the truth conditions of material implication, but nonetheless, it is determined by them. In this way, semantics and pragmatics of conditional sentences are tightly tied one another, and the former determine the latter. As I have argued, whether a conditional expresses a decision we are about to make or our disapproval about a person's action depends on the truth value of the corresponding material implication.

Furthermore, this theory also connects epistemology of conditionals to pragmatics and, indirectly, to semantics. By looking at what it means, according to Ramsey, to assert a conditional and what relation an assertion has with an agent's beliefs and knowledge, it has been possible to establish

also when a conditional is accepted. The acceptability criterion of this theory shows the role context plays – context understood as a combination of beliefs held by the subject and facts related to the situation in which the sentence is uttered. The theory gives a nice account of the semantics, the pragmatics and the epistemology of conditionals and tries to explain their interrelations.

The validity criterion I proposed and which, I think, smoothly fits within Ramsey epistemology, allows to block some controversial inference patterns, like the paradoxes of material implication, contraposition and antecedent strengthening. This results in the conditional not being monotonic, an important requirement a theory of conditionals should satisfy.

On the other hand, many aspects have not been clarified yet, especially technical ones. Indeed, the formal system needs to be developed and some questions to be answered. For instance, it is not clear whether this account can handle nested conditionals. Although I intuitively would say yes, a proof is lacking in the present presentation. In particular, it is not clear whether such nested conditionals would be instances of a single variable hypothetical or not. Another problem concerns the huge subjectivity this theory delivers, and if and how this can be represented. Accepted conditionals differ greatly among people according to the knowledge and beliefs of each person. Namely, the identification of the variable hypotheticals endorsed and the facts known by someone can be very difficult and open to underdetermination. Furthermore, there are many similarities with the second account I have here presented, and it would be interesting to investigate how much they have in common. Therefore, the theory is, as it is, incomplete. Undoubtedly, there is a lot of future work to do.

The second theory I have outlined relies on the similarities of Ramsey's account with a well known semantics for conditionals and on a probabilistic tool that can be used with counterfactuals. It is possible to obtain a unified treatment of all types of conditionals diverting a bit from the road suggested by Ramsey, and emending his account by replacing a formal tool with another which works for every case. The result is a theory that, since it is developed within a known semantics, is ready to use and needs just a few adjustments.

Furthermore, this theory has two main qualities: the first is that it points out how much possible world semantics have in common with Ramsey's view

of conditionals. It is a shared opinion, given the "orthodox" interpretation, that Ramsey only speaks of indicative conditionals, that probabilistic theories of conditional adhere to Ramsey's ideas far more than other solutions. However, thanks to the similarities found between Ramsey and Stalnaker, I have proved that this opinion is totally ungrounded. Rather, both accounts share the same interest in the role of contextual beliefs and information. Ramsey has as much in common with probabilistic accounts as he has with possible world semantics, and this has not often been acknowledged. Moreover, grafting Ramsey's theory into possible world framework improves this latter with clarity and precision. Indeed, the similarity order of worlds is determined by the variable hypotheticals a person endorses. And this is obvious, a person orders what he believes to be more plausible and possible than something else thanks to his general beliefs and rules for judging, which determine, for instance, what are his expectations. Then, additional contextual information rs tell exactly what is the closest world where the conditional should be evaluated. This is because the closest world is one where also the additional propositions rs are all true. Thus, rs tell what the information needed to evaluate the conditional are, as Ramsey stresses. Last but not least, the use of imaging provides an easy way to handle nested conditionals.

Of course, this last approach looses accuracy with respect to Ramsey's texts, but it gains a well defined formal apparatus, which, on the other hand, the first theory does not have at the moment. The first, however, offers a way for a theory of conditionals which puts together semantics, pragmatics and epistemology. It also underlines that a theory of conditionals should not ignore any of these three aspects, so closely related.

The preference between the first and the second theories is a matter of sensibility and interest. If you are more interested in Ramsey's ideas and less in formal system you may go for my first proposal; if, on the contrary, you prefer a theory that accommodates some of Ramsey's intuitions but it is also ready to use I reckon you to go for the second.

In the next chapter I will compare both theories with the most famous and successful contemporary accounts of conditionals.

Chapter 4

Ramsey's test and Ramsey tests

In this chapter I compare my two updated Ramsey's accounts of conditionals with contemporary theories.

I first suggest two readings of Ramsey's footnote, following my two theories of ch.3. For each of them I propose a Ramsey test, a criterion for the evaluation of the acceptability of conditional sentences. This will offer a common parameter for the comparison to those contemporary theories that use a version of the test.

The title of this chapter underlines an opposition between what I call *Ramsey's test* and all the tests in the literature on conditionals carrying Ramsey's name. This presupposes the existence of *the* Ramsey's test, namely a the correct interpretation of Ramsey's footnote, a test for conditionals that strictly follows Ramsey's ideas. I believe that the version of the test for my theoretical account is the more accurate interpretation with respect to Ramsey's works. I think that it captures the sense of Ramsey's famous footnote and highlights the fact that, to my understanding, it was not meant to be a procedure for the evaluation of a certain type of sentence, but rather a description of how the evaluation is carried out in human minds. Furthermore, my version of the test places Ramsey test back to the role of a footnote within a more complex text and work, that are needed to grasp its meaning.

After the introduction of my two Ramsey tests, I analyse the most important contemporary theories of conditionals – many of them rely on a specific interpretation of the footnote. I start by what I call "additional premises

theories". This type of theories supports the idea that a conditional is an enthymematic linguistic entity that is true or accepted when there are additional information that together with the antecedent imply the consequent. The resemblance to Ramsey's core ideas is plain. What types of sentences implicit premises are composed by differ from theory to theory, as well as the range of application of the analysis. Chisholm (1946, 1955) and Goodman (1947, 1983) are primarily concerned with counterfactuals and conditionals whose antecedents are false[1], while Rescher (1964) offers a wider analysis. Furthermore, Rescher's account defines acceptability conditions, Goodman's and Chisholm's truth conditions. But, as in Ramsey, all of them give emphasis to the tight relation between conditionals and laws.

Chisholm and Rescher acknowledge their indebtedness to Ramsey, whereas Goodman never mentions him. And both Chisholm and Rescher do not read Ramsey's suggestion as covering the indicative case only, contrary to what more recent literature does.

The prominent interest in counterfactuals is shared with another group of theories, those using possible worlds. In ch.3, I suggested to unify Ramsey's treatment of conditionals by means of Stalnaker's framework. Here, I compare Stalnaker's original theory to my modified Ramsey-version for what concerns inference patterns and axioms. The same I do for my theoretical proposal. Lewis' system is also discussed and compared – considering the position laws and additional premises occupy in his account, and their characterisation. Particular attention is given to some assumptions that distinguish the two semantics and their admissibility in my proposals, as Conditional Excluded Middle.

The next typology of theories I consider has its focus on indicative conditionals, by going after Ramsey's use of conditional probability. Aside a brief introduction to Jeffrey (Jeffrey and Edgington (1991)) extension of de Finetti's "defective" truth table, I focus on Adams's assumption that the probability of a conditional is the conditional probability of its consequent given its antecedent and the logic that follows [2]. Adams is not alone in adopting this thesis, which has met consensus in philosophy, e.g. Edgington (1995) and Bennett (2003), as well as in psychology of reasoning and cognitive sci-

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[1]Goodman (1983) distinguishes between conditionals with false antecedents and consequents (counterfactuals), and conditionals with false antecedent but true consequents (semifactuals).

[2]See Adams (1965, 1966, 1975, 1998).

ence, see for instance Evans and Over (2004) and Douven and Verbrugge (2010, 2013). Adams develops Ramsey's idea that in some cases conditional sentences (those in the indicative mood) express conditional bets and that their acceptability is determined by the value of the degree of belief in the consequent given the antecedent. Although acceptability is defined differently, my theoretical and formal approaches coincide with Adam's for what concerns the controversial inferences they respectively validate and block.

Perhaps, the major difference between Ramsey and Adams is that Adams does not explicitly account for the conversational and belief contexts and their relevance in the evaluation of conditionals – at least, not as much as Ramsey does – although the beliefs held by a subject, as well as contextual information, can be thought as implicitly conditioning conditional probability values.

Lastly, I take belief revision theory and its version of the Ramsey test as proposed by Gärdenfors (1981); Gärdenfors (1986). I consider the triviality result that can be derived from the test and some basic assumptions, trying to identify a plausible culprit. This discussion also shows how in Gärdenfors (1986) the suppositional aspect the antecedent has in Ramsey is lost, replaced by an idea of actual belief change for the evaluation of conditionals. The notion of "belief state" where the antecedent is added recalls Ramsey's "stock of knowledge". However, my theories select only some propositions, among the true belief held by a subject, as additional information, whereas Gärdenfors takes the whole belief set.

Certainly, the Ramsey test of belief revision cares more of contextual beliefs than other accounts do; therefore it places the analysis of conditionals within a wider background theory on operation on beliefs. With respect to this, Gärdenfors is more similar to Ramsey than other accounts here discussed are; both approaches acknowledge that an investigation on conditionals demands for an epistemological framework.

This chapter shows, I believe, that the accounts of ch.3 are reasonable alternatives to contemporary most attractive solutions, delivering similar results but perhaps with more sophisticated and specific explanations.

The comparison, as the introduction to contemporary theories, are obviously not exhaustive. Each theory here presented would need a chapter on its own, but this is not possible in the present work.

A remark for the symbols used: I use the simple arrow whenever I am

talking of a conditional operator that is not a material conditional (horse-shoe). For Stalnaker's and Lewis' conditionals I use, as before, the symbol ">".

4.1   Ramsey's test

In ch.2 I have recovered Ramsey's account of conditionals, moving from the suggestions in his famous footnote. As we have seen, many authors used Ramsey's ideas as a source of inspiration for utterly different accounts of conditionals. From probabilistic semantics, to possible world approaches and belief revision, the majority of contemporary theories dealing with conditionals sentences rely on Ramsey's footnote. Whether they promote truth conditions or acceptability conditions, the common sign is a Ramsey test, stated variously.

I have stressed that the focus has usually been on the first part of the footnote, overlooking the last, where the conterfactual case is considered. As Slater (2004, p.432) notices:

> Stalnaker formulated his version of all this thinking that Ramsey's suggestion about adding p hypothetically covered only the case in which one has no opinion about the truth value of the antecedent (Stalnaker 1969, 101). But Ramsey's suggestion, at this place, evidently covered also the case where the antecedent is disbelieved. [...] But more important, if the question was turned into one about what followed from 'certain laws and hypotheses', it was not an adjustment or change of the belief set which was needed, according the Ramsey.

Slater (2004) acknowledges that in GPC Ramsey explains his view on counterfactuals[3] and on the linguistic difference between indicative and subjunctive mood in conditional sentences[4]. However, he does not consider MHP, thus failing to recognise that the account he thinks Ramsey uses for counterfactuals, actually applies to a wider range of cases (See ch.2, §2.2.1).

In ch.3 I have presented two ways to develop a unified theory of conditionals which reflected, as much as possible, what I suggested to be Ramsey's

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[3]Slater uses "subjunctives" instead "counterfactuals".

[4]See ch.2, §2.3.

view in ch.2. I now propose to read again Ramsey's footnote in light of the two theories I put together in the previous chapter, so that each will have its own version of Ramsey's footnote, its own Ramsey test.

Let us start from the first account, the theoretical one. There, conditionals are acceptable iff the agent posses such information rs that, together with the antecedent of the conditional, trigger a variable hypothetical, of which the conditional is an instance. The process of acceptance (or, more precisely, the adequate formal tools to describe the process) is different according to the truth value of the material implication corresponding to the conditional statement.

