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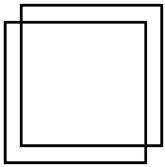

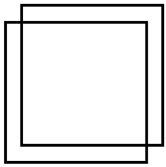

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Andrew Goodall, Jaroslav Nešetřil

Frank Plumpton Ramsey: Not to Scale

Institute for Theoretical
Computer Science (ITI)
Charles University

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(IUUK)

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Frank Plumpton Ramsey:
Not to Scale

GALLERIA
CHODBA

Exhibition 26 June – 10 November 2024
at Galleria Chodba,
MFF UK, Malostranské náměstí 2/25, Praha 1

Andrew Goodall and Jaroslav Nešetřil

Nor do In My picture of the
world is drawn in true perspective and
not like a map to scale.
The foreground is occupied by
human beings and the stars are
all as small as three pence bits.

Introduction

The life of Frank Plumpton Ramsey (1903-1930) is one of the most amazing stories in modern science. It seems that everything related to him was of great and lasting importance, particularly in his scientific life. The deeper one immerses oneself in his work, the greater the sense of his "sheer excess of powers" – to quote from the title of Cheryl Misak's recent biography of FPR. This sense of his superabundant capabilities is not just one that is felt retrospectively but was reported by many contemporaries of FPR such as the economist J.M. Keynes and the philosophers G.E. Moore and R. Braithwaite.

How did this feeling about FPR come about? Ramsey's brilliance was perceived early on by his family (FPR's father, Arthur, was a mathematician, and his mother, Agnes, a social activist) and his achievements at Winchester and at Cambridge as an undergraduate earned him early recognition, too. But FPR was not just a wunderkind: he had more up his sleeve. His capabilities would go on to make him stand out even in the highly intellectual milieu of 1920s Cambridge. As an

undergraduate he was at ease communicating with older and more established academics; indeed, he actively contributed to the development of their ideas – for example, in his discussions with Keynes arising from reading the latter's *Treatise on Probability*, published in 1921. (Ramsey wrote a review of the book, which appeared in *The Cambridge Magazine* in 1922; and later commented on Keynes' theory in his 1926 paper 'Truth and Probability.') In a mere seven years of activity, FPR made fundamental contributions to the three very different disciplines of economics, philosophy, and mathematics. But more is true; in these he did not just make contributions but created seminal work of lasting value. That FPR was able to write simultaneously on such diverse fields – analytic philosophy, theoretical economics, the foundations of logic, and combinatorial mathematics – in such a deep and penetrating way appears to be a unique phenomenon in modern history.

In each discipline, FPR seemed to have been attracted by very new developments reflecting aspects of modern life: pragmatism in philosophy,

probabilistic thinking, problems of truth and decision-making, and mathematical models in economics. In all these areas, he had few predecessors (in England or abroad) and his contributions are deeply original, difficult, and enduring. This we wanted to stress and to modestly illustrate in this exhibition.

But we would like to add another comment. Great science is the result of many factors difficult to isolate and formulate. But one of them is surely that of individual choice and the instinctive selection of a hard but fecund topic. It is our belief (and a point often raised by P. Erdős) that a particular, seemingly very concrete problem may lead to a wealth of new questions and indeed to a rich new theory of its own. But to isolate such a problem and to consider it in depth resides in the qualities and genius of the individual. FPR was attracted by the probabilistic reasoning of Keynes, which led him to subjective probability; equally, he was profoundly influenced by the understanding of truth in the work of Wittgenstein. FPR developed these ideas in several papers (by which he became a representative of the Cambridge school of

pragmatism), which remain points of reference to this day. He used his incisive mathematical technique (which lay behind his early recognition and intellectual "fame") to devise models for the macroeconomic problems of sustainable wealth and taxation. And in the timely crisis in the foundations of mathematics he was attracted early by Hilbert's Entscheidungsproblem, the tackling of which he probably viewed as a way out of the crisis. By trying to solve this hard (and far-reaching) problem, he devised what is now known as Ramsey's Theorem, a key result of modern combinatorics, logic, model theory, graph theory, discrete geometry, … to name just a few. Ramsey seems to be everywhere in modern mathematics. Thus indeed did it come to pass that Hilbert's difficult problem led to far-reaching theories: its partial (and in a way optimal) positive solution gave birth to Ramsey theory in its manifold forms, and the negative general solution due to Gödel, Turing and Church was the cradle of modern theoretical computer science.

Exhibition guide

We are glad to have had the opportunity to present an exhibition on the life and work of Frank Plumpton Ramsey, centred around photographs from the private collection of his grandson, Stephen Burch, and by his wife, Lettice Ramsey, from the collection of Peter Lofts. As well as the intrinsic interest of these photographs, our exhibition has several motivations. The main (and most obvious) one stems from the fact that FPR's work has been a constant and important impetus for mathematical work at the Faculty of Mathematics and Physics for many years, and, naturally curious about the man, we wanted to try to bring out the personality of FPR in more detail and complexity.

