THE REASONER

CONTENTS

EDITORIAL

It is with great pleasure that I introduce this issue of The Reasoner which features my interview with Philip Jonhson-Laird. A renowned expert of the psychology of reasoning, Fellow of the British Academy and of the Royal Society, Philip is Emeritus Professor at the Department of Psychology, Princeton University and Visiting Professor at the Department of Psychology at NYU. Many readers of The Reasoner will at some point have come across his 1983 book *Mental Models: Toward a Cognitive Science of Language, Inference and Consciousness*. I can imagine how impatient they are to know how it all begun, so without further ado I leave you with the interview, not before thanking very warmly Phil for his time and enthusiasm.

HYKEL HOSNI
University of Milan

FEATURES

Interview with Philip Jonhson-Laird

HH: Can you tell our readers what led you to study psychology?

At school, my passion was music, and one puzzle perplexed me: what makes chords dissonant? My father and grandfather had both been professional musicians. But, I left school at the age of 15, worked for five years as a quantity surveyor (don't ask!).

HH: OK, I won't . . .

As followers of Bertrand Russell's Committee of 100, my wife Mo and I were convicted for blocking the traffic down Whitehall, along with a couple of hundred others as a protest against the UK having nuclear weapons. For the same reason, I refused to do my military service, and had to work as a hospital porter. The need for an interesting job became urgent, and an obvious path was to go to University. What to study? Something leading to a stimulating career, and something for which I didn't need science exams at A-level, because I had to study on my own. After some research, I chose to study psychology – perhaps one of the few rational decisions I ever made, because one could do a BA in the subject, and it promised all sorts of jobs that looked appealing, from ergonomics to psychoanalysis.

HH: How did you become interested in reasoning?

One of my A-level subjects was logic, which I passed from reading Cohen and Nagel's excellent textbook. It treated quantifiers in a simple set-theoretic way. At University College London, one intellectual influence was A.R. Jonckheere, who worked every summer with Piaget in Geneva, and who remarked one day that the task for psychologists was to discover which logic was in the mind and how it was formulated there. Another influence was Peter Wason, who had been at the Harvard Center for Cognitive Studies, co-founded by Jerry Bruner and George A. Miller, where Chomsky's ideas had inspired the renewed study of psycholinguistics. In logic, my subsidiary subject, the lecturers were Bernard Williams, the brilliant moral philosopher, and A.H. Basson, for advanced logic. Basson lectured without notes, and gave his lecture on the deduction theorem two weeks in a row – he was twenty minutes into it before we, the handful of students in the audience, realized his mistake. No-one said anything. John Downing was my devastating but friendly tutor, to whom I read my essays on causality and other topics.

HH: You mentioned Peter Wason . . .

PJ-L: Yes indeed. Wason became my PhD adviser, and it took me years to understand the originality of his genius. But, he kindly ushered me through my thesis in two years. After my oral exam, an examiner remarked, "Now, you can do some real research". It was 1967, there were plenty of academic jobs, and so – without ever having aimed for it, I became a lecturer in psychology. My brother, Andy, became a computer programmer for a company that manufactured mainframes – the only sort of computer that existed then, and together we wrote a program that simulated rats running in a T-maze. But, what provoked my quest to understand reasoning was Wason's now well-known "selection" task.

HH: Can you brief our readers on the problem?

PJ-L: Four cards are put in front of you, such as A, B, 2, and 3, and you know that each of them has a number on one side and a letter on the other side. Your task is to select just those cards, which if turned over, would reveal the truth or falsity of the hypothesis, *If a card has an A on one side then it has a 2 on the other side*. Wason had made the striking discovery that most people failed to select the 3 card; yet, the combination of A and 3 refuted the hypothesis. This finding piqued my interest.

HH: Where did the research on the selection task lead?

PJ-L: The neglect of a putative piece of falsifying evidence (the 3 card) led philosophers, such as L.J. Cohen, to criticize the task in defence of human rationality. Wason and I got a three-year grant to study why people erred. We discovered two main phenomena. First, a change in contents led people to make more rational selections. As Paolo and Maria Legrenzi showed, they did very well with a deontic postal regulation. Second, if individuals had a chance to find out the consequences of their selections in a repeated version of the task, just about all of them soon started to make rational selections. I devised an algorithm to explain people's selections – it was perhaps the first "dual" process theory of reasoning, in which intuitions led to a focus on examples of a hypothesis whereas deliberations shifted the focus to counterexamples. As you may know, psychology is plagued by failures to replicate results. But, over fourteen thousand people have carried out the selection task, and its results are robust. My three years of living with the task lasted me for a lifetime – at least until last year, when my colleagues Marco Ragni and Ilir Kola showed that the dual-process algorithm gave an almost optimal fit to the results.

HH: You also did research on lexical semantics with George Miller, can you tell us briefly about it?

PJ-L: Miller invited me to visit the Institute for Advanced Study in Princeton. My Ph.D. has been on psycholinguistics, he had just completed a study of verbs of motion, and so we began a paper on the meanings of words. The paper morphed into a book. What it argued was that the meanings of words cannot be reduced to purely perceptual predicates (pace Carnap), that the mental lexicon is based on semantic fields often founded on a single semantic primitive, and that various other concepts, such as space, time, possibility, and intention, occur in many different semantic fields. The core concept of ownership, for example, cannot be reduced to perceptions, because it has a moral component (as Locke had argued). The concept of causation, which we reduced to sets of possibilities, occurs in all semantic fields. (Sunny Khemlani, Cristina Quelhas, and I are now pursuing the idea that possibilities underlie, not just causality, but all reasoning.) The weakness of the book was that we never implemented its theory computationally. After five years' work on it, we had neither energy to do so nor access to a computer. There were none at the Institute in the early 1970s.

HH: I guess most of our readers will readily associate you with "mental models". Can you tell us how it all begun?