Recall Ramsey's footnote:

> If two people are arguing 'If p will q?' and are both in doubt as to
> p, they are adding p hypothetically to their stock of knowledge
> and arguing on that basis about q; so that in a sense 'If p, q'
> and 'If p, $\overline{q}$' are contradictories. We can say they are fixing their
> degrees of belief of belief in q given p. If p turns out false, their
> degrees of belief are rendered *void*. If either party believes $\overline{p}$ for
> certain, the question ceases to mean anything to him except as a
> question about what follows from certain laws and hypotheses.

Given my theoretical account, the Ramsey test reads as follows: when two people are wondering whether if p happens q will follow, not knowing the truth values of both p and q, they add to the antecedent some true, certain information rs, obtained by a reliable process[5]. These information do not need to be the same for both of them [6], but they are determined by the context of conversation and by the content of the antecedent, inasmuch as additional information rs should be such that $\neg(p \wedge r)$, i.e. $p \rightarrow \neg r$, is not an instance of any variable hypothetical. Once selected the rs to add to the antecedent, the two people wonder whether q or $\neg q$ follows. Namely, each of them is considering whether the conjunction $p \wedge r$ triggers the variable hypothetical $\forall x(\phi x \rightarrow \psi x)$ or the variable hypothetical $\forall x(\phi x \rightarrow \neg \psi x)$. Depending on past personal experience, each of them holds either the former

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[5]Notice that I take Ramsey's "stock of knowledge" literally, since one of the requirement on the propositions in r is that they must be true, and not simply believed as true. Hence they cannot be simple beliefs. Of course, this can easily be changed.

[6]Recall that «in considering what would have happened if a man had acted differently, we are apt to introduce any fact we know, whether he did or could know it [...].», and the subjunctive mood makes no difference with respect to this.

or the latter, because for each of them the probabilistic correlation between the antecedent and the consequent is higher in one case rather than in the other[7]. This is why, as I have argued in ch.3, CEM holds. Indeed, in the footnote Ramsey clearly holds that the two people must choose between q and $\neg q$. Given the variable hypothetical they respectively endorse, and the probabilistic value relating the antecedent and the consequent, which determines whether the conditional is an instance of a law or of a chance, they accept either "if p then q" or "if p then $\neg q$". This also explains the process of «fixing their degrees of belief in q given p» according to conditional probability, as a bet.

However, if the antecedent results false, the bet is obviously called off. Their degrees of belief are rendered void since the material implication is true, and there is no deliberation to make about future events or actions. But they can still dispute. If they both believe that p is false, it can no longer be a matter of betting, which would be meaningless. Hence, the question "if p *will* q?" has no sense for what concerns direct effect on what would make the conditional (material implication) true, since this has already turned out true. The two people in this case are not predicting what will follow if something happens, because, as I have argued at length in ch.3, you cannot deliberate about, you cannot affect the past. However, it is always possible to wonder what would have happened, had something occurred. This is the case where the two people, while knowing the antecedent to be false, suppose it to be true, and, by adding information to the antecedent, see what follows according to some variable hypotheticals they respectively endorse. Namely, they judge whether q or $\neg q$ follows from the antecedent and additional information r, and hence accept either "if p had occurred, then q would have occurred" or "if p had occurred, then q would have occurred" depending on which of the two counterfactuals is an instance of a variable hypothetical held respectively by the two.

This reading of Ramsey's footnote reflects what I take Ramsey's spirit to be. The footnote describes the processes behind accepting or rejecting a

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[7]Variable hypotheticals are the result of induction over past experiences. I suggest they mirror the frequency with which two events occur together (in some cases one after the other): if the correspondence is one to one (in our past experience an event has always been followed by the same other one), we have a law. If it is not always the case that when a given event occurs the same one occurs (or follows), we have a chance, see ch.1, §1.2.2. Then, the degrees of belief of an ideal thinker adhere to these frequencies.

conditional, in relation to its truth value. So, strictly speaking, the footnote does not state a procedure for the evaluation of conditionals. The "Ramsey test" of this theoretical approach goes as follows: the meaning of a conditional statement – what the agent conveys by asserting it – is represented by conditional probability if the corresponding material implication has not a determinate truth value yet; otherwise the conditional explicitly expresses what the general beliefs of the agent are and what follows from them. You accept a conditional iff by adding some true information[8] to the supposed antecedent you can infer the consequent after a variable hypothetical you have.

The second account I presented in ch.3 is what I have called the "formal" approach. Here, a conditional is accepted if the closest antecedent-world(s) (worlds where the antecedent is true) to the actual one also worlds where the consequent is true. This account relies on the well known semantics for conditionals which use possible worlds as tools for the evaluation. It departs from Ramsey's own account because it replaces conditional probability with imaging, so that also counterfactuals can be covered. The Ramsey test is similar, to a certain extent, to the one proposed by Stalnaker we have seen in ch.2 and again in ch.3. It differs for it gives acceptability conditions and involves degrees of belief. Plus, variable hypotheticals are relevant in setting the ordering of worlds. Following this approach, Ramsey's footnote states that when the truth value of the antecedent (and the consequent) of the conditional is unknown in the actual world, the two people move to their respective closest world where it is true and see whether the consequent holds at that world or not. The degree of belief in the conditional is given by the probability share associated to the world. If, however, both agents believe that $\neg p$ is the case, it means that in the actual world the antecedent is false. Hence, the probability share of the actual world is shifted to the closest world where the antecedent is true and summed to its probability value. Then the sum will give the degree of belief the agent has in the counterfactual conditional.

The Ramsey test of the formal account establishes that to evaluate a conditional you move to the closest world where the antecedent is true[9] and

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[8] Adhering to all the other requirements on r – see ch.2 and ch.3.

[9] Given reflexivity, if the antecedent is true at the actual world the conditional is evaluated there.

see whether the consequent is also true there. The degree of belief in the conditional is given by the probability share attached to the world; if in the actual world the antecedent is false, its share is summed to that of the closest world where the antecedent is true.

It is clear that this second version of the Ramsey test has not much in common with Ramsey's original footnote. Indeed, it transfers Ramsey's core ideas to a different setting with different formal tools. The first reading I suggested is closer to Ramsey's intentions and it gives a good explanation of the footnote in its context. I then propose to take that one as the proper Ramsey's test and to compare it, and the theory behind it, to other theories which have been developed following Ramsey's suggestion or which seem very similar to our proposal of Ramsey's conditionals. Indeed, it is less interesting to compare my second proposal since a lot has already been said about possible world semantics, and my theory belongs to this group. However, in some circumstances the comparison will highlight peculiar features of my proposal. As in §4.3, when I talk about other possible world semantics.

4.2   Additional premises accounts

In this section I discuss those theories that maintain that the antecedent of many conditionals is not composed solely of the if-sentence explicitly stated, but also of some implicit premises that should be made explicit to establish whether a conditional is true or false, acceptable or not acceptable. These theories are especially thought for counterfactual conditionals. Also, they are among the first theories for conditionals proposed in contemporary philosophy[10].

I will consider three theories: Chisholm's, Goodman's and Rescher's. There are a few differences among the three, the most significant is that Chisholm and Goodman attach truth values to conditional sentences, whereas Rescher does not. But all of them assume that plain material implication is not adequate for conditional sentences in natural language, and that there are further information implied by the speaker in asserting a conditional, which secure the inference from the antecedent to the consequent. In all these three theories, laws are the essential information that support the conditional, once added to the antecedent.

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[10]Besides C.I. Lewis' strict conditional.

These "additional premises accounts" share with Ramsey the same intuition about conditionals: they are enthymematic pieces of language, and to correctly evaluate them we have to uncover the implicit premises. But these three theories are not equipped of an epistemology as background of their conditional theories. Hence Ramsey's theory results more sophisticate and able to handle different level of analysis of conditional sentences: semantics, pragmatics and epistemology.

Furthermore, the general requirements for these additional assumptions are not as strict as those proposed by Ramsey. For instance, sentences in conditional form are allowed in these theories in the set of additional premises, but not in Ramsey's.

I will present each of the three theory separately and then discuss similarities and differences with Ramsey's account(s).

4.2.1 Chisholm

In ch.2 we have seen that the first person to mention Ramsey in a work on conditionals is Chisholm in his 1946 paper *The contrary-to-fact conditional*. Contrary to what has then become the standard interpretation, Chisholm (1946) uses the first part of Ramsey's footnote (together with other parts of GPC) to develop a theory of counterfactuals, not of indicatives as we would expect.

Chisholm stresses the relevance counterfactuals have in our ordinary language and in scientific contexts, despite contemporary logic's negligence, that has focused on indicative conditionals only. He (Chisholm, 1946, p.289) acknowledges that «many contrary-to-fact conditionals are not expressed in the subjunctive mood and many conditionals which are expressed in this mood are not actually contrary-to-fact». Indeed, there are cases where we assert conditionals in the subjunctive mood even if we do not know the truth value of the antecedent. For instance, these are those cases where we act in order to avoid the realisation of the antecedent, like «I try to avoid falling through the ice because I believe that if I were to fall I should get wet» (Chisholm, 1946, p.290). However, he employs the two terms interchangeably to conform to the philosophical common usage.

Chisholm's goal in this paper is to find a way to get rid of this type of conditionals, by translating them into indicatives if possible. He considers some of the most important uses of counterfactuals in philosophy: from Car-

nap's dispositional adjectives, which are expressed by means of subjunctive conditionals, to the "deliberative use"[11], namely when, in preparing for an experiment, we «review the situation» by thinking what would happen if it goes as we predict or if it does not. In general, counterfactuals are «the most natural means of expressing what we claim to know» (p.291) and, as such, philosophy must consider them.

Material implication cannot account for counterfactuals for, as we know, «the subjunctive conditional may be true when the corresponding material conditional is not, and *vice versa* [...].» (Chisholm, 1946, p.295).

After having discarded alternative theories, Chisholm mentions Ramsey's idea that there must be some information – a «previous stock of knowledge» – that together with the antecedent entail the consequent. Hence, Chisholm (1946, p.299) proposes this first approximation:

> We may conclude, then, that our conditional C is another way of saying: "There is a statement p such that p and H entail W[12] and p is true"? This is a plausible suggestion, but a number of modification must be made if it is to be satisfactory.

The p (that in this theory denotes the additional implicit premises) should contain, if any, only universal conditionals that have existential import: there must be an additional statement asserting the existence of members of the class denoted by the antecedent. Plus, p should contain no material implication asserted simply because the antecedent is false or the consequent true.

As we see, the idea is very similar to Ramsey's one: there must be additional information, r in Ramsey and p in Chisholm, that together with the antecedent of the conditional imply the consequent. As in Ramsey, Chisholm's p is subject to many restrictions.

At the end, Chisholm's proposal for getting rid of a counterfactual of the type "$\forall x \forall y$ if x were ϕ and y were ψ, then y would be χ" is the following (p. 301):

> There is a true statement p such that: p and 'x is ϕ and y is ψ' entail 'y is χ'; p includes no universal conditional whose consequent includes any two functions which are logically equivalent

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[11]This is a term that Chisholm explicitly borrows from R. Fifth *Sense-data and the Principle of Reduction* (1943).

[12]Antecedent and consequent of the conditional respectively.

to functions having 'x is ϕ and y is ψ' and 'y is χ' as corre-
sponding instances, or whose antecedent includes any function
not containing the variable of quantification.

These are considerable similarities with Ramsey's account in GPC, but espe-
cially in MHP. But restrictions on additional information are a bit different.
First, they both require that the additional r (or p in Chisholm) is true.
Second, they both allow universal quantifiers among the premises. But they
differ slightly. Chisholm speaks of "universal conditionals", which are in-
terpreted as material implication with the further requirement of not being
vacuously true – viz. they must have an existential import. Indeed, vacuous
truth would trivialise the analysis (p.301): «Let p be "$\forall x[x =$ you $: \supset: x$ saw
the play $.\supset.x$ did not enjoy the play], there exists an x such that $x =$ you"».
This case would be true given that the material implication corresponding
to the counterfactual is vacuously true.