Another motivation is that FPR by his versatility and reported brilliance has been recently popularized in several books and articles. Called "the man who thought too fast" in a lengthy *New Yorker* piece, he is the subject of biographies by his sister Margaret Paul and, more recently, Canadian philosopher Cheryl Misak (covers of which are displayed in the title panel).

The deep impact of his thinking across the disciplines of mathematics, logic, philosophy and economics is evidenced by the various collections of his work that have been published over what is nearly a century since his untimely death, along with numerous articles by distinguished scientists developing particular strands of his work.

FPR came from a strong and distinguished family. His father Arthur was Fellow and lecturer in mathematics at Magdalene College, Cambridge, author of several mathematics and physics textbooks, and a pillar of college administration, finishing with a twenty-two-year run as vice-Master. FPR's mother Agnes, who studied modern history at Oxford, was socially active, agitating for progressive causes including women's rights, social welfare, and the furtherance of education. Her four children, of whom FPR was the eldest, were brought up to regard the Tories as "the stupid party." FPR's brother Michael went into the clergy, in 1961 becoming the Archbishop of Canterbury (the highest position in the Anglican Church). FPR was the intellectual star of this family, and he was actively supported by his parents during his

studies at Winchester and Cambridge University. The family home "Howfield" was one to which he was deeply attached. But FPR's life was to be unfortunately cut short: all he was given was 26 years! Soon after graduating, he married and became the father of two daughters. Photographic glimpses into his unhappily short happy life are seen in the panel **A brief life**.

FPR was a prodigy, communicating easily with much older and experienced people. His intellectual knowledge and activity were simply amazing from an early age. When he was just 18 he translated the key book of modern philosophy, Ludwig Wittgenstein's *Tractatus Logico-philosophicus*. How is such a thing possible? FPR was from the very start surrounded by intellectuals. Some of them, like Ogden, he was introduced to by his father; some of them, like Keynes, were drawn to him by his brilliance and quick thinking. The milieu of Cambridge was in this way a key factor and this we have tried to convey in the panels **Cambridge I** and **Cambridge II**. Cambridge clubs and societies, especially the Apostles and Heretics, helped propel FPR higher still into the intellectual

stratosphere. The secret (and secretive) Apostles was an elite club of undergraduates (numbering twelve when founded in 1820) which influenced FPR profoundly. He was elected in his first year as an undergraduate, and unfailingly attended its weekly meetings, reading several papers "from the hearth rug" and contributing vigorously to its discussions with the likes of Keynes, Russell, Moore, and Hardy. (After graduating, Apostles would become "Angels" and continue to be occasional visitors at meetings.)

Numerous Apostles were associated with the Bloomsbury Group, the loose-knit community of artists and intellectuals flourishing from 1905 to 1939 that grew out of meetings in the London district of Bloomsbury at the residence of Vanessa Bell, her brothers Thoby and Adrian Stephen, and her sister Virginia Woolf. As well as Keynes, Leonard Woolf, E. M. Forster, Lytton and James Strachey, and Roger Fry were all Apostles in their day and visiting Angels in FPR's time. The kinship between Bloomsbury and the Apostles was close:

Like the Apostles, Bloomsbury had no common ideas about art, literature, or politics. Like the Apostles,

Bloomsbury was united by friendship. Like the Apostles, nothing mattered to Bloomsbury so long as one was honest. Like the Apostles, Bloomsbury was engaged in a moral adventure. Like the Apostles, Bloomsbury saw through the humbug of family. Like the Apostles, Bloomsbury was marked by candid discussion in which high seriousness, gossip, gaiety, and argument were all mixed together. (W. C. Lubenow)

This intellectually very rich (one would like to say "super-rich") environment was a formative influence on FPR in both his social life and work.

The fact that FPR from a very early age was already an intellectual peer of the likes of Wittgenstein and Keynes, and publishing deep results in philosophy, economics and mathematics is simply unique in history. In a mere seven years of scientific life, he contributed significantly to these three very different disciplines – rather, it is fair to say, he contributed essentially. Through this exhibition we hope to convey something of the remarkable phenomenon that was Frank Plumpton Ramsey.