PJ-L: Not long after my return from Princeton, Stuart Sutherland persuaded me to move to Sussex University. The work with Miller had suggested that when individuals understood an assertion, they constructed a model of the situation to which it referred. Likewise, studies of syllogistic reasoning, with Janellen Huttenlocher, implied that they reasoned from models akin to the set-theoretic ideas in Cohen and Nagel's text. I had read Kenneth Craik's remarkable book, *The Nature of Explanation*, in which he talked of people constructing small-scale models of the world in order to make sensible decisions. But, Craik had argued that reasoning depends on verbal rules. Indeed, psychologists at that time accepted the view, as presaged in Jonckheere's remark above that reasoning depends on formal rules of inference akin to those of logic. My experience with the selection task made me skeptical. It would be a singular coincidence if the vagaries of human reasoning were based on the predicate calculus. So, with Mark Steedman's help, I learned my first list-processing language, POP-2, and wrote a program that used models in order to draw its own conclusions from syllogistic premises. Once again, it accounted both for the systematic errors that individuals made and, with a search for counterexamples, for their valid conclusions. Very few people can make a correct inference from premises such as:

○ None of the painters is a cubist.

○ All of the cubists are sculptors.

Some people infer that none of the painters is a sculptor, some infer its converse; some infer that some of the painters are not sculptors, and some infer that nothing follows from the premises. A valid inference, however, is:
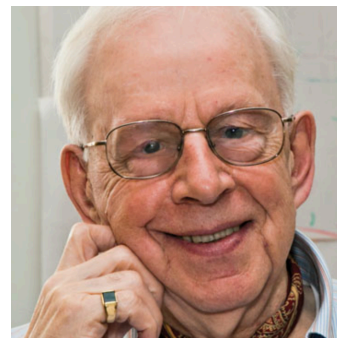
○ At least some of the sculptors are not painters.

HH: What happened next?

PJ-L: The Social Science Research Council – Mrs. Thatcher later insisted that it dropped "science" from its title, and so it's now known as the Economic and Social Research Council – gave me a grant that paid my salary for two years. It enabled me to write a book, *Mental Models*, which brought together models as representations of discourse and models as underlying reasoning. It was well received except by proponents of logic as the basis of human deductions. Even Chomsky quite liked it, apart from its use of phrase-structure grammars of the sort that Stan Peters and Gerald Gazdar advocated, and of the compositionality of meanings à la Montague. The big hole in the book was a plausible account of sentential reasoning. When Thatcher cut the funding of universities – and Sussex by 20%, I found myself writing a personal cheque to pay for animal feed for the Lab. I needed to escape, and an opening came up at the MRC Applied Psychology Unit in Cambridge. (Thanks to Alan Baddeley!) Ruth Byrne came to work with me there, and together we filled the hole in the theory, showing how models could represent conditionals and disjunctions in a way that accounted for robust results.

HH: In what ways are mental models incompatible with logic?

PJ-L: You can make them compatible with logic (as Philipp Koralus has done). But, there are many ways in which everyday reasoning diverges from logic. In logic, infinitely many different conclusions follow validly from any set of premises; people often assert that "nothing follows". In logic, any conclusion whatsoever follows from a contradiction. My favorite example is Russell's riposte to a person who said, "Well, if so, prove from 1 + 1 = 1 that I am the Pope." Russell replied at once: "You are one, and the Pope is one, but one plus one equals one, so you and the Pope are one." Of course, that isn't the real reason, *ma se non e vero è ben trovato*.

HH: Classical truth-functionality is often another issue . . .

PJ-L: Indeed! The truth-functional account of compound assertions doesn't work, either. Consider the inference:

○ It is not the case that if the Christian God exists then atheism is correct.

○ Therefore, the Christian God exists.

The premise is true and, given that its embedded conditional is a material implication, the inference is valid, and so its conclusion is true too. A short sound proof that God exists! In modal logics, the notion of "possibility" differs from its everyday sense. Most people infer, as Marco Ragni has shown:

○ It's possible that Trump will be impeached.

○ So, it's possible that he won't be.

The inference is invalid in modal logics.

HH: Of course. So, what would you say to either classical or non-classical logicians to convince them that mental models are on the right lines?

PJ-L: Suppose that only one of these three premises is true:

○ Pence or Pompeo, or both of them leaked.

○ Pence or Sessions, or both of them leaked.

○ Kushner leaked.

Does it follow that Pence could have leaked? Logicians should say, "No". So, why, then, do most people say, "Yes"? Mental models predict the answer, and a computer program implementing the theory led to the discovery of these illusory inferences. Mental models represent only what's true, and so people envisage what holds if the first premise is true, what holds if the second premise is true, and what holds if the third premise is true. In two of these cases Pence is potential leaker. So, that's why people think he could have leaked.

HH: On behalf of non-logicians, what's wrong with that?

PJ-L: Only one premise is true. So, if the first premise is true then the other two premises are false, and the falsity of the second premise implies that neither Pence nor Sessions leaked. If the second premise is true then the other two premises are false, and the falsity of the first premise implies that neither Pence nor Pompeo leaked. If the third premise is true, then the other two premises are true, so neither Pence nor Sessions nor Pompeo leaked. So, in any case, the leaker can't be Pence. Didn't you know that he was an Eagle scout, and scouts are trustworthy?

HH: One fallacy doesn't make a theory, though, does it?

PJ-L: No, but such illusory inferences occur in all the main domains of reasoning. Here's another sort that concerns blood relatives:

○ Ann is related to Beth.

○ Beth is related to Chuck.

○ Is Ann related to Chuck?

As Geoff Goodwin showed, most people say, "yes". They think of siblings or descendants, and overlook a counterexample: Ann and Chuck are Beth's parents.

HH: Does the theory apply to reasoning other than deductions?

PJ-L: Yes. For instance, it explains how individuals induce informal algorithms that are recursive. As Monica Bucciarelli, Robert Mackiewicz, and Sunny Khemlani have shown, it applies to algorithms – containing while-loops – that 10 year-old children formulate for rearranging the order of the cars in a train of arbitrary length. It is on a railway track equivalent to an automaton with two stacks. The kids are not allowed to touch the cars: as their gestures corroborate, they use a kinematic mental model to simulate the sequence of moves.