We know that for Ramsey "general propositions" can be of two types: a
long but finite conjunction, if the scope of the quantifier is limited; or variable
hypotheticals, which, however, cannot be interpreted as material implication
since they are not propositions and have no truth values attached.

As in Ramsey, in Chisholm laws play an important role with respect
to counterfactuals. Among the universal conditionals that can be part of r
(Chisholm's p), "accidental" universal conditionals are not included (Chisholm,
1946, p.302). These are distinguished from the non-accidental universal con-
ditionals because «they do not warrant the inference of certain contrary-to-
fact conditionals». However, the function laws play in the two accounts is
different. For Chisholm a law supports a counterfactual not just because
this latter can be an instance of it, but insofar as the law itself is among the
information that must be added to the antecedent of the conditional to infer
the consequent. Consider this example (Chisholm, 1946, p.301):

Suppose that one afternoon two men, quite independently of each
other (as we should ordinarily say), were to sit on the same park
bench, that they were alone there, and that, as it happened, each
of them was Irish. We could then say: "$\forall x$ if x is on ... park
bench at ... time, x is Irish". Our formula is such that, if we were
to apply it to this case, we would infer: "If Ivan were to be on ...
park bench at ... time, Ivan would be Irish". But this conclusion

would hardly be warranted.

This is a case where the universal conditional added to the antecedent is an accidental generalisation, hence the counterfactual is not supported. But it shows the place laws hold in Chisholm's account (and not in Ramsey): the non-accidental universal conditional *must* be included among the additional information needed to infer the consequent. Although Chisholm's notion of non-accidental universal conditionals involves a non-vacuously true material implication, it resembles Ramsey's variable hypotheticals. For, in Chisholm as in Ramsey, counterfactuals are supported by non-accidental generalisations, as laws of nature[13], expressed in a conditional form. However, the relation between these generalisations and counterfactuals seem different in the two accounts[14]. As we know[15], Ramsey requires counterfactuals with some information rs to be, all together, instances of a variable hypothetical endorsed by the agent[16]. In Chisholm, however, the non-accidental general propositions are added, together with other possible information, directly to the antecedent. The counterfactual is not an instance of any non-accidental universal conditional, as it is made explicit by Chisholm's restriction that the consequent of such material implications under the scope of an universal quantifier should contain no proposition logically equivalent to the consequent of the counterfactual. If this were the case, given that the universal conditional is a material implication, the conterfactual would be vacuously be true being an instance of one of its premises. Chisholm (1955, pp.101-2) specifies that in asserting a counterfactual, a speaker is supposing the antecedent of the conditional in its indicative form, together with a statement that he *believes* to be a law:

> [...] a man in asserting a counterfactual is telling us something about what can be deduced from some "system of statements" when the indicative version of the antecedent is added to this system as a *supposition*. We are referring to the statement of

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[13]Recall that in Ramsey laws are characterised by being general propositions that we trust.

[14]I must underline that according to Chisholm (1946, p.304), Ramsey holds the view that general propositions are infinite conjunctions, which is not correct. Indeed, Ramsey rejects this view in GPC, and it is quite odd that Chisholm does not notice it, although he cites GPC for what concerns conditionals.

[15]From GPC and MHP, cf. ch.2.

[16]Recall that r can contain laws, even tautologies, but it does not contain the variable hypothetical the conditional is an instance of.

> this system (other than the indicative version of the antecedent)
> as the *presuppositions* of his assertion.

Let us consider this set of presuppositions. Chisholm, as Ramsey, requires
the presuppositions to be true. The set should not include the negation
of the antecedent and it should not include «any statement he would treat
as nonlaw satements» (p.103). Contrary to what suggested by Ramsey, for
Chisholm the set of presuppositions is constituted in particular by those
statements the agent believes to be laws. Furthermore we do not find any
temporal restriction on this set of presuppositions, as well as no compatibility
requirement. Requiring that the denial of the antecedent of the conditional is
not in the additional set of statements is weaker than requiring also that the
antecedent does not imply (by law) the denial of the additional information.
Plus, recall that for Ramsey laws are not identified by the fact that they
support counterfactuals. Indeed, in my theoretical proposal counterfactuals
can be supported also by chances. The only type of variable hypotheticals
characterised by the particular type of conditionals they support are causal
laws: they support those conditionals whose consequents refer to events later
than those described in the antecedent and in the additional information (see
ch.2 §2.2).

   Chisholm faces the problem of how the additional information can and
are selected, since in many occasion the conditional might be ambiguous and
open to multiple interpretations and therefore to multiple sets of additional
statements. In everyday life «the context of inquiry determines which suppo-
sition is being made» (Chisholm, 1946, p.305). In the same way, in Ramsey
the additional premises are «of a kind implied by the context» (MHP, p.238).
The conditional can be logically disambiguated by making somehow explicit
the piece of context the antecedent refers to[17].

   According to Chisholm, counterfactuals share with probability state-
ments the fact that they both are elliptical to a certain extent. As prob-
ability assertions presuppose certain evidences supporting them, in the same
way certain presuppositions support a counterfactual assertions. However,
they differ because counterfactuals need some additional propositions, de-

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[17]Chisholm (1946, p.303) discusses this example: "if Apollo were a man, he would be
mortal", to which one can reply "No: if Apollo were a man, at least one man would be
immortal". The unambiguous version of the antecedent would be "if Apollo were different
from what we have believed him to be and had instead the attributes which all men
possess".

termined by the context, but not all the possible statements which could support them[18], whereas probability assertions need the «total evidence». This is a further difference with my theoretical approach: the same requirements for r in the counterfactual case apply also in all the other cases, even when the conditional is captured by conditional probability. In my account it is not excluded, in principle, to take the maximal consistent set of propositions with respect to the antecedent of the counterfactual[19], but it is not required.

The approach to explain counterfactuals is the same for Ramsey and Chisholm. Same is the idea that the assertion of a counterfactual is meant to convey information about the speaker's general beliefs. Hence the need to extend the antecedent and add a set of further propositions to it, in order to capture the meaning of such assertions. However, this additional set is characterises in two different ways. Although it can be compounded of true propositions only, for Ramsey it may contain laws, for Chisholm it must. For Ramsey it must contain only conjunction or universal quantifiers, not in Chisholm[20]. The additional set contains propositions that must be compatible with the antecedent of the conditional in Ramsey, for Chisholm it is sufficient that the set does not contain the negation of it. Moreover, in Ramsey there are often temporal restriction on the propositions of the set, whereas in Chisholm there are none. A further difference concerns the range of application of this analysis: Ramsey's inferential account does not apply only to counterfactuals but to all those cases where the corresponding material implication is true. On the other hand, Chisholm is interested exclusively in those conditionals whose antecedents are contrary to facts.

It is then natural that Chisholm's proposal is not thought for a unified account of both indicatives and counterfactuals. He seeks a way to translate the latter into the former, which are handled by entailment. It is an analysis of counterfactuals that takes into account the peculiarities this type of assertions have and tries to bring it back to classical entailment relation. Hence, it is a unified account of conditionals in the sense that it is an attempt to handle all types of conditionals with classical tools. Instead, Ramsey's pro-

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[18] This specification is somehow lost in possible world semantics and belief revision theory – see the related sections here.

[19] As in Kratzer's semantics – see Kratzer (1981).

[20] Allowing conditionals among the additional premises could perhaps lead to a form of circularity, that Ramsey does not face.

posal presents a sort of superstructure on top of classical logic: the truth conditions are those of material implication, but the pragmatics and epistemology of conditional statements go behind it.

My first account, the theoretical one, is able to cover all types of conditional sentences extending classical logic, with the same Chisholm's idea of additional information. My second account uses possible world semantics, which can be seen as a natural evolution of Chisholm's idea, and as I have argued also of Ramsey's inferential account. Chisholm is interested in the truth of conditional sentences, whereas I have proposed a unified acceptability criterion for all cases.

Another account for counterfactuals, which shares with Ramsey and Chisholm the idea that there are some enthymematic premises that should be made explicit and added to the antecedent to infer the consequent is Goodman's theory. I now turn to it.

4.2.2 Goodman

Nelson Goodman's account of counterfactuals is well-known. It is one of the first and most influential theory of counterfactuals in contemporary philosophy. His work was first presented in Goodman (1947), and then again in his book *Fact, Fiction and Forcast*. Ramsey's inferential approach recalls Goodman's theory of counterfactuals and *cotenability*, although Goodman never mentions Ramsey's work and footnote on conditionals – unlike the other scholars here considered.

Goodman's notion of *cotenability* defines the requirements the additional premises must satisfy. Goodman (1947) focuses on conditionals with both false antecedent and consequent[21], aware that classical material implication does not grasp our intuitions about truth and falsity of such conditionals. First, he notices that there is a connection between the antecedent and the consequent of such conditionals, that holds in virtue of «the presumption that certain circumstances not stated in the antecedent obtain» (p.116). Second, that connection is not a logical one.

The general idea is very similar to Ramsey's: a counterfactuals is true if «the consequent follow by law from the antecedent and *all* true statements»

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[21]For Goodman, conditionals with false antecedent and consequent are counterfactuals. Conditionals with false antecedent and true consequent are called "semifactuals" (cf. Goodman (1947) and Goodman (1983, ch.2)).

(p.117). However, this additional set of statements must satisfy some limitations. It must be composed of true statements only, the negation of the antecedent cannot be included, and each of the statement in the set must be «both logically and non-logically» compatible with the antecedent of the counterfatcual. As in Ramsey, this means that the conjunction of the set and the antecedent of the conditional do not violate any "non-logical" laws[22]. The set is a set of relevant conditions for the conditional and must be *cotenable* with the antecedent. Being cotenable means that it is not the case that the statements in the set would not be true if the antecedent of the conditional considered were true. Namely, if p is the antecedent and r the set of additional propositions, $p \wedge r$ is "self-cotenable" if it is not the case that r would not be true if p were[23].

Goodman suggests that counterfactuals presuppose a set of implicit antecedents, "connecting principles", and laws, of which the conditional is an instance. Although Goodman speaks of laws as supporting counterfactuals, their definition is open to include Ramsey's chances, since there is no specification about the relation between the antecedent and the consequent – whether it is of probabilistic nature and the value it should have in case (i.e. equal to 1 or lower).

On the other hand, counterfactuals are said to be true or false: truth conditions for this type of conditionals do not coincide with those of material implication, but they are informally defined by means of the set of relevant conditions and the law the conditional is an instance of. Goodman's set of relevant conditions has much in common with Ramsey's r, as we have seen, but there are a few differences. First, there is no temporal restriction on Goodman's set, whereas Ramsey's r is required to refer to events earlier than those described in the consequent of the conditional. This holds in particular when the variable hypothetical supporting a conditional is a causal law, which seems to be what Goodman has in mind when he speaks of "laws" in general (cf. Goodman (1947, p.123)). But Goodman never refers to any particular restriction concerning the time the events in the additional set of

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[22]Goodman defines "non-logical" laws as lawlike true statements, namely as those statements used to make predictions, and whose acceptance «does not depend upon the determination of any given instance [...] there is no particular instance on the determination of which acceptance depends» (Goodman, 1947, p.126).

[23]Goodman (1947, fn.8) adds that the double negation is essential to this requirement and cannot be eliminated, for its positive version would be too strong (r would be true if p were false).

statements should refer to, although causal laws clearly involve a time order between the events described.