The four panels **Mathematics I, II , III** and **IV** may seem to be laying too much stress on the mathematical facet of FPR's work. However, this

facet seems sometimes to be slighted (when compared to his other work) or even overlooked, and thus we wanted to give a partial corrective. FPR clearly had a supreme mastery of mathematical technique. His two papers on economics clearly demonstrate this: his knowledge of calculus and overall mathematical level is simply excellent. FPR wrote just a single mathematical paper per se. This is the paper 'On a Problem of Formal Logic,' published posthumously in 1930 but read by FPR to the London Mathematical Society in 1928 (in the presence of Hardy, among others). The topic of the paper (of which we possess a rare original offprint, extracts of which are displayed in the panel **Mathematics I**) is important. It deals with the Entscheidungsproblem, which, while formulated as late as 1928 by Hilbert in his book with Ackermann, had clearly been circulating much earlier as there are published papers long predating this book related to the problem. Put simply, the problem asks whether there exists 'a procedure that allows us to decide, by means of finitely many operations, whether a given logical expression is universally valid or, alternatively,

satisfiable.' In the 1920s the Entscheidungsproblem (helped no doubt by Hilbert's authority) was regarded as the central problem not only in mathematical logic but in the whole of mathematics: it has been variously called the "philosophers stone", the "real heart of mathematics", and the "problem of solving all problems." Generally, in FPR's day one can say that the problem was believed to have a positive solution (particularly as there was at the time no formalization of a "procedure"). Hilbert himself repeatedly expressed this view (canonized by his well-known words: 'We must know. We will know.') FPR responded quickly: extending earlier work by Bernays and Schönfinkel, he proved that the validity of any formula with universal quantifiers stacked before all existential quantifiers can be decided by a particular procedure. In this he in fact reached the boundary as some thirty-five years later Trachtenbrot showed that for formulas with more alternations of quantifiers the Entscheidungsproblem is already undecidable.

The great work of Kurt Gödel, followed by that of Alan Turing and Alonzo Church, provided a

negative solution to the Entscheidungsproblem. Sometimes it has been said that modern computer science arose from the thrashes of the Hilbert problem. Well, this may be true, but the Entscheidungsproblem was a hard problem which motivated the leading figures in mathematics; in trying to solve it one had to devise results of great value. FPR while tackling this problem isolated a basic combinatorial principle now universally called Ramsey's theorem: For every colouring of the p-subsets of an infinite set by finitely many colours there exists an infinite subset with all its p-subsets having the same colour. (A p-set is just a set with p elements; the theorem is nontrivial even for $p = 2$). Thus FPR, in devising his solution to a difficult problem (the Entscheidungsproblem for an important class of formulas), isolated a very important result about homogeneous subconfigurations in any colouring of a very large system – this is the essence of Ramsey's theorem.

The importance of Ramsey's theorem is hard to overestimate, and this was immediately recognized by contemporaries (Thoralf Skolem, young Paul Erdős). In particular, the study of "Ramsey numbers" (how large a finite set needs

to be for any colouring of its p-subsets to always have a subset of given size k, all of whose p-subsets are the same colour) became a standard motivation of research not only in combinatorics but also in theoretical computer science. The panel **Mathematics II** reflects the surprisingly broad spectrum of early "Ramsey type" results (starting with, again, David Hilbert). The versatility of these results was instrumental in the development of Ramsey Theory some fifty years later, on which many books have been written. In the panel **Mathematics IV** we include only those publications whose title features FPR's name; virtually every book that deals with some combinatorial problems has a chapter on Ramsey's theorem. At the bottom of the panel, we list the names of key researchers studying various aspects of Ramsey theorem – a necessarily partial, continually growing list, which contains many important names of scientific endeavour today. Some of the highest awards in mathematics have been given for work in Ramsey Theory: two Fields Medals and two Abel Prizes.

As an example of the many international meetings devoted to Ramsey's theorem, we reproduce in

the panel **Mathematics III** the poster for our DocCourse on Ramsey Theory in 2016. This features a copy of FPR's paper 'On a Problem of Formal Logic' superimposed by writing in the hand of Paul Erdős, the longevity and profundity of whose work in Ramsey Theory certainly contributed to its enrichment and popularity.

FPR's proximity to Cambridge economists such as Keynes, Pigou and Dobb helped turn his attention to how mathematics could not only shape economic theory but affect economic practice; his papers 'A contribution to the theory of taxation' and 'A mathematical theory of saving' remain reference points in the field. More is said in the panel **Economics** on these papers, and on FPR's posthumously published paper 'Truth and probability.' This last paper is emblematic of his polyvalent thinking, a meld of mathematics, philosophy and economics. One must recall that in the early twentieth century probability was still being grappled with mathematically and philosophically, and quantum physics was muddying any clarity there might have been – the Copenhagen interpretation of quantum mechanics was being developed around 1925.