HH: How about probabilistic reasoning?

PJ-L: The idea that probabilities enter into reasoning is quite popular at the moment: theorists want to replace logic with the probability calculus to account for reasoning. I'm skeptical. People are unlikely to adduce probabilities in reasoning unless the task itself suggests that they do. Two pilots asked me to adjudicate a disagreement between them. They were arguing about the likelihood that both engines of a twin-engined plane failed. The pilot who flew jets in Vietnam said: double the probability of one engine failing, whereas the light-plane pilot said: halve it. In a spirit of compromise, I told them that they were both wrong. What this anecdote confirms is that people don't know how to calculate the probability of a conjunction of two events. The model theory predicts that when the two probabilities differ they take the average. Sunny Khemlani and Max Lotstein corroborated this procedure, and similar ones for disjunctions and conditional probabilities. We are all duffers

about probabilities until we have mastered the calculus, and most of us remain so afterwards. You're not a duffer, if you can answer this question: what three probabilities fix the complete joint probability distribution for two events, and no matter what numerical values you guess for them, its sum is always 100%?

HH: Did you ever research anything other than human reasoning?

PJ-L: Oh, yes. When my weekday job was quantity surveyor, my weekend job was jazz pianist. That experience helped me many years later to develop an algorithmic theory of creativity, and to model it in a program that improvizes jazz. What makes chords dissonant turned out to be the oldest problem in cognitive science: Pythagoras circa 500BCE proposed a geometric explanation. My solution only took fifty years to formulate. My friend Keith Oatley and I developed a theory of emotions, and we have published about a dozen papers on the topic. Emotions, we argue, are a cut-price version of rationality, evolving first in social mammals. They are a guide towards appropriate actions, and you can't control your feelings. Thanks to Plato many people think of emotions as inimical to reason. Mental illnesses (not psychoses) are emotional disorders. And their best treatment, so far, is cognitive therapy, which presupposes that their cause is faulty reasoning. But, Francesco Mancini and Amelia Gangemi, both cognitive therapists, have shown that patients with mental illnesses reason better than control participants, but only about matters pertaining to their illnesses. ... We seem to have arrived back at reasoning.

HH: Never mind, you're talking to the right audience! And since many readers have an interest in algorithmic reasoning, can you tell us why you think it's important to build computer models?

PJL: Psychology is infected by theories that take too much for granted. The flow of thought moves through a series of planes (Vygotsky). It depends on structural operations of centering (Wertheimer), and of equilibration, which is a compensation that annuls a transformation (Piaget). Such accounts seem little more than crutches on which these great psychologists lean in order to point the way. But, a theory expressed in a computer program ... well, it's not likely to be taking too much for granted. And, as in the discovery of illusory inferences, it may lead to unexpected consequences of a theory. The actual process of devising a program can even lead to ideas about how to test the theory. As Mark Steedman told me years ago: "You should do your own programming." The other day a reviewer in rejecting a paper of mine asked, "what's the point of the computer program?" So, my case for programming, which goes back to Mark's advice, has been about as effective as the case for abstinence as a method of contraception.

HH: A final question: any advice to students just starting their careers?

PJ-L: Three tips. There is no one right way to do research: people differ. Everyone gets papers rejected, so, unless you think the reviews were right, keep submitting until a journal accepts your latest effusion. My personal worst: six journals until acceptance. Only your research matters; so stop doing it if you don't enjoy it.

Conference Report: SOPhiA 2018, 12–15 September

The *9th Salzburg Conference for Young Analytic Philosophy* was held from the 12th till 15th September 2018 at the Department of Philosophy of the University of Salzburg, Austria. The conference brought together over 150 participants from 28 different countries to share and discuss their research in about 90 contributed talks, divided into 26 sessions, three plenary lectures, and five affiliated workshops. As such, the SOPhiA conference covered nearly all areas of analytic philosophy and was attended by a wide range of participants coming from different backgrounds and different areas of philosophy, unified by the idea that analytic methods can help to clarify philosophical problems.

On the occasion of the opening ceremony, the winner of the SOPhiA Best Paper Award was announced: Maximilian Fenner for the paper *Is the UN Charta a Global Constitution?* Afterwards, the first keynote by Helen Beebee (Manchester, UK) titled *Peer Disagreement and Philosophical Commitment* took place, in which Beebee defended a sceptic account of philosophical knowledge. She proposed that instead of aiming for 'truth', a more archivable aim for philosophy is an equilibrium of our own individual opinions. Under this view, instead of aiming for knowledge, philosophers aim to find out which equilibria can withstand closer examination, thus, aiming for a stable and comprehensive body of 'opinions'. Even if this project is revisionary, it is conservative on the first-order level: Philosophers can carry on as normal, although they should take a different attitude towards their own theories. On the same day, the first workshop *Der gegenwärtige Augenblick*, organized by Florian Fischer (Siegen) and Philipp Ritzen (Düsseldorf) took place, which brought together various historical perspectives on the concept of presence.

The second day of the conference featured the second keynote by Elisa Aaltola (University of Eastern Finland): *Moral Psychology and Animal Ethics*. Aaltola stressed the importance of empathy for ethics in general and for animal ethics in particular: If emotions are a necessary constituent of moral agency, purely rational animal ethics, which ignore emotions, are deemed to failure. Instead, Aaltola stressed the relevance of emotions in their influence on our moral decisions concerning animals. Especially reflective empathy can provide a fruitful start point, because it involves evaluation and first-order emotion concepts, but also includes second-level evaluation, making it the ideal choice to cultivate our emotions and allowing us to become better reasoning moral agents in our treatment of animals. After the keynote, three affiliated workshops took place: Popularizing Philosophy, organized by Frauke Albersmeier and Alexander Christian (Düsseldorf) brought together perspectives on the popularization of philosophy, from both a historic and a meta-philosophical account. *Didactics of Philosophy*, organized by Bettina Bussmann (Salzburg), ques-

tioned the foundations, aims, contents and methods of teaching and learning philosophy and their connection to metaphilosophical presuppositions as well as the rapid transformation of our lifeworld. The third workshop, *Bolzano and Contemporary Metaphysics*, organized by Stefan Roski (Hamburg), focussed on Bolzano's contributions to metaphysics and their relevance for contemporary debates.