The second difference concerns the logical form of the propositions in Goodman's set of relevant conditions. As I have discussed at length in ch.2 and ch.3, Ramsey places strict limitations on the type of propositions added to the antecedent of a conditional: they must be absolutely specific or categorical. This means, as we know, that they should not contain negations, disjunctions, material implications and existential quantifiers. There is no similar requirement in Goodman. Goodman does not specify what logical form should the propositions in the additional set have. We just know that he allows for laws, universal statements, to be included[24].

Among the common features of Goodman's and Ramsey's accounts, it is worth mentioning a very similar view on causality. Indeed, they are both humean[25] and they both adopt a «realistic»[26] view of causation. Goodman (1983, pp.59-60) defends Hume's view that there exist no necessary connection and that the idea of causality emerges from the notion of habit. The frequency of an event following another leads the mind to form a habit connecting the two events and «the idea of necessary connection arises from the felt impulse of the mind in making this transition» (Goodman, 1983, p.60) from an event to another, which we have experienced to usually follow whenever the first occurs.

Hence, as implicitly in Ramsey, the question of which counterfactuals are true (acceptable for Ramsey) becomes a question of what general hypotheses are correctly supported by induction and then a question about inductive practice. A proper discussion of Goodman's account of induction would lead us out of the scope of this work, but, briefly, as in Ramsey, induction is evaluated as deduction is (Goodman, 1983, p.64):

> I have said that deductive inferences are justified by their conformity to valid general rules, and that general rules are justified by

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[24]If the law conjoined to the antecedent of the conditional is the one the conditional itself is an instance of, the counterfactual follows logically. Recall that Ramsey excludes the possibility that r is taken as to include the conditional under evaluation in order to avoid triviality. I think this can be reasonable extended to say that r should not even include the variable hypothetical the conditional is an instance of, since this too would trivialise the proposed analysis to a certain extent. For, it would not say anything about the *meaning* of such conditional assertions. Again in Goodman, as in Chisholm, Ramsey's restrictions on the logical form of the additional information prevents a form of circularity.

[25]For Ramsey's account of causality see ch. 1, §1.2.3.

[26]Ramsey (GPC, p.252-3).

their conformity to valid inferences. [...] The point is that rules
and particular inferences alike are justified by being brought into
agreement with each other. [...] All this applies equally well to
induction. [...] Predictions are justified if they conform to valid
canons of induction; and the canons are valid if they accurately
codify accepted inductive practice.

Although the argument is circular, Goodman (1983, p.64) claims that it is a
virtuous circularity, as Ramsey does[27].

One blatant difference between Ramsey's inferential account of condi-
tionals and Goodman's account of counterfactuals is that, as it is clear,
the former works not only for counterfactuals, but for all those conditionals
whose correspondent material implication is true. Recall also that Good-
man uses "counterfactuals" to refer only to those conditionals where both
antecedent and consequent are false, which is clearly not what Ramsey has
in mind, when in GPC he speaks of "unfulfilled" conditions *tout court* – in-
deed, in MHP he treats all together conditionals whose antecedents are false
(no matter what truth value the consequents have).

It is not clear what Goodman's view on other conditionals is, he seems to
suggest that for indicatives the simple material implication works[28]. If this
is case, it is difficult to imagine how Goodman's view could be extended to
other types of conditionals, since it would probably end up in a refined ver-
sion of material implication. Both unified theories I have proposed in ch.3
extend Ramsey's inferential account, and I believe that each of them has
affinities with Goodman for different reasons. Nonetheless, my formal ap-
proach can be considered as belonging to the class of "ontic conditionals"[29],
since it makes use of possible worlds semantics. This is against Goodman's
idea that counterfactuals express a linguistic relation between statements p
and q of the type "if the statement p were true, then the statement q would
be true", and not ontological. This is in line with my theoretical approach,

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[27] «Induction is such a useful habit, and so to adopt it is reasonable. All that philosophy
can do is to analyse it, determine the degree of its utility, and find on what characteristics of
nature this depends. An indispensable means for investigating these problems is induction
itself, without which we should be helpless. In this circle lies nothing vicious» (TP, p.
198).

[28] «Also, we half-consciously expect that the truth-functional treatment of ordinary in-
dicative conditionals will somehow serve as a helpful model for the analysis of counterfac-
tuals.» Goodman (1983, p.35).

[29] See Arlo-Costa (2019).

which does not need to postulate entities but relies on linguistic and pragmatical analysis of conditionals. Furthermore, the requirements Goodman applies to the set of additional statements are different and more detailed than those applied to the closest world(s) in theories like Stalnaker's and Lewis'. Lewis (1973, §2.6 and ch.3) notices that, depending on how cotenability is defined, it is possible to obtain a theory equivalent to his own[30].

Of course, the major difference between Goodman's proposal and my two versions of Ramsey is that he attaches truth values to counterfactuals, whereas I define acceptability conditions for both theories of ch.3. This is meant to reflect Ramsey's idea that truth conditions of conditional sentences coincide with those of corresponding material implication. The goal of Ramsey's analysis is not to find other truth-conditions, but rather to explain what we convey or want to convey with conditional assertions.

Next, I will discuss Rescher's theory of conditionals, the last one belonging to the additional premises accounts that I will consider.

4.2.3 Rescher

Lastly, for the "additional premises" group, I consider Rescher's account of conditionals. Let us start by discussing some differences that distinguish Rescher from Chisholm and Goodman.[31].

Unlike the other two additional premises theories, Rescher's account (Rescher, 1964, 2007) is not specifically thought for counterfactuals, but it applies to a wider range of conditional sentences. Second, Rescher does not give truth conditions for conditionals, but he provides an analysis belonging to the fields of epistemology and pragmatics, whose goal is to clarify what information we want to convey in uttering such sentences.

Rescher (1964) starts by hypothetical inferences where premises are merely supposed. The supposition could be *problematic*, when the truth value is

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[30]Lewis discusses what he calls "metalinguistic theories" of counterfactuals, among which he includes Goodman's theory, but also Chisholm's and Rescher's: «the metalinguistic theorist uses his further premises in much the same way as I have used the system of spheres representing comparative similarity of worlds: to rule out of consideration many of the various ways the antecedent could hold, especially the more bizarre ways.» (Lewis, 1973, p.66). Lewis (1973, §2.6) also restates his truth conditions for counterfactuals in terms of cotenability.

[31]Rescher expresses its indebtedness to both of them. See Rescher (1964, ch.4 and A1.4) and Rescher (2007, ch.7 and ch.9) for Chisholm's account. See Rescher (1964, A3.3) for Goodman's account.

unknown, *belief-contravening*, believed to be false and contradicting some beliefs already held, and *counterfactual*, actually known to be false[32]. Antecedents of counterfactuals are classified as "belief contravening" and the confusion we might have in choosing between two counterfactuals with same antecedent and contradictory consequents derives from (Rescher, 1964, p.26-7):

> the contextual ambiguity generically inherent in such hypotheses must thus also enter into counterfactual conditionals, and gives rise there to mutually discordant conditionals of the type we have witnessed[33]. The antecedent of a counterfactual conditional must, in the nature of things, be a belief-contravening hypothesis that can be rendered consonant with the residual beliefs in various *alternative* ways.

Indeed, similarly to Ramsey, for Rescher (2007, p.7) «when a conditional "if *p* then *q*" is appropriate, there lies in the background some categorical (unconditional) facts in virtue of which this conditional obtains – facts that must obtain for the conditional to hold». And this applies to all types of conditional sentences. Whenever asserting a conditional, the speaker has what Rescher (2007, p.7) calls an *enthymematic basis* of beliefs he accepts (i.e. believes to be true) that he implicitly adds to the antecedent of the conditional to support the whole sentence. Of course, the case of counterfactuals is more complex since the antecedent explicitly contradicts the speaker's beliefs. Hence, many of Rescher's efforts are devoted to a clarification of the selection procedure of propositions included into the enthymematic basis of a counterfactual. In order to avoid inconsistency between the basis and the antecedent, a *principle of rejection and retention of beliefs* (Rescher, 1964, ch.5) must be found.

First, Rescher (1964) divides counterfactuals into *nomological* and *purely speculative*. The former are «counterfactuals specifications of covering laws»

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[32]In my discussion of Ramsey's counterfactuals I did not make any distinction between believing and knowing that the antecedent of a conditional is false, because, I think, it is not necessary. However, it must be said that Ramsey speaks of knowledge of the falsity of the antecedent, and hence of the truth of the corresponding material implication, but it does not seem that a specification of it would make a significant change to my theoretical theory.

[33]Rescher (1964, p.24) mentions Quine's example: "If Bizet and Verdi had been compatriots, Bizet would have been Italian" and "If Bizet and Verdi had been compatriots, Verdi would have been French".

(p.30). Namely, they are instances of some laws we entertain and, as such, they require that the law itself is retained in the implicit set of statements that, added to the antecedent of the conditional, make it possible to infer the consequent. The law the conditional is an instance of must be kept in the set of beliefs «at cost of adapting all else to it» (p.31). An example Rescher (1964) discusses is "if Julius Caesar had been a lion, he would have had a tail", and "if Julius Caesar had been a lion, there would have been a tail-less lion (because Caesar had no tail)". In both cases, you start with this set of beliefs: (a) "Caesar was not a lion", (b) "Caesar had no tail" and the law (c) "All lions have tails". Proposition (a) must be excluded from the additional premises set in both cases because it contradicts the antecedent of the conditional. But in the first conditional we retain the law and reject the proposition (b) while in the second we do the opposite. Rescher (1964, p.31) argues that the first conditional sounds more "natural" exactly because we retain the law, above all.

Notice, however, that in Ramsey's account proposition (b) would have been excluded *tout court* from the additional set r, since it does not respect one of the restrictions on it – i.e. no negation. Therefore, it would not be part of the additional premise set in any case, not even in the second case. Furthermore, it is difficult to think of a variable hypothetical we endorse which Rescher's second conditionals about lions could be an instance of[34]. Hence, the counterfactual would not be accepted in Ramsey's account too. Also, recall that in Ramsey's account the variable hypothetical triggered by the conjunction of the antecedent of a conditional and propositions rs need not to be contained in r itself. Conditional "if Julius Caesar had been a lion, he would have had a tail" could be accepted if we suppose r to be "and it was an healthy lion", o something similar, which, clearly, the law somehow presupposes too - there might be lions born without the tail or some might have broken it etc.

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[34]I cannot think of any, but perhaps someone has such variable hypothetical and accepts the second conditional. Nevertheless, recall that in ch.1 I have argued that, according to Ramsey, "reasonable" habits are those that produce in the subject a degree of belief that reflects the actual proportion with which an event has occurred given an other. Those habits which obey this principle are reliable and translated into variable hypotheticals. We can assume that in our experience – at least mine – all (or almost all) lions we have met or seen have a tail. If someone holds a different variable hypothetical we can suppose it is unreasonable, for perhaps he has not taken into account all evidences – see ch.1 for a detailed explanation.

The *purely speculative* counterfactuals are «genuinely paradoxical» (p.37) since, according to Rescher, they are not direct instances of a law[35]. In order to find the set of premises that is compatible with the antecedent of such conditionals, Rescher (1964, ch.7) introduces *modal categories*: consistent sets of beliefs (sentences) that can be used as additional premises. Each modal category contains some accepted propositions of the set of premises and each modal category has an index – the lower the index is, the more committed we are to that set of statements. The idea is the following: first, the set of accepted beliefs is divided into modal categories, then the antecedent of the counterfactual is added to this set of accepted beliefs. To what modal category in the set depends on which modal category requires minor adjustments to accommodate the antecedent. Rescher (1964, p.47) explains that

> The function of the modal categories is to provide the machin-
> ery for an exact logical articulation of the informal idea of the
> "relative degree of potential commitment" to the endorsement of
> statements, reflecting their priority-rating with respect to "fun-
> damentality" or "importance".

The set with modal index "0" (the one we are most committed to) contains categorically demonstrable statements.