The axiomatization of probability came later in the context of topology and measure theory (Kolmogorov formulated what are now the standard probability axioms in 1933). FPR in his 'Truth and probability', and independently de Finetti in 1931, laid the foundation for modern decision theory by formalizing notions of subjective, Bayesian probability.

FPR is a figure of great stature in analytic philosophy and was recognized as such in his time. A year after completing his translation with Ogden of Wittgenstein's *Tractatus Logico-Philosophicus,* and just after completing his undergraduate studies, FPR went to Vienna for half a year, in part to visit Wittgenstein, at the time a primary school teacher in the nearby village of Puchberg, so they could discuss difficulties arising in the translation. He was influential, along with Keynes, in persuading Wittgenstein to return to philosophy and to Cambridge in 1929. Russell asked FPR to be the supervisor for Wittgenstein's doctoral thesis. Albeit over thirteen years his junior, FPR was among the very few who Wittgenstein took seriously. (The unaltered *Tractatus* was submitted

– after the defence, Wittgenstein consoled the examiners, Russell and Moore, 'Don't worry, I know you'll never understand it.')

FPR began much of his philosophical thinking out of the then unresolved "crisis in the foundations of mathematics," paradoxes such as Russell's antinomy springing up like mushrooms. The panel **Philosophy** describes work published in his lifetime; his posthumous reputation also rests greatly on his posthumously published work (a selection was first collected in 1931 by his friend and colleague Richard Braithewaite, and then almost sixty years later by Hugh Mellor) – this includes incisive forays into ontology, modal logic, subjective probability, causation, conditionals, laws and theories. The pragmatic turn his thinking took is recounted in Cheryl Misak's biography of FPR.

Finally, we return to the photographic inspiration for this exhibition. After FPR's death, his wife Lettice was left with their two young children and in need of a job. After just one term studying photography she went into partnership with Helen Muspratt, and, exploiting her social connections, quickly established Ramsey & Muspratt photography studio in Cambridge in

1932 (see the panel **Lettice Ramsey I**). Five years later Muspratt set up a parallel studio in Oxford, while Ramsey maintained the studio in Cambridge until her retirement in 1978. The final tenant, from 1980 to 1985, of the Post Office Terrace studio was Peter Lofts (the site was then redeveloped for other uses). Peter Lofts lodged most of the historical archive of the studio, dating back to 1867, with the Cambridge Collection at the Central Library: over 50,000 negatives have been catalogued and indexed. You can preview a generous selection of Ramsey & Muspratt portraits on Peter Lofts' website, and we were pleased to be able to reproduce several in this exhibition in the panels **Lettice Ramsey II** (uniting figures from C.P. Snow's "two cultures", and featuring a portrait of FPR's brother, Michael, who at the time of the photograph was Bishop of Durham) and **Lettice Ramsey III** (gathering together some of the Bloomsbury Group figures Lettice photographed in the studio or en plein air).

FPR's grandson, Stephen Burch, on his birding and dragonfly website includes a page on his grandparents, featuring several photographs of FPR and his family along with portraits taken by

Lettice. He has been most generous in providing us with images for print reproduction, and also offered to put us in touch with Anne Paul Jones, niece of FPR, who kindly provided us with the family group portrait on the panel **A brief life** (minus Michael, who one supposes must have been taking the photograph).

FPR was larger than life; he was a man whose life has had – and continues to have – an enormous impact out of scale with its brevity. In the words of one of the Bloomsberries, David 'Bunny' Garnett, "His chuckle was the chuckling of a god."

Acknowledgments

We are grateful to Stephen Burch and Anne Paul Jones for supplying us with photographs of FPR and his family from their private collections, and to Peter Lofts for photographs from the Ramsey & Muspratt collection. Other photographs and pictures are reproduced from publicly available online sources, including King's College Archives for several photographs of FPR as a child.

We are also grateful to UNCE, a joint project of Charles University's Faculty of Mathematics & Physics and Faculty of Arts.

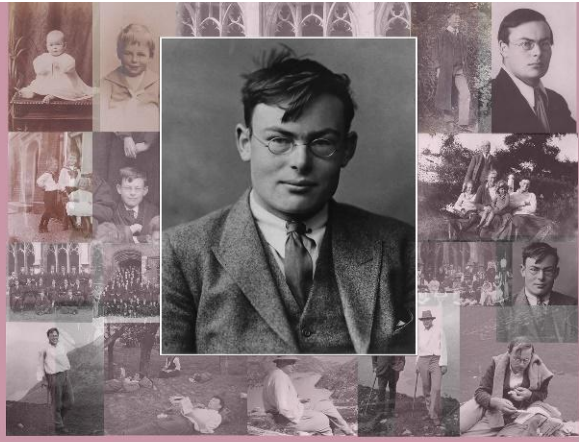
The text of the Economics panel was kindly supplied to us by Michal Čertík, while that of the Philosophy panel draws on Cheryl Misak's biography of FPR, Rob Trueman on the 'Foundations of Mathematics' and Peter Sullivan on 'Universals'. Captions in the Lettice I panel are adapted from Peter Lofts' webpage. The account of FPR's translation of Wittgenstein Tractatus is adapted from a passage in the biography of FPR by his sister, Margaret Paul. We further drew on the two biographies for information on FPR's academic and social life at Cambridge.