On the third day, the final keynote lecture was given by Wolfgang Künne (Hamburg): *Literally or Figuratively? – Reflections on Bolzano's Philosophy of Religion and his Hermeneutics*, which was also 2018's Bolzano Lecture, organised in cooperation with the *International Bernard Bolzano Society*. Künne presented a detailed reconstruction of Bolzano's philosophy of religion, aiming to resolve the incompatibility between, on the one hand, Bolzano's claim that divine revelation always attempts to communicate something that is true and, on the other hand, his claim that many revealed doctrines represent their subject matter figuratively, that is not as it is but rather as it is most beneficial for us to think of it.

On 15th, the final affiliated workshop took place. Titled *Biological Individuality and other Issues in Contemporary Philosophy of Biology* and organized by Karim Baraghith (Düsseldorf) and Gregor Greslehner (Salzburg), it brought together leading experts and young researchers from the philosophy of biology and other areas of philosophy of science to discuss various issues from the philosophy of biology.

The conference was organized by Pascale Lötscher, Albert J.J. Anglberger, Christian J. Feldbacher-Escamilla, Alexander Gebharter, Laurenz Hudetz, Sebastian Krempelmeier, Gregor Greslehner, Markus Hierl, Stefanie Orter, and Sebastian Sattlecker. The SOPhiA conference covers a vast number of different topics from analytic philosophy; allowing participants to encounter interesting and thoughtful ideas in contributed talks, plenary lectures, discussions in and after the sessions and the workshops. Thus, many thanks to the conference organizers, all speakers and chairs, to the workshop organizers, participants and, finally, to all sponsors: KRITERION – Journal of Philosophy, mentis, Land Salzburg, Stadt Salzburg, Metzler, DCLPS, Springer, and the University of Salzburg, without whom such a great and free of charge conference for young analytic philosophers would certainly not have been possible.

PAUL HASSELKUSS
Heinrich Heine University Düsseldorf

Practice-based Approaches in Science, Mathematics, and Logic: Challenges and Prospects, Brussels, 28–29 September

The conference *Practice-based Approaches in Science, Mathematics, and Logic: Challenges and Prospects* was held at the University Foundation in Brussels by the Centre for Logic and Philosophy of Science (CLPS) of the Vrije Universiteit Brussel (VUB) with support from the Research Foundation Flanders (FWO). The main organisers where Karen Francois (VUB), Bart Van Kerkhove (VUB), Steffen Ducheyne (VUB) and Patrick Allo (VUB).

The emerging discipline of the philosophy of mathematical practices aims to avoid idealised views about what mathematics is like by studying how mathematics is practised. The body of literature has now grown to an extend that allows for and requires a reflection upon its own theoretical perspective, methods and theoretical concepts. Recently, a practice-based approach has been proposed in the philosophy of logic. This approach is explicitly developed in close dialogue with the philosophy of mathematical practices. The theme of this international conference was the commonalities and dissimilarities between mathematical, logical and scientific practices, on the one hand, and between the history and philosophy of scientific practices, the philosophy of mathematical practices, and the philosophy of logical practices, on the other.

The honorary guest of the conference was Jean Paul Van Bendegem (VUB) who was influential in bringing about a shift towards practice in the philosophy of mathematics, who was a founding member of the Association for the Philosophy of Mathematical Practice (APMP), who has founded and led the Centre for Logic and Philosophy of Science at the Vrije Universiteit Brussels which organised this event, and who became an emeritus professor the day after the conference.

There were three invited speakers at this conference. José Ferreirós (Seville) spoke about how the practice turn in philosophy of mathematics can lead to sociological or constructivist reductions. Ferreirós argued that, nevertheless, such reductions are not necessary. We reflect on mathematics as the product of the joint work of communities of human agents, rather than philosophize about some idealised mathematics, but this does not entail that this product cannot be affected by other factors than the social interaction among these agents.

Karine Chemla (Paris) focused on the place-value notations that one can find in Chinese sources where algorithms were executed on a material surface. In her presentation she discussed these specific traditions, that persisted along centuries, and demonstrated how the evidence suggests how a certain mathematical practice was shaped and how it produced new mathematical results and knowledge.

Sonja Smets (Amsterdam) presented a logical framework for analysing informational cascades, a phenomenon in which the rational behaviour of individual agents in a sequence of communications might prevent a group from tracking the truth. One of the main results she reported is that informational cascades in a group can be unavoidable even in situations where the agents engage in higher-order reflections with unbounded higher-order reasoning powers.

Ten contributed papers were presented. Brendan Larvor (Hatfield) spoke about *The material-ideal dyad of culture and the revolutionary materialism of practice studies*; Oliver Tatton-Brown (Bristol) on *Theses and antitheses*; Daniel Kuby (Konstanz) presented joint work with Carolin Antos (Konstanz) on *The practice of forcing in mathematical logic and its relevance to foundational issues* (cf. also their Forcing Project); Diderik Batens (Ghent) gave *A case study of logical practice: Local triviality*; Benjamin Martin (London) was *Using a practice-based approach to motivate logical abductivism*; Line Edslev Andersen (Aarhus) presented joint work with Brad Wray (Aarhus) on *Collective authors and authorship policies: What can we learn from retraction notices*?; Colin Rittberg (Brussels) asked *Case studies as evidence*?; Stef Frijters (Ghent) presented joint work with Kris Coolsaet (Ghent), Joke Meheus (Ghent) and Pawel Pawlowski (Ghent) on *A natural heuristic method for proofs in predicate logic and its implementation in a web-based tutoring tool*; Sofie Avery (Ghent) presented joint work with Kris Coolsaet (Ghent) and Joke Meheus (Ghent) on *Why schoolchildren should learn from machines: how to construct proofs*; and Pieter Present (Brussels) took

Steps towards an integrated history and philosophy of science education in practice. Between them, these talks reflected on a diverse range of theoretical, conceptual and methodological issues in the philosophies of mathematical, logical and scientific practices.