The modal categories can be interpreted in different ways: as alethic (from necessary to impossible), as epistemic (from certain to impossible) and as establishing degree of confirmation. There can be different ways to accommodate into modal categories the statements of the set of accepted beliefs. The alternative that requires less adjustments to be consistent with the antecedent of the counterfactual will be the one needed to infer the consequent[36]. Even if it is not explicit, it is clear that whenever the conditional

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[35]An example is the already cited Quine's conditionals: "if Bizet and Verdi were compatriots, Bizet would have been Italian" and "if Bizet and Verdi were compatriots; Verdi would have been French".

[36]To clarify, consider this example Rescher (1964, ch.9) proposes. Your set of accepted beliefs is the following: (a) This coin is a penny; (b) this coin is not a dime; (c) this coin is made of copper; (d) this coin is not made of silver; (e) all pennies are made of copper; (f) all dimes are made of silver. Then suppose your counterfactual hypothesis is "not (b)", i.e. "assume this coin were a dime". You now have two options to sort out your beliefs into modal categories: 1. particular statements have a lower modal index than generalisations; or 2. generalisations have a lower modal index than particular statements. So, in the first case you would have: 1. (e, f) (a, b, c, d); in the second: 2. (a, b, c, d) (e, f). If you add your hypothesis not-b to the second categorisation you would immediately encounter some adjustments to make: you must take off b from the set and the consequent of our

is not a counterfactual, the process is the same but simpler, since the antecedent does not contradict any belief we have.

Although the core idea is very similar to Ramsey's inferential account – with even the possibility of introducing degrees of belief thanks to modal categories – the theory developed is quite different. First, as we have seen in the other additional premises theories, the requirements on the these additional premises are not the same. Rescher does not impose to propositions in the set to be exclusively conjunctions, although they all must be (or at least deemed as) true. There are no temporal restrictions, that I think are crucial in some counterfactual cases. Modal categories can also be used to classify statements according to the probability or degree of confirmation in them, but the role of probability is different from the one that chances play in Ramsey. Furthermore, it is not completely clear if such statements classified according to their probability have some impact on the consequent and on the probability of the conditional itself, once added to the antecedent of a conditional – I suppose they do not.

As I mentioned before, the position laws occupy in Rescher's picture diverge from that of Ramsey's variable hypotheticals, since they are usually included in the enthymematic premise of the conditional instance they are instantiated by.

All things considered, among the additional premise theories, Rescher's account is the most similar to Ramsey's and to my theoretical approach, since it treats all conditionals with the enthymematic account that we have seen at work in ch.3. Moreover, Rescher does not attach truth values to conditionals. This makes it more complex translating it into Lewis' possible world semantics, as he (Lewis, 1973) acknowledges. But this is again another similarity with my theoretical proposal, as well as with my formal approach of ch.3, both treating conditionals not as truth bearers. The most significant difference between Rescher and my formal account is my use of probability and imaging.

The idea that conditionals are evaluated according to a set of propositions not explicitly stated is borrowed by those theories that introduce possible

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counterfactual would then be a consequence of the set $\neg b \wedge c \wedge d$, and you would also need to add $\neg a$ and $\neg f$. Option number 2. is simpler, because by adding our hypothesis to the set you do not face inconsistency right away and you do not need to make any further adjustment. From the conjunction $\neg b \wedge e \wedge f$ you can infer as consequences $\neg a$ and $\neg c$ and $\neg d$, without adding them to the conjunction.

worlds to represent this set.

4.3   Possible worlds

In ch.3 I showed how Ramsey's account of conditionals can be turned into a possible world semantics by using imaging. Thanks to variable hypotheticals it is possible to order worlds for their similarity to the actual one and thanks to $p \wedge r$ (antecedent and additional information) the closest world(s) where the antecedent of our conditional is true is (are) selected. In ch.3 I used interchangeably selection function (Stalnaker) and sphere semantics (Lewis), since Lewis has showed that the truth conditions are equivalent. But, of course, there are differences between the two theories and it is worth discussing the major ones, also with respects to the two unified accounts I presented in the previous chapter.

There are some relevant discrepancies between Stalnaker's and Lewis' theories[37]. First, Stalnaker uses a selection function, which selects *the* closest world among the antecedent-worlds epistemically accessible from the actual one. Notice that, since the accessibility relation is reflexive (cf. ch.3 §3.2) such world can be the actual one, if the antecedent is there true. On the other hand, Lewis uses a similarity relation that orders worlds according to their similarity to the actual one. Although relevant, this aspect does not make any difference with respect to Ramsey's theories, since the translation is in any case possible.

What makes a real difference is what the two tools (function and relation) select or order respectively. Indeed, given a conditional "if p then q", Stalnaker's selection function selects *one* p-world as the closest to the actual, whereas Lewis relation orders sets of worlds into spheres, hence it might be that there are equally close worlds where p is true and perhaps in some of them q is false and in other true. This is because Stalnaker (Stalnaker (1968); Stalnaker and Thomason (1970)) makes two strong assumptions which guarantee him conditional excluded middle (CEM). One is *uniqueness*: for every world w there is at most one closest p-world to w. The other is the *limit assumption*: for every world w there is at least one closest p-world to w. These two assumptions together imply CEM; these two assumptions are what Lewis

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[37]I will here consider Lewis' VC semantics, which is the one genuinely thought to deal with counterfactuals.

(1973, 3.4) criticises. Hence, «Stalnaker's theory is equivalent to a special case» of Lewis' (Lewis, 1973, p.78), where uniqueness and limit assumption are valid. Lewis' idea is that it is not always possible to choose between two conditionals with contradictory consequents.

Take again Quine (1982) example mentioned in section 4.2.3: "if Bizet and Verdi were compatriots, they would be French" and "if Bizet and Verdi were compatriots, they would be italian". According to Lewis, we have no cogent reason to consider one of the two conditionals true (or, in Ramsey's case acceptable) and the other false. Hence, instead of selecting a single closest world, Lewis' machinery selects a *set* of equally close worlds where the antecedent of the conditionals is true but one consequent may be true in some and the other consequent true in others. Thus, it is not possible to choose between the two counterfactuals and neither is true at the actual world.

> Given Conditional Excluded Middle, we cannot truly say such things as this:
>
> > *It is not the case that if Bizet and Verdi were compatri-*
> > *ots, Bizet would be Italian; and it is not the case that*
> > *if Bizet and Verdi were compatriots, Bizet would not*
> > *be Italian; nevertheless, if Bizet and Verdi were com-*
> > *patriots, Bizet either would or would not be Italian.*
>
> [...] I want to say this, and, I think it probably true; my own theory was designed to make it true. But offhand, I must admit, it does sound like a contradiction. Stalnaker's theory does, and mine does not, respect the opinion of any ordinary language speaker who cares to insist it is a contradiction. But the cost of respecting this offhand opinion is too much. [...] the selection function still must choose. I do not think it *can* choose – not if it is based entirely on comparative similarity anyhow.

This is how Lewis (1973, p.80) explains and justifies his choice of rejecting CEM. In some cases, it seems that the similarity among worlds is not suffi-cient to choose between two worlds differing only for the truth values assigned to the consequent of a conditional. Hence, instead of modifying comparative similarity, Lewis decides to reject CEM, although, as he acknowledges, the

everyday use of conditionals validates it[38].

Before discussing Ramsey's theoretical and formal approaches, I shall briefly explain Lewis's argument against Stalnaker's limit assumption, since it is the other essential side of his rejection of CEM. If we counterfactually suppose that in front of us there is a line longer than 1 cm (when actually it is shorter) it is hard to find a set of closest worlds[39]. There can be sphere where the line is 2 cm, some others where it is 1.75 cm, in others 1.50 cm, 1.49, etc. so that we never reach *the* closest set of worlds where "if this line were 1 cm long..." is true, i.e. no smallest permitting sphere.

In ch.3, I claimed CEM to hold in my theoretical account but not in the formal one. There are at least two reasons for this choice: first, Ramsey (GPC) is quite clear that the negation of (or, more precisely, disagreement about) a conditional is expressed by negating the consequent of such conditional. Indeed, «we apply the Law of Excluded Middle not to the whole thing but to the consequence only» (GPC, p.240), and I have argued that the footnote should be read along these same lines («in a sense 'if p, q' and 'if p, $\neg q$' are contradictories» (GPC, fn.1, p.247)), although it has been claimed differently (cf. McCall (2012)). To achieve this, I had also to assume that our subject is an ideal thinker and has an opinion on everything in the sense that she is always able to choose between "if p, q" and "if p, $\neg q$". Since the account already deals with an idealised thinker who has a system formed of laws and chances from which she derives his degrees of belief in specific cases, this assumption is harmless.

Given that Ramsey is quite explicit with respect to his acceptance of CEM, I decided to make it valid in the account which develops more accurately his own view and to reject it in the other (of course, it can be made valid or invalid respectively)[40]. Indeed, in the formal approach I account also for the second possibility of disagreement (cf. ch.2, §2.2.1 and ch.3, §3.2) and propose to abandon CEM.

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[38]Notice that if we adopt Ramsey's variable hypotheticals and the idea that a subject endorses either $\forall x(\phi x \to \psi x)$ or $\forall x(\phi x \to \psi x)$, we are able to justify CEM, and selection function can actually choose.

[39]I am applying the assumption to a system of spheres (I am here considering the limit assumption on its own and not together with uniqueness). This version of the limit assumption says that there is «the *smallest* antecedent-permitting sphere, and in it the *closest* antecedent-worlds» (Lewis, 1973, p.20).

[40]If we take my *Ramseyan* formal approach to be equivalent to Lewis' VC, then if we add CEM to it we obtain Stalnaker's system $C2$.

Hence, Stalnaker's theory is more similar to Ramsey's theoretical approach than Lewis', which, on the other hand, is closer to my formal approach: the rejection of CEM and acceptance of Boethius thesis make this account more similar to Lewis system of spheres [41]. Then, in the formal approach it is not possible to have both the limit assumption and the uniqueness assumption, since they together imply CEM[42]. It is more reasonable to give up uniqueness and accept that in the closest antecedent permitting sphere there can be both worlds where the consequent is true and worlds where the consequent is false. Conversely, if we want to "translate" Ramsey's theoretical approach into a possible world semantics, both the limit assumption and the uniqueness assumption should be valid. However, as I explained in ch.3, if we take CEM off from Ramsey's formal approach it is dubious whether we can still use imaging, since this machinery is explicitly defined for Stalnaker's logic, where CEM holds[43].

Besides CEM, both Ramsey's account invalidates contraposition, which is invalid in Stalnaker's and Lewis' semantics too. Moreover, the theoretical approach stops other inference patterns which do not hold neither in Lewis nor in Stalnaker[44]. Indeed, in all these three theories the two paradoxes of material implication (false antecedent and true consequent) are blocked, as well as transitivity and antecedent strengthening (variably strict conditionals are non-monotonic, as Ramsey's). As Lewis' VC, Ramsey's theoretical approach validates also limited transitivity and cautious monotonicity. Both Stalnaker's logic $C2$ and Lewis' VC validate ID: $\therefore p \to p$. In Ramsey's theoretical approach, however, I have defined an inference as valid iff the implicit information needed to accept the conclusion are a subset (at most, the conjunction) of the implicit information we need to accept the premises. In the identity case, since there are no premise, the set of additional propositions is empty, hence the set of additional premises for the conclusion must

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[41] Although I actually started by translating Ramsey into Stalnaker's setting, I have already said that Lewis (1973) shows that the two accounts have the same truth conditions for conditionals and that Stalnaker's can be considered a restriction of Lewis' semantics – Lewis' semantics with CEM.

[42] The limit assumption alone does not imply CEM because in the closest sphere there can be both worlds which validate the consequent and some that do not.