Extracts from Ramsey's manuscripts are reproduced from the University of Pittsburgh's Frank Plumpton Ramsey Papers digital collection. Facsimiles of original published papers, when not publicly available, are from sources made accessible through Charles University journal subscriptions.

Andrew Goodall

Jarik Nešetřil

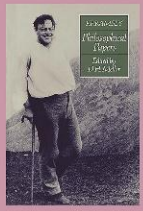
Catalogue

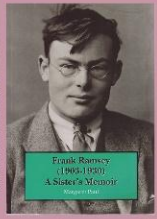


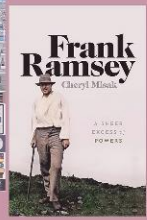
Frank Plumpton Ramsey

Not to Scale

"My picture of the world is drawn in perspective, and not like a model to scale."







A great mind of the 20th century

The man who thought too fast and ahead of his time

A rare combination of mathematical prowess and humanistic scholarship and excellence

Whatever he put his mind to - be it in logic, philosophy, economics or mathematics - he established definitive and profound results of lasting value

A brief life

1903	Frank Plumpton Ramsey born 22 February in Cambridge to Congregationalist and mathematician Arthur Ramsey, President of Magdalene College and socialist and suffragette Agnes Ramsey née Wilson. Three siblings Michael, Bridget and Margaret would follow (in 1904, 1907 and 1917, respectively).
1911-13	King's College School
1915-20	Winchester College
1916	Confirmed in the Church of England despite atheist tendencies
1920-23	Goes up to Trinity College to read Mathematics In his 1st year meets future wife, Lettice Baker (then in her 3rd year)
1921	Elected to the Cambridge Apostles
1923	Half a year in Vienna, where he undergoes psychoanalysis with Theodor Reik and visits Wittgenstein in nearby Puchberg
1924	Elected Fellow at King's College
1925	Marries Lettice Baker in London, in St. Pancras Registry Office
1926	University Lecturer in Mathematics and later Director of Studies in Mathematics at King's College Daughter Jane Elizabeth born in October
1927	Agnes, his mother, is killed in a car accident
1929	Daughter Sarah Ann Jala born in March Wittgenstein returns to Cambridge. Ramsey his nominal supervisor for a doctorate In November falls ill with flu and jaundice
1930	Dies 19 January in Guy's Hospital London, probably from hepatitis carried by water rats in the River Cam where he liked to swim. Buried in the Parish of the Ascension Burial Ground in Cambridge. His parents were buried in the same plot.


Frank Ramsey aged 8½ months (King's College Archives)

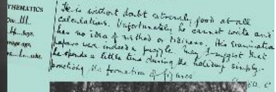

Frank Ramsey aged about 2 (King's College Archives)


Frank (centre) and his siblings, Howfield, 1910 (King's College Archives)


Frank as a Scholar of Winchester, c.1917 (King's College Archives)


Arthur Ramsey (standing), Bridget, Agnes holding Margaret, and Frank, at home c.1919 (private collection of Anne Paul Jones)


Mary Agnes Ramsey (Lettice Ramsey/ © Stephen Burch)


THEMATICS

He is without doubt extremely good at all calculations. Unfortunately he cannot write and has no idea of method or [illegible]. His examination papers were indeed a puzzle. May I suggest that he spends a little time during the holidays simply [illegible] the formation of figures


Frank with Irene Martin and Kingsley Martin in Bavaria, 1931 (Dorothy Wrinch papers (SxMs) University of Sussex Special Collections at The Keep)


Arthur and Frank, Buttermere Lake District, 1925 (Lettice Ramsey/ © Stephen Burch)


Lettice Baker c. 1925 (unidentified photographer/ © Stephen Burch)


Frank in the Austrian Tyrol, 1928 (Lettice Ramsey/ © Stephen Burch)


Frank on the peak of Buttermere Red Pike, the Lake District, 1925 (Lettice Ramsey/ © Stephen Burch)

The loss of Ramsey is, therefore, to his friends, for whom his personal qualities joined most harmoniously with his intellectual powers, one which it will take them long to forget. His bulky Johnsonian frame, his spontaneous gurgling laugh, the simplicity of his feelings and reactions, half-alarming sometimes and occasionally almost cruel in their directness and literalness, his honesty of mind and heart, his modesty, and the amazing, easy efficiency of the intellectual machine which ground away behind his wide temples and broad, smiling face, have been taken from us at the height of their excellence and before their harvest of work and life could be gathered in.