The concluding remarks were given by the honorary guest Jean Paul Van Bendegem, who reflected upon his personal history with and in the philosophy of mathematical practice movement.

Colin Rittberg
Sven Delarivière
Joachim Frans
Yacin Hamami
Vrije Universiteit Brussel

Calls for Papers

Knowing the Unknown: Philosophical Perspectives on Ignorance: special issue of *Synthese*, deadline 20 February.

Thought Experiments in the History of Philosophy of Science: special issue of *HOPOS*, deadline 31 March.

What's Hot in . . .

Medieval Reasoning

The St Andrews spring workshop on topics pertaining to medieval logic has become a yearly appointment not to be missed, if you are interested in such things. The upcoming workshop, scheduled for the 7th and the 8th of May 2019, will focus on the History of Arabic Logic and it looks like it's going to be a stimulating meeting, as usual. The call

for papers should be out soon, but in the meantime you can take a look at the workshop's description:

Since the last century, scholars have acknowledged the original and relevant contribution of medieval Arabic philosophers and thinkers to the development of medieval Western logic and, more generally, to the history of logic.

The study of logic in Arabic began with the translation project undertaken in the eighth century CE during the Umayyad era, and fostered by the Abbasid Caliphate, whose capital was Baghdad, to make the great works of Greek science, including those of Aristotle, accessible to the Arabic world. The study of Aristotle led in time to important and original creations by such figures as al-Farabi in the tenth century and Avicenna (Ibn Sina) in the eleventh, Fakhr al-Din al-Razi in the twelfth, and al-Tusi in the thirteenth. Avicenna, in particular, introduced novel ideas on the hypothetical syllogism, and on modal and temporal logic. A modified Avicennan logic took the place of Aristotelian logic in Arabic studies of the subject after his time.

Arabic logic had a strong but largely indirect influence on Latin medieval logic. Although translations of small parts of al-Ghazali's and Avicenna's logic (in a broad sense) were transmitted in Latin, the influence came mainly through translations of the Aristotelian commentaries of Averroes, who was working in Cordoba in Muslim Spain in the twelfth century, in close contact with Christendom.

The Workshop on History of Arabic Logic has two main aims: to make better known the richness and importance of Arabic logic, that is, logic developed and studied in Arabic-speaking lands from the 8th to the 15th centuries CE; and to provide a forum for interaction and discussion by scholars of Arabic logic.

Invited Speakers: Saloua Chatti (Tunis); Khaled El-Rouayheb (Harvard); Wilfrid Hodges (British Academy); Riccardo Strobino (Tufts).

If you are interested and think you can make it to St Andrews in the beginning of May to learn more about Arabic Logic – we all ought to! – you can contact the Workshop Organisers Stephen Read and Barbara Bartocci.

Graziana Ciola
UCLA

Uncertain Reasoning

Richard Pettigrew has been writing an interesting series of blog posts on the "dutch book theorem" over at the m-phi blog. The first of them is here. `http://m-phi.blogspot.com/2018/07/what-is-probabilism.html`
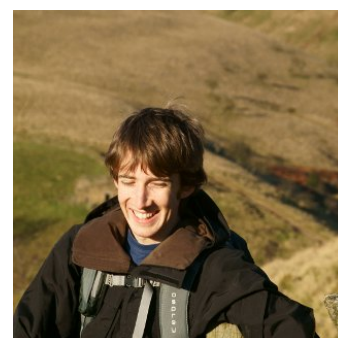
Before I go on to my main point, I want to say that I think it's maybe time we stop referring to the betting justification for probabilism as the "dutch book theorem" since this is, after all, a bit racist. English is full of phrases that implictly disparage England's historical rivals (most prominently the Dutch and the French) and this is quite clearly an example of that. It's hard to get an accurate picture of when this phrase – "dutch book" meaning set of bets that never win – came into the language, since the Netherlands was also the site of many early book publishers so searching old texts for "dutch book" on Google Books or Ngrams gets you lots of instances of people talking about actual books. According to this page on Peter Wakker's website (`https://personal.eur.nl/wakker/miscella/dutchbk.htm`) the term goes back to at least 1955, but not as far as Ramsey or de Finetti (although Ramsey does talk about "having a book made against you" meaning "to be subject to a sure loss").

In other respects philosophy is so careful to critique established practices that evince some sort of bias, but this seems to be something of a blind spot. Of course, the Dutch aren't a historically marginalised or oppressed group in the same way that for example women are, and thus we perhaps don't have

the same duty to remove anti-Dutch phrases as we do to remove sexist language from our vocabulary, but even so it seems strange that this obviously negative stereotype is allowed to live on in our professional lexicon.

Anyway, getting off the soapbox now. One of the things Pettigrew discusses in this first post is the fact that probabilism is typically seen as a condition that requires that your rational beliefs be bounded above by 1 and below by 0. Pettigrew thinks that this is mistaken and the correct formulation of probabilism only requires that your rational beliefs are bounded by some numbers that correspond to your credence in the necessary event and your credence in the impossible event. I had a discussion with Richard where I pointed out that if you think in the terms de Finetti originally used to discuss these topics, the more general version of probabilism is the natural one.

De Finetti starts by considering a space of gambles – functions from states to real numbers – and asks what rationality constraints should be placed on a rational agent's prevision: the function that represents the price at which she values the gamble. Given the constraint that the agent should want to avoid sure loss, the prevision is guaranteed to be additive. Probabilities enter the picture by considering indicator functions of propositions as gambles. That is, propositions are sets of states and the indicator function of A is a function from states to the set $\{0, 1\}$ that returns 1 if w is in A and 0 otherwise. A linear prevision, restricted to the domain of indicator functions of propositions over the states is a probability function. And this is where the 0-1 bounds enter the picture. Merely as a result of taking probabilities to be determined by the 0-1 indicator functions. Indeed, probabilities are basically secondary to these previsions.