[43] Probability share of the actual world where, suppose, the antecedent is false are moved to *closest* world where the antecedent is true. CEM seems essential.

[44] The main difference between these two theories being CEM.

always be empty too. I do not know whether this is always the case[45]. I suspect that also in asserting conditionals such as "if it rains, then it rains" or "if it had been sunny, then it would have been sunny", what make them acceptable is some implicit contextual information – for, a sentence of this type out of its context sounds quite silly. But, as it is, with an empty set of premises and therefore of additional premises too, it cannot be valid in my theoretical account.

Since in ch.3 I have showed how many similarities there are between Ramsey's conditional account presented in MHP and variably strict conditionals, and I have also showed how Ramsey's inferential account can be translated into Stalnaker's, I suppose that all inference patterns valid for his theory are valid also for Ramsey's formal approach.

Concerning Ramsey's formal approach and Lewis' theory of counterfactuals, I should add a few remarks upon Lewis' notion of laws of nature and their role in sphere semantics. This addition to Lewis' semantics is meant to show how the additional premises theories for conditionals can be "implemented" in it. Lewis (1973, p.73) adopts Ramsey's account of laws of nature as proposed in ULF (1928), which is then explicitly rejected in GPC, one year later[46]. Lewis' idea is that

> a contingent generalization is a *law of nature* if and only if it appears as a theorem (or axiom) in each of the true deductive systems that achieves the best combination of simplicity and strength. Likewise, a generalisation is a law at a world i, if and only f it appears as a theorem in each of the best deductive systems true at i.

If we want Lewis' system to take laws of nature into account, this is his recipe: «the set of all and only those worlds that do not violate the laws prevailing at a world i is one of the spheres around i. [...] in terms of comparative similarity: whenever the laws prevailing at i are violated at a world k but not at a world j, j is closer than k to i.» (Lewis, 1973, p.73). Lewis explains that his theory does not impose this constrain because he does not believe that «laws of nature have as much of a special status as has been thought». Indeed, Lewis (1973, p.75) argues that in some cases worlds where laws are

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[45]Recall that the additional propositions rs must contain only categorical and specific propositions, hence we cannot have $p \supset p$ itself in r.

[46]See ch.1, §1.2.3

different but particular facts similar can be closer to the actual world than those where the converse happens. This is his own example: in a world with deterministic laws a roulette wheel at time t stops on black. If we consider the counterfactual "if the roulette wheel stopped on red ..." we have two options: either the closest worlds are those where the laws hold and some particular facts are different, or the closest worlds are those exactly equal to the one considered before time t and the laws in these worlds «hold *almost* without exception; but where a small, localized, inconspicuous miracle at t or just before permits the wheel to stop on red in violation of the laws». Lewis believes this second option more or at least as acceptable as the first. I must confess I am not convinced at all[47].

Lewis' argument revolves around the idea that a violated law replaced by another is not necessarily a more complicated scenario, but rather it can still be as simple and strong as the original one. To my intuition laws are the last part of my system of beliefs I am inclined to change, exactly because they are laws and, as such, they occupy a peculiar space in my system of beliefs.

This leads us again to Ramsey and his latest view on laws (GPC): laws are those generalisations we trust. This is their main peculiarity with respect to other generalisations, which can be simple as laws. Namely, we trust laws to make new inferences and to lead us in our judgments and actions. For this reason, in the formal approach outlined in the previous chapter, variable hypotheticals have a preeminent role and determine the ordering of worlds. Ramsey's rs specify exactly what the particular facts which can stand together with the counterfactual antecedent are. These additional propositions are restricted by certain temporal requirements, which, however, do note coincide with Lewis' t. Indeed, Lewis "miracle time" t is the time of the antecedent, whereas Ramsey's temporal restrictions refer to the time of the events in the consequent – the antecedent and the additional information rs usually refers to events earlier than those described in the consequent (see ch.2).

Notice also that in ch.3 I said that the antecedent plus rs determine the variable hypothetical triggered, hence the variable hypothetical for the conditional must be one that holds in the actual world, but it should not

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[47]I believe, following Ramsey and Rescher, that an essential feature of laws is that they are guiding rules and as such they are the beliefs we are less inclined to revise or reject.

necessarily be among the information added to the antecedent. Lewis, as the additional premises theorists, includes laws into the set of additional premises, whereas Ramsey does not. Hence, Lewis is mistaken in thinking that the laws involved in the facts described in the factual event in the actual world are those that determine the closest worlds. The closest worlds where the conditional (even the counterfactual) is evaluated are selected by the antecedent and the additional rs among those worlds where the variable hypotheticals endorsed by the agent hold, which are clearly closer than those where there are no such variable hypotheticals, but other rules.

Possible world semantics for conditionals has been largely studied and developed in a plurality of axiomatic logical systems. This is maybe the main reason why it is the most used account by those who believe that material implication is not enough to account for conditional sentences in natural language. It works for counterfactuals, but perhaps it is not so good for other types of conditionals (like indicatives). Furthermore, it brings a metaphysical flavour that not everyone is willing to greet. So far, there are not many good alternatives, especially because many theories can be adjusted to possible world semantics, as we have seen. Moreover, variably strict conditionals have truth conditions and are truth functional, features that simplify the work and the logic, especially because they allow for nesting and embedding of conditionals.

Ramsey's theoretical account reverses the perspective: it does not look for alternative truth conditions, but it maintains material implication and it uses it to determine epistemology of conditional sentences. Then, it refers to actual context and gives strict conditions on how it should be handled and what kind of information should be considered in the evaluation of a conditional, instead of similarity among worlds. Perhaps, if developed, this theory would prove circular or unable to give a correct explanation of conditionals. It is even very plausible that no useful original formal system can be carried out from it. Nonetheless, it can suggests a way for an alternative to possible worlds, an updated additional premises account that can be applied to all types of conditionals.

4.4 Probabilistic semantics

At the beginning of chapter 2, I showed that Ramsey has been and still is commonly considered a source of inspiration especially for theories of indicative conditionals. The attention has always been drawn to the first part of the footnote, hence Ramsey has ever since been considered the first proponent of the use of conditional probability for indicative conditionals[48]. Some scholars have taken Ramsey's suggestions about conditional probability and endorsed it all the way down, developing a probabilistic semantics for indicative conditionals. The most notable account of indicatives based on the assumption[49] that the probability of an indicative conditional is the probability of the consequent given the antecedent is Adams' theory (Adams (1966, 1975, 1998)). From this assumption, Adams (1975, 1998) has developed a probabilistic logic, sound and complete, with a non-truth functional operator for indicative conditionals and a validity criterion for inferences involving conditionals.

Adams (1975, p.3) refers to Ramsey as the source of inspiration for his work and as the first proponent of the idea that conditional probability equals the probability of a conditional statements. Together with Ramsey, Adams also acknowledges Jeffrey as his predecessor [50]. Jeffrey is well known primarily for his work on decision theory and probability (cf. Jeffrey (1983), where he also presents and discusses Ramsey's subjective interpretation of probability of TP). In particular, Jeffrey is famous for a revised version of Bayes' conditionalisation that carries his name and takes into account also the degree of belief that new evidence, upon which beliefs are updated, does not happen or had not happened[51].

Jeffrey (Jeffrey and Edgington, 1991) holds that "if" really expresses conditional probability, for all types of conditionals. Indeed, he rejects «questions of counterfactual forms as either nonsense or as colorful ways of asking about conditional probabilities» (p.164). To a certain extent, this is also the

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[48] There are some exceptions, like Chisholm (1946).

[49] Known as *the Equation, the Thesis* or *Adams' thesis*.

[50] Adams (1975, p.3) cites an abstract by Jeffrey named "If" that, however, I could not find.

[51] Jeffrey is known for his "radical probabilism". Very roughly, radical probabilism claims that no facts are believed for certain. Hence not even knowledge is certain, but "practically certain". We have seen (see ch. 1 §1.3) that Ramsey holds the same view: knowledge can always be fallible, and subjected to revision. The degree of belief we have in those beliefs we take as knowledge is not equal to 1 but slightly lower.

view endorsed in my theoretical approach, where all types of conditionals are supported by variable hypotheticals that express degrees of belief to which those of actual people approximate. Conterfactuals too express degrees of belief and conditional probability, although not *prima facie* (Ramsey, GPC, p.247) and not explicitly.

Jeffrey (Jeffrey and Edgington, 1991, pp.165-6) recalls Ramsey's idea that when we give a definite answer to the question "if p then q?", our degree in it is actually the degree of belief in the corresponding material implication. On the other hand, when we are uncertain the probability is given by conditional probability (see ch.2). Jeffrey takes on this idea, but he extends conditional probability to cover also the certainty case, even when the degree of belief in "q if p" is 1. He then develops a theory of conditionals based on de Finetti's notion of *random variable*, functions representing propositions, that assign a value to possible worlds according to the truth value a proposition has in a world. The probability of a proposition is the expectation of the random variable – i.e. the weighted average of the value of the proposition. Hence, given a proposition A, and its possible two truth-values, 0 and 1, the expectation of A will be: $0 \times P(A) + 1 \times P(A)$, that clearly reduces to the probability of A. The same applies to conditionals. If the antecedent is true, the conditional must take the value of the consequent, hence false if the consequent is false and true if the consequent is true, like material implication. However, when the antecedent is false the conditional takes the value that conditional probability assigns to it, between 0 and 1. Thus, Jeffrey obtains a truth table that assigns the same truth value of the material implication when the antecedent of the conditional is true; it goes with conditional probability when the antecedent is false. I will not discuss this account in detail, but it is relevant that, although it uses conditional probability, it blocks Lewis' triviality results[52]. It is clear, then, that even if there are some similarities – behind every conditional there is a degree of belief – the resulting theory diverges from my accounts of the previous chapter. But there is another similarity: Jeffrey's account relies on degrees of belief, so that the value of the conditional varies across people – as in Ramsey. In my formal approach, conditional probability is replaced by imaging, so in a sense it is more similar to Jeffrey's idea since it retains a probabilistic updating rule also for counterfactuals.

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[52]Cf. Jeffrey and Edgington (1991, p.174 and ff.)

Adams (1965, 1966, 1975) is the one who takes the first part of Ramsey's footnote seriously and develops a theory of acceptability of indicative conditionals that depends on the degree of belief in q given p. The assumption is that the probability of a conditional "if p then q" is given by the conditional probability of q given p. Of course, this applies only to indicative conditionals and not to counterfactuals, because of the falsity of the antecedent. This account has been endorsed and defended also by others philosophers, like Edgington (1995) and Bennett (2003). Adams' assumption suffers of Lewis' triviality result(s); to avoid it the probability of the conditional should not be read as the probability of the conditional to be true and not as a truth-functional connective – embedding is forbidden: conditionals can only appear as the main connective.

Conditional probability is weaker than material implication, hence the probability of this latter is always higher than that of the former – except when $P(p \wedge \neg q)$ is 0 or when $P(p)$ equals 1. However, conditional probability is stronger than the probability of the conjunction of the antecedent and the consequent of the conditional. This means that if someone believes to a high degree that $p \wedge q$, she believes at least at the same degree that $p \rightarrow q$. Notably, believing the Stalnaker-Lewis conditional implies believing the conjunction of the antecedent and the consequent, but not necessarily Adams' conditional, which is stronger, i.e. $P(q|p) \leq P(p > q)$.

Clearly, since conditional probability is undefined when the probability of the antecedent is 0, counterfactuals are not covered by this account. Stalnaker (1970) uses Popper function to extend a modified version of Adams' thesis to counterfactuals[53]. On the other hand, Adams (1965) stipulates that whenever the antecedent is false the conditional probability is vacuously equal to 1. The crucial point is that for Adams, like for Ramsey, indicative conditionals express bets and a "commitment to action" (cf. Adams (1970, p.92)), while counterfactuals do not[54]. He later attempts (Adams, 1975, p.103) a characterisation of counterfactuals as "epistemic past tense" of indicative conditionals, in the sense that «their probabilities at the time

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[53]See also Leitgeb (2012a,b) for a probabilistic semantics for counterfactuals.