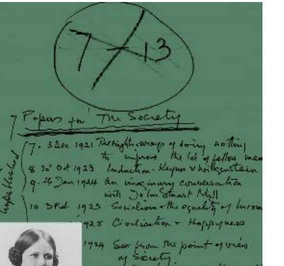
J. M. K.


Obituary, Nature, 125, pp. 245–246 (1930)


Lettice with daughters Jane and Sarah, 1933 (Helen Muspratt/ Bodleian Library)

Cambridge (I)
Heretics and Apostles

Upon Ramsey going up to Cambridge, C.K. Ogden suggested that he get himself into the left-leaning, anti-Church, Heretics Society, founded in 1909, of which Ogden was president: "The gist of heresy is free personal choice in act, and specially in thought – the rejection of traditional faiths and customs" (Jane Harrison, 'Heresy and Humanity,' 1909). It was at a Heretics meeting that Frank first met his wife-to-be Lettice, treasurer at the time. Between 1921 and 1927 the Heretics Society ran an economics section, which met in the house of the economist Philip Sargant Florence, brother of Alix Strachey. In his second year, Frank read a revised version of 'Mr. Cole's Social Theory', in which he argued for Guild Socialism.




Charles Kay Ogden, portrait by James Wood. Philosopher, linguist, psychologist, and editor, and key figure in inducting Ramsey into Cambridge (he was at Magdalene College, where Arthur Ramsey was President).


Standing, from left: Mary Sargant Florence, Philip Sargent Florence, Lella Secor Florence. Kneeling: James Strachey. Sitting: Alix Strachey. The two boys are Anthony and Noel Sargant Florence. Late 1920s.


Joan Maurice (Marshall Library of Economics, Cambridge). A frequent attender of the Heretics, and to become the famous left-wing economist under her married name Joan Robinson. Austin Robinson was Keynes's associate on The Economic Journal and attended Keynes's Political Economy Club to which only men were invited.

Ramsey was elected in his first year as an undergraduate to The Apostles, also known as the Conversazione Society, or simply 'The Society.' Members would meet each Saturday evening, often with former members ('Angels') such as Keynes or Russell in attendance. Other undergraduate brethren at Ramsey's time included F.L. (Peter) Lucas, W.H. (Sebastian) Sprott, Lionel Penrose, Richard Braithewaite, and, when Penrose left for Vienna 1922-3, George (Dadie) Rylands. Ramsey attended all but one of the meetings as an undergraduate, reading six papers (and continued to give papers when he became an angel).


The Apostles Society, 1932 (Lettice Ramsey/ © Peter Lofts). Left to right: Richard Llewellyn Davies, Hugh Sykes Davies, Alister Watson, Anthony Blunt, Julian Bell and Andrew Cohen.


Richard Braithwaite, 1932 (Lettice Ramsey/ © Peter Lofts, Stephen Burch). Proposed in early 1921 by Sprott as an 'embryo' (considered for election as an Apostle); later that same year Braithwaite proposed Ramsey for election, joining Alec and Lionel Penrose.


F.L. 'Peter' Lucas. Classical scholar, literary critic, poet, novelist, playwright and political polemicist. Fellow of King's College, and intelligence officer at Bletchley Park during the Second World War.


Lionel Penrose. Gained a first class degree in moral sciences before leaving for Vienna for a year to study at the psychological department at the University of Vienna. After the Second World War he became a central figure in British medical genetics.

Cambridge University Moral Sciences Club

Ramsey also gave papers at the Moral Sciences Club; for example in November 1926, Ramsey read 'The Idea of Probability' a precursor of the posthumously published paper 'Truth and Probability.' And he was involved with various other societies, such as the Cambridge Philosophical Society (where Ramsey met Pat Blackett, one of Rutherford's star young physicist, who was to become a close friend), Keynes's Political Economy Club (a venue for talent-spotting for *The Economic Journal*, in which Ramsey published two papers), and the Cambridge University Labour Club (in 1923 Braithwaite was treasurer, with Ramsey, Maurice Dobb and Kingsley Martin active members).


Dora Carrington, Stephen Tomlin, Walter John Herbert (Sebastian) Sprott, and Lytton Strachey, 1926 (Lady Ottoline Morrell)


Dadie Rylands, 1935 (Lettice Ramsey/ © Peter Lofts). Rylands taught an exceptional generation of Shakespearean actors how to speak. Gielgud, Olivier, Ashcroft, Redgrave – all owed their superb diction to him.