This exchange got me thinking about the domain of probability functions. We're typically told that probability functions have as their domain an algebra of propositions. But in de Finetti's framework, that's very much secondary to the space of gambles over the states. In extensions of de Finetti's work to so-called "lower previsions" (Miranda, Enrique. "A survey of the theory of coherent lower previsions." International Journal of Approximate Reasoning 48.2 (2008): 628-658.) the presumption that we are dealing with the full space of gambles is dropped. That is, we no longer require any sort of algebraic structure on the space of gambles. (Although we are still interested in those lower previsions that can be extended to a coherent prevision on the space of all gambles).

One can instead take the "basic probability assignment" that assigns values to the states as the primitive, and take the values assigned to the propositions – the sets of states – as derivative (this is the sum of states in the proposition).

Yet other possibilities abound! For example, Paris (The Uncertain Reasoner's Companion, 1994, Cambridge University Press) defines probabilities over sentences in a logical language. Others define probabilities over random variables (one can think of gambles as real-valued random variables). Further afield people are exploring "probability-like" objects in more general algebraic contexts; belief functions on lattices, MV-algebras, categorical probability...

I don't really have any further point to make about this range of options for the domain of probability functions except to say "look: isn't this fun!". Perhaps I'll just end by saying that when engaging in uncertain reasoning – or theorising about uncertain reasoning – it's worth bearing in mind the breadth and depth of the formal machinery on offer, even within probability theory.

SEAMUS BRADLEY
Philosophy, University of Tilburg

Mathematical Philosophy

In the former Imperial Abbey of Irsee, the second International Rationality Summer Institute (IRSI2) took place. Secluded from the outside world, the summer institute brought together 19 instructors and 45 students who enjoyed a baroque learning environment. The IRSI series, funded by the Volkswagen foundation, aims to provide a highly international and interdisciplinary environment in which students can learn the state-of-the-art research on rationality. While IRSI1 was mainly concerned with individual rationality, IRSI2 shifted the focus towards collective rationality. A common theme of the courses was the relation between individual decision-making and collective decision-making.

Many courses revolved around the question whether there is a rational way to aggregate individual inputs (beliefs, preferences, votes, etc.) into a corresponding group output. Why would such a rational aggregation not be possible? Any democratic election seems to presuppose a rational procedure to aggregate the votes. In 1785, however, the Marquis de Condorcet observed a 'paradox' of voting: a rational choice might be impossible when transitioning from individual preferences to a group preference. Here is a story illustrating this failure of rationality.

As a consequence of the Napoleonic campaigns eastwards, the Abbey of Irsee was absorbed into the Electorate of Bavaria. The prince-elector of Bavaria became a member of the collegium that elected the Holy Roman Emperor. Upon decease of an Emperor, the 9 prince-electors chose the "King of the Romans". The Golden Bull of 1356 prescribed that the candidate, who obtains more than half of the votes, wins. This majority rule implies that 5 out of 9 votes suffice to elect a new King.

Let us suppose there are three candidates running for Emperor, from the Houses of Luxembourg (*L*), Habsburg (*H*), and Wittelsbach (*W*), respectively. Here is a summary of the prince-electors preferences that inform their choices:

1	1	3	4
L	*L*	*W*	*H*
H	*W*	*L*	*W*
W	*H*	*H*	*L*

Each column represents a ranking of preferences in which candidates in lower ranks are ranked lower. The numbers on top of each column stands for the number of voters having this particular preference ranking. Don Saari showed at IRSI2 how such tables can be represented by an equilateral triangle:
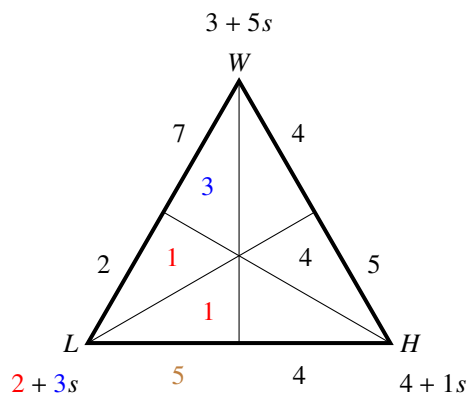
Each vertex represents a candidate. Any point in the triangle stands for a ranking, where topologically closer corresponds to more preferred. For example, the subtriangle with the number 4 in it is closest to the vertex H, next closest to W, and least closest to L. This means that 4 prince-electors have the ranking $H \succ W \succ L$. No single candidate receives the absolute majority of 5 out of 9 votes. So, who should be elected King?

Condorcet advocated a pairwise comparison of the candidates. King shall be the candidate that wins the most pairwise majority tallies against the others. $1 + 1 + 3 = 5$ voters prefer L over H, and 4 voters prefer H over L. In brief, $L \succ H$ with $5 : 4$. All other pairwise majority tallies can be read off similarly. The outcome is the cycle $W \succ L \succ H \succ W$. But this means that the pairwise majority rule does not determine who will be King. The aggregation rule made a rational choice impossible.

The cycle obtained by pairwise majority voting violates transitivity, which would imply: if $W \succ L$ and $L \succ H$, then $W \succ H$. The antecedent is satisfied, not the consequent. Hence, the group ranking is not transitive, even though each prince-elector's ranking is. Let us assume that a preference ranking is rational only if it is transitive. It follows that, even if each voter has transitive preferences, the aggregated group outcome need not be rational. As just observed, pairwise majority voting, a paradigm of democracy, may not have a determinate outcome at all. More generally, Kenneth Arrow proved that, under seemingly plausible assumptions, there is no voting procedure that rationally aggregates individual preferences into a group ranking. A strong interpretation of the theorem is that no voting method is fair, if there are more than two candidates.