[54]Indeed, Adams (1970, p.92) in discussing his famous Oswald-Kennedy example adds that «anyone asserting that if Oswald hadn't shot Kennedy, Kennedy would be alive today would not be acting contrary to that assertion if he refused to bet that if Oswald wasn't the assassin, then Kennedy is still alive, or even if he bet that if Oswald wasn't the assassin, Kennedy is nevertheless now dead».

of utterance equal the probabilities which were or might have been attached to corresponding indicative conditionals [...] on real or hypothetical prior occasions».

As Ramsey, Adams distinguishes between *meaning* and *truth* of a conditional sentence (see, for instance, Adams (1987)). For Adams, as for Ramsey, the acceptability of conditionals is independent from their truth. However, in my theoretical account, the truth of a conditional – i.e. of the corresponding material implication – determines the meaning of the conditional sentence, in the sense that what the speaker wants to convey by asserting a conditional is determined by the truth value of the material implication. Although the acceptability of a conditional in the theoretical theory is the same for all types of conditionals and independent from the truth value of the material implication, its epistemic and pragmatical characterisation is not. Furthermore, I have ruled out the case where the material implication is false, saying that in that case the corresponding conditional sentence is neither acceptable nor assertable. This is clearly not the case for Adams. In Adams' theory material implication plays no role, conditional probability covers the meaning and the epistemology of all those conditionals whose antecedents are not false. With respect to my formal approach the situation is even more diverse, since the account is similar to Stalnaker's account and imaging captures the probability of this conditional, which we know to be in general weaker than the corresponding conditional probability.

Adams (1998) develops a probabilistic logic for conditionals and defines a probabilistic validity criterion (*p-validity*) for inferences. The idea is straightforward: reformulate the truth preservation criterion into a probabilistic form. Since our reasonings very often move from uncertain premises, Adams requires that in inferences with conditionals[55] the uncertainty of the conclusion does not exceed the sum of the uncertainties of the premises. Uncertainty $U(\phi)$ is defined as $1 - P(\phi)$, where ϕ is a factual formula or a conditional. Given a set of formulas Γ and a formula ψ, $\Gamma \models \psi$ if and only if for every formula ϕ in Γ, the sum of the uncertainties of the premises is lower or at most equal to the uncertainty of the conclusion, i.e. $U(\psi) \leq U(\phi_1) + ... + U(\phi_n)$. In case of formulas not containing conditionals, *p*-validity coincides with classical validity.

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[55]Recall that conditionals can only appear as the main "connective", viz. you cannot have $t \wedge (p \to q)$.

It is then possible to see which of the controversial inferences I have discussed in ch.3 are valid in Adams' account. What we find is that all the inferences which are not valid in Ramsey's theoretical approach are not valid also in Adams' theory either. The paradoxes of material implication are blocked, as well as transitivity, contraposition, antecedent strengthening and simplification of disjunctive antecedent. Instead, rational monotonicity and limited transitivity are p-valid. It is clear that Adams' theory invalidates the same inference patterns that my theoretical account invalidates. Furthermore they presumably coincide[56] with the same inference patterns invalid also for the formal approach, since they are the same inferences that Stalnaker's semantics does not validate[57] and we have seen the similarities of my account and Stalnaker's. Hence, it seems legit to believe that all the inferences not valid in Stalnaker's theory will not be valid even in my formal approach[58], which are the same not valid in Adams.

Adams' theory is very attractive for it seems to capture our intuitions about indicative conditionals, as many works in the psychology of reasoning have shown[59]. A fully developed complete logic ready to use is another reason for its success. It does not need entities like possible worlds and it fits quite well into Bayesian epistemology. Adams is considered Ramsey's heir, since he develops Ramsey's idea that if two people are wondering whether q will happen if p happens, they are considering their degrees of belief in q given p. Indeed, this is right if we consider only the first part of Ramsey's footnote, as the literature on conditionals has usually done. However, in the second section of ch.3 I showed how many similarities there are also between Stalnaker's possible world semantics and Ramsey's inferential account of counterfactuals.

Of course, there are many common features with Adams' theory too. Conditional probability is used by Ramsey, and it is used to represent a bet and the actions the acceptance of such conditional would lead to. But, first, this is not the only formal tool used by Ramsey; second, it does not cover all the cases of indicative conditionals Adams' account does. We have

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[56]Except for identity, see previous section.

[57]See Stalnaker (1970).

[58]Whether we hold CEM or not does not make any difference with respect to the inference patterns invalid in Adams, since they are also invalid in Lewis' semantics for conditionals VC.

[59]See, for instance, Evans and Over (2004).

seen that when the antecedent is false, Adams' thesis does not apply, but it applies to all other cases. In ch.2 I have argued that if we strictly follow Ramsey's texts, there is no evidence that his intentions were to apply conditional probability to all conditionals whose antecedents are not false. Instead, in many cases he speaks of material implication or degree of belief in the corresponding disjunction – i.e. $\neg p \vee q$. Therefore, I suggested to restrict conditional probability to the single case where both antecedent and consequent are uncertain (neither true nor false). Then, in ch.3, in my theoretical approach, I proposed to extend conditional probability to those conditionals where the truth value of the corresponding material implication is not settled yet, but not to all indicatives. For instance, a conditional with an uncertain antecedent and a true consequent is covered by the inferential account, and not by conditional probability like it would be in Adams. The other approach, the formal account, uses probability but not conditional probability, and it can give an adequate account of counterfactuals.

In all theories of conditionals that present a version of the Ramsey test, the notion and role of other beliefs held, general beliefs in particular, is almost completely ignored. This is a further difference between Adams and Ramsey's conditionals: laws and rules for judging are decisive for the acceptance of a conditional in Ramsey, but they play no role in Adams. In Adams' theory, conditionals are taken outside their context of assertion and of beliefs. From this perspective, my two accounts are more similar to possible world semantics and additional premises accounts than they are to Adams' approach.

For sure, Adams' theory is the theory of conditionals most similar to Ramsey's ideas for what concerns truth and acceptability: they both seek an explanation of the ordinary usage of such sentences, more than new truth-conditions. Both theories rely heavily on degrees of belief, more or less explicitly, and allow the same conditional to be accepted by some people and rejected by others.

Adams does not give a role to the system of laws and beliefs a person endorses, but degrees of belief clearly vary from person to person and they ask for a system of beliefs with which degrees of belief in conditionals interact. For this, Ramsey's account as presented in ch.2 and ch.3 can be an improvement of Adams' theory, for it makes explicit what is there left implicit. Acceptability and validity in Adams should be replaced by those

proposed in my theoretical account, and conditional probability restricted only to some cases, this time really as a pure description of the process of accepting a conditional. Nonetheless, notice that the probabilistic value of conditional probability still plays a role in my proposal, since the conditionals accepted are instances of variable hypotheticals, which must state a high probability correlation between the antecedent and the consequent to be endorsed, if the variable hypothetical is a chance[60]. In adopting my theoretical theory we loose a developed logical system, but we gain a unified theory that covers all types of conditionals, and that is able to tell us what role the other beliefs a person has play.

4.5 Belief revision theories

Finally, I discuss one use of the Ramsey test in a field related to conditionals, but not strictly meant to provide a formal theory for this type of sentences. Belief revision is a relatively young research field, that developed from the Eighties, with the seminal work of Gärdenfors, Makinson and Alchourrón (Alchourrón et al. (1985)), who defined the AGM postulates. These are postulates stating the properties an operator for belief revision should satisfy for a belief revision to be considered rational. From then on, the field of belief revision has flourished and many logics (probabilistic and not) have been proposed. I will not discuss belief revision in detail, but I will focus on the version of the Ramsey test proposed by Gärdenfors and his arguments for the correspondence between belief changes and conditionals.

Gärdenfors (1981, p.203), moves from the assumption that «*conditional sentences*, in various forms, *are about changes of states belief*». He proposes an epistemic semantics for conditionals based on the notion of belief states, and he argues that in the counterfactual case, his semantics coincides with Lewis-Stalnaker possible worlds account, in the sense that the two semantics validate the same formulas. However, instead of giving truth conditions – as in possible worlds semantics – Gärdenfors gives an acceptability criterion. Belief sets are defined as sets of sentences that an agent can hold rationally; tautologies belong to belief sets, and if p and $p \supset q$ belong to a given belief set, then q belongs to that belief set too. A probability function correspond

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[60]Recall that a chance to be endorsed must have a value higher than that of its contrary with the negated consequent. Adopting CEM also excludes the possibility that the probability value between antecedent and consequent is $1/2$.

to belief set K iff for all formulas p, $P(p) = 1$ if p belongs to K.

According to Gärdenfors (1981) there are different ways to represent the acceptance of a conditional in a given state of belief. Depending on whether the conditional is a counterfactual, whose antecedent contradicts the beliefs held in the state, or it is open, viz. the agent does not know the truth value of the antecedent, there is an operation on belief states that represents it. For instance, in the counterfactual case, the acceptance is a "belief contravening" case: you must first remove the belief $\neg p$ contradicting the antecedent p of the counterfactual from the belief set K, by *contraction*. Then, you add p, the antecedent of our counterfactual, to K, by *expansion*. The general rule of acceptability of a conditional is presented in Gärdenfors (1986, p.81) as a version of the Ramsey test:

> The Ramsey test can be summarized by the following rule:
>
> (R) Accept a proposition of the form "if A then C" in a state of belief K if and only if the minimal change of K needed to accept A also requires accepting C.
>
> [...] The Ramsey test presumes some method of *revising* states of belief.

This version is quite different from Ramsey's original footnote: many elements of the footnote have disappeared – like conditional probability – and new others are introduced – as minimal change. But we still have Ramsey's notion of "stock of knowledge", namely the belief state to which the antecedent of the conditional under evaluation is added.

The crucial notion of "minimal change" refers to the way belief revision must work: the modification of the belief set should be such that «nothing that is not a consequence of A [the new proposition added to the set] together with the earlier accepted sentences should be accepted in the new state of belief» (Gärdenfors, 1981, p.205). This requirement is meant to represent the way Bayesian conditionalisation works: by conditionalising on new acquired evidence, conditionalisation does not modify the probabilistic relations and values of the sentences in the belief set. Of course, what a minimal change is can be defined in different ways, as in possible world semantics there is not an unique and uncontroversial definition of closeness of worlds. For this, like in possible world semantics, Ramsey's variable hypotheticals can perhaps

help in the definition of minimal change: the new set of beliefs of an agent cannot contain sentences which are not consequences or instances of the variable hypotheticals endorsed by the agent. In a certain sense, this quote from Gärdenfors (1981, p.206) suggests the role that variable hypothetical might play:

> Even if the class of possible states of belief may be very large it may very well happen that for any particular agent there is a smaller set of states of belief which forms the 'horizon' for the agent in the sense that no matter how the agent will change his beliefs he will never reach a state outside this set. This horizon determines what is *necessary* for the agent since he will regard a sentence as necessarily true if it is true in all states of belief he can imagine.

The horizon Gärdenfors speaks about can be thought as defined by the variable hypotheticals endorsed by an agent. This horizon would be the deductive system Ramsey talks about in C (see ch.3 §3.1 and ch.1, §1.2.2), that obeys probability laws and from which the actual degrees of belief of the agent are deduced by adding known facts to the system. However, variable hypotheticals are not necessarily true, they are not even true, but simply accepted or rejected. Variable hypotheticals are not necessary since it is always possible to revise them if we find other new and more useful rules of judgement, in the sense that they lead more often to truth and successful action than the previous ones.