From left: Jimmy Doggart, Frances Marshall (later Partridge), Alec Penrose, Lytton Strachey, Frances Penrose and Dora Carrington, taking tea at Ham Spray in Wiltshire, c. 1928 (Ralph Partridge)


Pat Blackett, 1932 (Lettice Ramsey/© Peter Lofts, Stephen Burch). Ramsey would have known Pat Blackett from the Cambridge Philosophical Society and also through Kingsley Martin. A lifelong friend of Ramsey's, he would go on to win the Nobel Prize for his work on cloud chambers and cosmic rays.

Portrait of Kingsley Martin by David Low, 1932. Editor of the left-leaning political magazine *The New Statesman* from 1930 to 1960.


Opening page of Ramsey's paper 'The Nature of Propositions,' read to the Moral Sciences Club in November 1921.


Lytton Strachey (left), Dadie Rylands and Rosamond Lehmann taking tea at Ham Spray House, late 1920s (Frances Partridge)


Frances Partridge (née Marshall), c. 1931 (Lettice Ramsey/ © Peter Lofts, Stephen Burch). Contemporary of Lettice as an undergraduate, becoming a close friend, member of the Moral Sciences Club and in with the Bloomsbury set.

Cambridge (II)
"A great time for thinking"

Roger Fry, Trinity College Library, 1930

Cambridge in the 1920s was abuzz with activity; Ramsey would say at the end of his degree: 'We really live in a great time for thinking.' And academic sparring:

Victory was with those who could speak with the greatest appearance of clear, undoubting conviction and could best use the accents of infallibility. Moore . . . was a master of this method—greeting one's remarks with a gasp of incredulity—*Do you really think that*, an expression of face as if to hear such a thing said reduced him to a state of wonder verging on imbecility, with his mouth wide open and wagging his head in the negative so violently that his hair shook. *Oh!* He would say, goggling at you as if either you or he must be mad; and no reply was possible. Strachey's methods were different: grim silence as if such a dreadful observation was beyond comment and the less said about it the better, but almost as effective for disposing of what he called death-packets. Woolf was fairly good at indicating a negative, but he was better at producing the effect that was useless to argue with *him* than at crushing you.

(Keynes, 'My Early Beliefs', 1938)

I.A. (Ivor) Richards (Mark Kauffman/LIFE images)
Lecturer in English and moral sciences at Magdalene in 1922, from 1926 a university lecturer, and with Ogden promoter of Basic English.
Accomplished mountaineer - Ramsey went on adventurous hiking trips with him

Gerald Shove, portrait by Duncan Grant
Economist at King's College, lecturer from 1923, and Fellow from 1926.

Oliver Strachey, G.E. Moore, and J. M. Keynes, 1914 (Ray Strachey)
Moore was Fellow at Trinity from 1898 and Professor of Mental Philosophy and Logic from 1925 to 1939.

Duncan Grant, Portrait of Keynes, 1917

Roger Fry, Portrait of Keynes, c. 1917

John Maynard Keynes
Fellow at King's College from 1909. When Ramsey arrived in Cambridge, Keynes had recently returned after a stint working with the British government.

Piero Sraffa
Friend of Antonio Gramsci in fascist Italy. With Mussolini's increasing grip on power, brought to King's in 1927 by Keynes.

Bertrand Russell 1924 (Lady Ottoline Morrell)
Russell was reinstated to Trinity in 1919 after his imprisonment in Brixton, resigned in 1920, returned as Tarner Lecturer in 1926. From 1922 to 1927 the Russells divided their time between London and Cornwall.

Maurice Dobb (Lettice Ramsey/ © Peter Lofts)
Contemporary undergraduate of Ramsey at Pembroke College, and after gaining a PhD at LSE returned in 1925 to Cambridge as a university lecturer at Trinity. Influential Marxist economist.

J. E. McTaggart, portrait by Roger Fry, 1912
At Trinity since 1885, holding a college lectureship in Philosophy until 1923, and continuing to lecture until his death in 1925.

John Edensor Littlewood, 1932 (Walter Stoneman)
Fellow at Trinity and Rouse Ball Professor of Mathematics from 1928 to 1950.

Xu Zhimo
Research scholar at King's from 1920 to 1922. Modernist Chinese poet with a predilection for wei-chi (Go). Died a year after Ramsey in a plane crash.

Ludwig Wittgenstein, 1928/9 (Moriz Nähr/ Klimt Foundation, Vienna)
Portrait for the conferment of the Trinity College scholarship 1929.

Arthur Pigou (Cambridgeshire Collection, Cambridge Central Library)
Fellow at King's College since 1902 and Professor of Political Economy from 1908 to 1943. Ramsey had his rooms next to Pigou's at King's.