Saari gave his original take on Arrow's theorem. Using his triangle representation, he showed that one of Arrow's assumptions (IIA) limits the information exploited by the voting rule. The individual rankings contain information about the positions of the candidates relative to each other. The assumption forces us to disregard this information. Saari uses the information already given in the individual rankings by modifying the assumption. This move allows him to consider positional voting rules, such as the Borda count, which brings us back to our matter of interest.

Which candidate best reflects the will of the prince-electors? On first sight, candidate H seems to be a good candidate: H is more often ranked first than any other candidate. The outcome of the plurality tally is $H \succ W \succ L$ with $4 : 3 : 2$. (Observe that the plurality vote corresponds to the terms at the vertices for $s = 0$.) However, H is also ranked last 4 times. So, H seems to divide the opinions of the prince-electors. The election of H would thus be a breaking test for the whole Empire. Maybe to prevent such danger, Nicolas Cusanus proposed in 1433 Borda

counting for the election of Holy Roman Emperors.

The normalized Borda count gives in our example the first-ranked candidate unit weight, the second-ranked candidate half weight, and the bottom-ranked candidate zero weight. (Observe that the normalized Borda count corresponds to the terms at the vertices for $s = \frac{1}{2}$.) This count results in the outcome $W \succ H \succ L$ with $5,5 : 4,5 : 3,5$. As compared to the plurality tally, the Borda count reverses the group ranking of H and W. Saari's triangle nicely illustrates this reversal: different voting rules use and neglect different information from the individual preference rankings. Depending on whether the plurality tally is used or the Borda count, the candidate H or the candidate W will become King, respectively. It does not seem obvious which candidate best reflects the will of the prince-electors. Nevertheless, there is a lesson to be learned: whoever decides on the voting rule can influence who becomes King.

In sum, Saari provided an elegant geometrical perspective on voting paradoxes, as well as on Arrow's and Amartya Sen's theorems. He went on to defend the Borda count against the criticism that it is susceptible to strategic voting. Saari's work directs attention from Arrow-inspired pessimism towards the possibilities of collective decision-making. Hopefully, this teaser conveys how insightful and how much fun his course was.

The courses and keynotes at IRSI2 were excellent. Many students gave catchy talks on their research which sparked engaging discussions throughout the days. There has been plenty of opportunities for professional and personal exchange with internationally leading experts in the field of rationality, including philosophers, psychologists, cognitive neuroscientists, and economists. The casual talks while enjoying an evening beer in the Abbey's cellar completed the IRSI2 experience. As I witnessed first hand, the IRSI series has far more than succeeded in meeting its goals. I would like to express my deep gratitude to the organizers of IRSI2 in Irsee. Thank you Jean Baccelli, Stephan Hartmann, and Reuben Stern!

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MARIO GÜNTHER
Munich Centre for Mathematical Philosophy

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Evidence-Based Medicine

The 'Journal of Evaluation in Clinical Practice' (JECP) 2018 Philosophy Thematic Edition was released this summer. The editorial for the issue notes that it is "the largest single edition of the JECP in it's 24 year history", including over 50 papers, reviews and reports on conferences. These papers are split into broad topics: *Science, Context and Value: Expanding Conceptions, Rethinking Categories*; *Rethinking Disease*; *Too Much Medicine*; *The Guidelines Challenge*; *Mechanisms in Medicine*; *GRADE*. For those interested, but who may be a little time poor at the start of this new academic year, the editorial gives a nice summary of each of the papers.

All topics and papers reflect "the attention being given across the board - by practitioners, guideline developers, systematic revierers, and philosophers - to the relationship between evidence, science, context, bias, truth, value, and methodology." All this with the aim to aid decision making - throughout the special issue there is a keen focus on relating philosophy to practical outcomes in health care. For example: in *Too Much Medicine*, contributors to a conference of the same name held at University of Oxford in April 2017 approach the issue of over-diagnosis from multiple philosophical perspectives; in

The Guidelines Challenge, work in the philosophy of causation is used to make suggestions for changes in how clinical guidelines are made.

Two sections fall into two areas of personal interest. *Mechanisms in Medicine* features papers from contributors to the mechanisms in medicine conference hosted at my own institution, University of Kent, in July 2017. Mechanisms are typically disregarded when making clinical decisions, but there is an increasing push for this view to change, led by work in the epistemology of medicine. *GRADE* features papers on the Grading of Recommendations, Assessment, Develpment and Evaluation (GRADE) framework for assessment of evidence from clinical research. GRADE has been a focus of a lot of my own PhD research, and it is good to see a whole section devoted to critical examinations of the GRADE framework. As the authors of the editorial note, "the GRADE framework has thus far received little in the way of philosophical scrutiny" despite being the framework by which evidence is assessed by organisations as important and varied as World Health Organisation (WHO), the UK's National Institute for Health and Care Excellence (NICE), and the USA's Agency for Healthcare Research and Quality (AHRQ). The papers included in this section apply the much needed conceptual and theoretical scrutiny that GRADE needs to overcome the theoretical and practical challenges it faces, of which there are many. Again, the theme running through these papers is using work in philosophy of medicine to improve clinical practice.

The editorial to the previous philosophy thematic issue noted that there has been a change in discussions of reasoning, evidence, and clinical decision making, where medicine itself is more open to the contributions philosophy can make to such discussions. Instead of being labelled 'un-scientific' it is recognised that key practical problems can only benefit from addressing the sort of questions being posed by philosophers of medicine. Anyone keen to see how this philosophy in practice works should take a look at the issue.

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D.J. AUKER-HOWLETT
Philosophy, Kent

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EVENTS

NOVEMBER

NAR: Norms and Reasons, University of Zurich, 1–3 November.

KBAP: Knowledge, Belief and Probability, University of Hamburg, 3–4 November.

LEM: Logic, Epistemology and Metaphysics Seminar, London, 6 November.

BD&ML: Statistics of Big Data and Machine Learning, Cardiff University, 6–8 November.