Gärdenfors (1986) paper is important because he proves a triviality result from his Ramsey test together with some, apparently plain, assumptions for belief revision. One of them is monotonicity, «a consequence of (R) [Ramsey test]» (p.84). This is a consequence of Gärdenfors' test, but clearly not of Ramsey's test and footnote, as both my accounts in ch.3 show, giving both non-monotonic conditionals. Monotonicity fails in Ramsey because there are strict requirements on the propositions that can be added to the antecedent, above all they must be compatible with the antecedent itself.

There are many differences between Gärdenfors' account of conditionals and my two proposals. I think that the most relevant is the very simplified form of Gärdenfors' Ramsey test, that suggests to add directly the antecedent to the stock of belief and to modify the stock to make it consistent with the

new addition. At the beginning of his paper, Gärdenfors (1986) mentions that the antecedent is added *hypothetically* to the stock of beliefs, but this notion seems somehow to be lost in his Ramsey test. Furthermore, this version of the Ramsey test presupposes a revision[61] of the belief state, which does not seem necessary in Ramsey's account of conditionals. Especially in the theoretical account, even when the conditional is a counterfactual, there is no operation of revision of the state of beliefs[62], but simply some compatible known facts are added to the antecedent – which could be many, but always finite – in order to infer the consequent, after a variable hypothetical endorsed. In Ramsey, as we know, the addition of the antecedent to the stock of knowledge is strictly hypothetical, unless the antecedent is believed to be true, in which case it is already part of the stock of beliefs. The counterfactual case is handled not by modifying the set of beliefs the agent has, but by letting emerge from it only the true beliefs related to antecedent and context, that abide by all Ramsey's requirements. As I already said in ch.3, the antecedent of a conditional has a role in selecting the information needed to infer the consequent after a variable hypothetical, whether the antecedent is true, false or "open" – i.e. uncertain.

However, it must be noticed that perhaps more than any other account, Gärdenfors sets his view on conditionals within a theory of beliefs. He does not give an account of the nature of beliefs, but his acceptability criterion calls on operations on beliefs and sets of beliefs, as Ramsey requires a system of general beliefs and knowledge with which the conditional under evaluation interacts.

4.6   Chapter summary

In this chapter I have briefly discussed the main approaches to conditionals that contemporary literature offers. I have tried to highlight the main features of each of them, as far as it was needed for a comparison with Ramsey's accounts. Unfortunately, my analysis cannot investigate further the

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[61]The revision operations are many. Earlier I mentioned two of them which are, perhaps, the most fundamental: contraction (i.e. delete a belief from our set of belief) and expansion (i.e. add a new belief to our set of beliefs).

[62]Recall also the passage from Slater (2004, p.432) I quoted at the beginning of this chapter about Ramsey's footnote: «if the question was turned into one about what followed from 'certain laws and hypotheses', it was not an adjustment or change of belief set which was needed, according to Ramsey».

similarities of these theories with the ones I proposed, because each comparison would require at least a chapter on its own.

The aim of this chapter was to show how the two theories of ch.3 can compete with contemporary accounts of conditionals. Indeed, the controversial inferences that are blocked in the more attractive alternative to material implication, are invalidated also in my solutions. But these latter also show how contemporary studies can be improved by Ramsey's notions and fine analysis, pointing at some aspect sometimes overlooked in conditional theories.

The chapter stresses how much many contemporary accounts are indebted to Ramsey's work. Nonetheless, many misinterpretations of Ramsey's ideas on conditionals have been promoted, even in theories that were trying to stick to Ramsey's work as much as possible. All the theories discussed here were primarily engaged to develop a theory that could handle conditional sentences in natural language, and not to investigate Ramsey's view. However, I think it is incorrect, in any case, even if we are not mainly interested in historical investigations, to prompt inaccurate interpretations of historical figures' works. I have tried, with this chapter and my whole work, to restore Ramsey's original thought and to develop it into a contemporary account, that reflects as much as possible what I take Ramsey's intentions to be.

We have seen that there are many similarities between famous accounts of conditionals and Ramsey. While the additional premises theories are very similar for the general idea that a conditional sentence does not express the total information that connect the antecedent with the consequent, more recent theories share with Ramsey some formal tools (like conditional probability) or some results (valid and invalid inferences). In general, I think the additional premises accounts reflect more closely Ramsey's ideas. This is because they stress the importance of additional information[63] and the role laws endorsed by a subject play in accepting or rejecting a conditional. This is peculiar of this type of theories, although laws are usually added directly to the antecedent among the additional information, as we have seen. Nonetheless, the idea that the conditional is accepted only if it is an instance

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[63]Of course, additional information play a role also in possible worlds semantics – the propositions that are true in the closest world(s) – and in Adams' theory – conditional degrees of belief are somehow determined by other degrees of belief.

of a law endorsed has this relevance solely in this group of theories.

This chapter shows that the two accounts I presented in the previous chapter are valid competitors of contemporary theories. They both establish acceptance and validity criteria, determining what inferences are valid or not. I think they do even more: they both stress the importance of the two contexts that are essential to the evaluation of conditional sentences, by accounting for them: the conversational context and the belief context. Furthermore, contrary to the majority of theories here discussed, both my accounts set within a developed epistemology and, more importantly for what strictly concerns conditionals, they can both make use of a structured account of laws and general propositions.

Conclusion

This work shows that Ramsey has indeed the clear idea that very often material implication could not exhaust the meaning of everyday conditional sentences. But it also shows that he does not question the legitimacy of material implication for determining the truth of a conditional sentence. Ramsey simply points out that the classical tool is not apt to capture the information a speaker conveys in asserting a conditional. However, he does not have in mind an alternative logical system to classical logic in order to handle conditionals, as his use of the horseshoe even for counterfactuals attest. His arguments on conditionals are not thought to belong properly to the logical discussion. Ramsey's approach to probability theory reflects in his approach to conditionals: an interpretation of a phenomenon (e.g. conditionals or physical events) does not exclude another possible one. The type of analysis and the tools employed depend on the goal we want to reach. As for investigations in physics the frequentist interpretation of probability is the correct one[64], for abstract investigation on abstract thinking material conditional seems to work correctly. To a certain extent, the different tools for conditionals connects to the distinction that Ramsey proposes in TP between the logic of consistency (deductive logic) and human logic, the logic of truth (inductive logic). Material implication works for the logic of consistency; but accepted conditionals are instances of variable hypotheticals endorsed, which are, in turn, reliable habits translated into rules for judging, and habits are evaluated according to their success to lead to true beliefs and successful actions (induction on past experiences). What conditionals are accepted strictly depend on induction and and a question that belongs to human logic. Hence we can say that if we are interested in consistency of formal systems, we can look at material implication. In this sense, Ramsey

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[64]See TP and ch.1 here.

says that «the most generally accepted parts of logic, namely formal logic, mathematics and the calculus of probabilities, are all concerned simply to ensure that our beliefs are not self contradictory» (TP, p.191). But we may want «our beliefs to be consistent not merely with one another but also with the facts» although «there are mathematical propositions whose truth and falsity cannot as yet be decided. Yet, it may humanly speaking be right to entertain a certain degree of belief in them on inductive or other grounds» (TP, p.191). The point is that it is frequency of past successful experience (that might be direct or indirect) that defines the variable hypotheticals a person endorses, hence the conditional she/he is willing to accept. The subject might recognise a conditional true for the laws of classical logic, yet he does not accept it. This is what very often happens with counterfactuals.

This research also proves that, contrary to what is commonly believed in the literature on conditionals, Ramsey has an account of counterfactuals. Furthermore, the analysis of his texts and the interpretation of them I have given here suggest that Ramsey's famous footnote should not be read as a test for the evaluation of conditionals, but as a description of the process of decision on the acceptability of a conditional sentence. New evidences (like the note MHP) support the idea that the meaning of conditional probability does not capture *all* indicative conditionals, but it essentially depends on a condition of incertitude (about the truth value of the material implication).

This complexity of Ramsey's account, that layers different analyses unified by the general epistemological framework, delivers us three important philosophical lessons. The first is that more than one account can coexist within the same theory of conditionals. As Ramsey shows, they can be two aspects of the same phenomenon, moreover, one can even determine, to a certain extent the other[65]. Second, it highlights the necessity of a theory of belief and knowledge in order to better understand the usage and meaning of conditional sentences. Third, it stresses the relevance context has in the evaluation of conditionals.

The idea that a context is necessary in order to evaluate conditionals underlines another feature often missing in contemporary theories of conditionals, as I have argued in ch.4. Whether the context is conversational, identified by the beliefs an agent has, or both, there must be a tool to represent it and that allows it to play a role in the evaluation of a conditional.

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[65]Like material implication and conditional probability or inferential analysis.

Regarding this, both my approach lay down two possible way context can be implemented and used, also to assess the validity of inferences with conditionals.

On the same lines, I reckon that Ramsey's version of Stalnaker's semantics is an improvement towards more precise characterisation of the information needed for the evaluation of a conditional. For instance, Ramsey's limitations on r, the additional information, can define possible worlds, in the sense that they specify what type of propositions constitutes the epistemically accessible worlds where the conditional can be evaluated. Variable hypotheticals, on the other side, can be used to determine the closeness of worlds – if you differ from D. Lewis in believing that laws and generalisations do not have a primary role compared to other beliefs. Worlds where the variable hypotheticals endorsed by the subject hold are closer to the actual one than worlds where those variable hypotheticals do not hold.

I have here recovered Ramsey's account of conditionals and tried to update it into a unified contemporary account. However, there is still much work to do, in many different possible directions. For instance, it would be interesting to try to develop a formal system that reflects the acceptability and validity criteria of my theoretical approach, selecting the axioms and checking what other inferences are valid. This would also be useful to see more similarities and differences between this proposal and other contemporary theories. I believe that the system obtained would be very similar to possible world semantics, but I do not know to what extent – recall that all the validities of my account are valid also in Stalnaker and Lewis, except for CEM.

Another compelling open question is how the notion of variable hypothetical could be effectively implemented into Stalnaker's semantics and what this would cause. I have said in the last chapter that Lewis argues that laws can easily implemented in his system, obtaining an equivalent system to his own. However, Lewis is thinking of additional premises accounts, where laws are among the propositions added to the antecedent to infer the consequent. We known that in Ramsey this is not the case, the relevant variable hypotheticals are those the conditional is an instance of. It would be interesting to see whether this would make any difference in the formalisation and implementation of variable hypotheticals.

Variable hypotheticals on their own would be worth investigating, from a

purely historical perspective, for understanding by whom Ramsey has been influenced (for instance, a comparison with Weyl's conception of general propositions) and who he has directly or indirectly influenced in turn (e.g. variable hypotheticals in general philosophy of science, compared, for instance, to Hempel's laws in his account of scientific explanation). Moreover, a deeper research on induction, variable hypotheticals and habits, also compared to scholars like Peirce and Hume, would be intriguing.

Another possible direction of study would be belief revision theory: investigating what role, if any, variable hypotheticals could play in determining the correct revision or in explaining why an agent revise her beliefs in a certain way and accepts (or rejects) certain beliefs instead of others. Moreover, understanding whether a modified version of the Ramsey test – and its consequences, like a possible rejection of monotonicity – could stop the triviality result; or whether, instead, the Ramsey test characterises a very specific type of revision and not the general pattern.

Finally, since Ramsey considers and offers an explanation of disagreement between two people, it would be appealing to try to extend his analysis and his account of conditionals with the acceptability criterion to group of people, to social epistemology. Indeed, disagreement is one of the key interactions among people and Ramsey's idea of variable hypotheticals and additional information needed for the evaluation of conditionals could perhaps offer a model also for explaining decisions and acceptability of propositions by groups of people.

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