MODECON: Preference-based Modelling in Economics, London School of Economics, 10 November.

MIWAI: Multi-disciplinary International Conference on Artificial Intelligence Venue, Hanoi, Vietnam, 18–20 November.

PATS: Philosophy and Technologies for Simulation, Milan, 22–23 November.

BIP: Bayesian Inverse Problems, Edinburgh, 23 November.

NTIQF: New Topics in Quantum Foundations, University of Lausanne, 29–30 November.

DECEMBER

KEIMS: Conference on Knowledge Exchange in the Mathematical Sciences, Aston University, 3–4 December.

ML4H: Workshop on Machine Learning for Health, Montréal, Canada, 8 December.

RLPO: Reinforcement Learning Under Partial Observability, Montréal, Canada, 8 December.

W'SBAD: What's so Bad About Dialetheism?, Kyoto University, Japan, 15–17 December.

JANUARY

POMAL: Graduate Conference on the Philosophy of Mathematics and Logic, University of Cambridge, 19–20 January.

FISS: Foundations in Social Science—Mechanisms, Actions, Functions, University of Duisburg-Essen, Germany, 24–25 January.

COURSES AND PROGRAMMES

Courses

SSA: Summer School on Argumentation: Computational and Linguistic Perspectives on Argumentation, Warsaw, Poland, 6–10 September.

Programmes

APHIL: MA/PhD in Analytic Philosophy, University of Barcelona.

MASTER PROGRAMME: MA in Pure and Applied Logic, University of Barcelona.

DOCTORAL PROGRAMME IN PHILOSOPHY: Language, Mind and Practice, Department of Philosophy, University of Zurich, Switzerland.

DOCTORAL PROGRAMME IN PHILOSOPHY: Department of Philosophy, University of Milan, Italy.

LOGICS: Joint doctoral program on Logical Methods in Computer Science, TU Wien, TU Graz, and JKU Linz, Austria.

HPSM: MA in the History and Philosophy of Science and Medicine, Durham University.

MASTER PROGRAMME: in Statistics, University College Dublin.

LOPHISC: Master in Logic, Philosophy of Science and Epistemology, Pantheon-Sorbonne University (Paris 1) and Paris-Sorbonne University (Paris 4).

MASTER PROGRAMME: in Artificial Intelligence, Radboud University Nijmegen, the Netherlands.

MASTER PROGRAMME: Philosophy and Economics, Institute of Philosophy, University of Bayreuth.

MA IN COGNITIVE SCIENCE: School of Politics, International Studies and Philosophy, Queen's University Belfast.

MA IN LOGIC AND THE PHILOSOPHY OF MATHEMATICS: Department of Philosophy, University of Bristol.

MA PROGRAMMES: in Philosophy of Science, University of Leeds.

MA IN LOGIC AND PHILOSOPHY OF SCIENCE: Faculty of Philosophy, Philosophy of Science and Study of Religion, LMU Munich.

MA IN LOGIC AND THEORY OF SCIENCE: Department of Logic of the Eotvos Lorand University, Budapest, Hungary.

MA IN METAPHYSICS, LANGUAGE, AND MIND: Department of Philosophy, University of Liverpool.

MA in Mind, Brain and Learning: Westminster Institute of Education, Oxford Brookes University.

MA in Philosophy: by research, Tilburg University.

MA in Philosophy, Science and Society: TiLPS, Tilburg University.

MA in Philosophy of Biological and Cognitive Sciences: Department of Philosophy, University of Bristol.

MA in Rhetoric: School of Journalism, Media and Communication, University of Central Lancashire.

MA programmes: in Philosophy of Language and Linguistics, and Philosophy of Mind and Psychology, University of Birmingham.

MRes in Methods and Practices of Philosophical Research: Northern Institute of Philosophy, University of Aberdeen.

MSc in Applied Statistics: Department of Economics, Mathematics and Statistics, Birkbeck, University of London.

MSc in Applied Statistics and Datamining: School of Mathematics and Statistics, University of St Andrews.

MSc in Artificial Intelligence: Faculty of Engineering, University of Leeds.

MSc in Cognitive & Decision Sciences: Psychology, University College London.

MSc in Cognitive Systems: Language, Learning, and Reasoning, University of Potsdam.

MSc in Cognitive Science: University of Osnabrück, Germany.

MSc in Cognitive Psychology/Neuropsychology: School of Psychology, University of Kent.

MSc in Logic: Institute for Logic, Language and Computation, University of Amsterdam.

MSc in Mind, Language & Embodied Cognition: School of Philosophy, Psychology and Language Sciences, University of Edinburgh.

MSc in Philosophy of Science, Technology and Society: University of Twente, The Netherlands.

MRes in Cognitive Science and Humanities: Language, Communication and Organization: Institute for Logic, Cognition, Language, and Information, University of the Basque Country (Donostia San Sebastián).

Open Mind: International School of Advanced Studies in Cognitive Sciences, University of Bucharest.

Research Master in Philosophy and Economics: Erasmus University Rotterdam, The Netherlands.

Jobs and Studentships

Jobs

Postdoc: in Logic for Practical Reasoning, University of Milan, deadline: until filled.

Assistant Professor: in Epistemology, California State University at Sacramento, deadline: until filled.

Assistant Professor: in Logic & Epistemology, University of North Carolina at Greensboro, deadline: until filled.

Assistant Professor: in Philosophy of Medicine, University of North Carolina at Greensboro, deadline: until filled.

Assistant Professor: in Philosophy of Science, University of Florida, deadline: until filled.

Senior Lecturer: in Mathematical Statistics, Umeå University, deadline 16 November.

Professor: in Philosophy of Science, City University of New York, deadline 3 December.

Studentships

PhD position: in Epistemology and Realism, École Polytechnique Fédérale de Lausanne, Switzerland, deadline 15 November.

PhD position: in Theoretical Philosophy, University of Edinburgh, deadline 30 November.

Another night alone for Daniel Dennett.