Charles Kay Ogden
Took Classics at Magdalene (1908), founder of the Heretics Society, the *Cambridge Magazine*, and monograph series e.g. *The International Library of Psychology, Philosophy and Scientific Method*. Advocate of Basic English from 1925 till his death in 1957.

Lettice Ramsey (I)

Photography in Cambridge

Portrait of Lettice Ramsey by her mother, Frances Baker, 1915 (Newnham College College, Cambridge)

After Frank's death in 1930, Lettice looked for a new way to support herself and her two young daughters. In 1932 she set up in the photographic business with Helen Muspratt, a Dorset photographer who had trained at Regent Street Polytechnic in London. Lettice had the Cambridge contacts to attract clients to the firm while Helen had the photographic skills and experience.

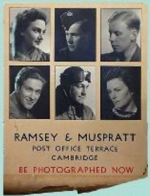
Lettice Ramsey and Helen Muspratt met in 1932 and that same year opened their studio at 20 St Andrews St, Cambridge. They moved premises in 1934 to Post Office Terrace. About its decoration, Wittgenstein advised "If it is good, paint it white. If it is bad, paint it black." In 1937 Helen Muspratt moved to Oxford and set up a second studio for the firm there, while Lettice ran the Cambridge studio until her retirement in 1978.

Reception area of the studio, early 20th century. (© Peter Lofts)
Situated in the heart of Cambridge, the premises at Post Office Terrace consisted of a motley assortment of buildings including a first floor daylight studio, and operated from 1867 until 1985 used by photographers - in chronological order - Arthur Nichols, J.E Bliss, Valentine Blanchard, Colin Lunn, John Palmer Clarke, Charles Goodrich, Frederick Sanderson, Lettice Ramsey, Helen Muspratt, Nicholas Lee, and Peter Lofts.

Lettice Ramsey, 1920s (Private collection, via Donna Casella 'Frances Baker Farrell, Lettice Ramsey and Myrin Hayes,' 2018)

View of rooftops and church from the Post Office Terrace studio. (© Peter Lofts)

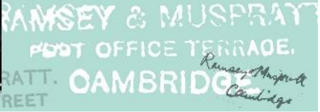
Triple self portrait, solarised c. 1932 (Helen Muspratt Bodleian Libraries)



Ramsey and Muspratt studio poster advertisement (Fading Images Cambridgeshire Collection)

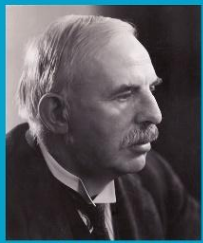
Lettice in the Ramsey & Muspratt studio, c. 1937 (© Peter Lofts)
Granta described the studio's "whitewashed walls, a glass roof, bare floor, light coloured seats and divans and a tubular steel chair. Mrs Ramsey sits in a tyrolean peasant dress, she is tanned because she has been abroad, she looks competent and strong and slightly flamboyant". Lettice belonged "to that class which gave England of yesterday its scientists, and that of today its artists, writers and higher Civil Servants. Many now famous people were photographed by Mrs Ramsey during her long tenancy of the studio.

Lettice Ramsey 1930s (Helen Muspratt © Peter Lofts)



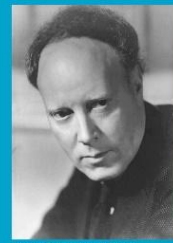
Lettice Ramsey (II)

Ramsey & Muspratt studio



Ernest Rutherford, 1937 (Lettice Ramsey/© Peter Lofts, Stephen Burch)
Awarded the Nobel Prize in Chemistry in 1908 from 1919 Rutherford was Cavendish Professor of Physics at Cambridge. He died in October of the year this photograph was taken.

Jane Cam, 1937 (Helen Muspratt/© Peter Lofts)
The "Girl with the Golden Voice", voice of the speaking clock in the UK from its inception in 1936, and lasting the time until 1963.

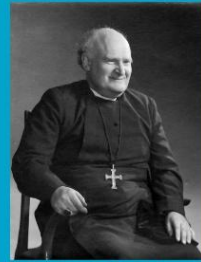


Clive Bell, 1931 (Lettice Ramsey/© Peter Lofts)
Art critic, whose book Art (1914) propounded the notion of 'significant form' ("The important thing about a picture, however, is not how it is painted, but whether it expresses aesthetic emotion").

Paul Dirac, 1934 (Lettice Ramsey/© Peter Lofts)
Nobel laureate in 1933, alongside Erwin Schrödinger. Dirac's wave equation introduced special relativity into Schrödinger's equation.

Charles Percy Snow, 1934 (Lettice Ramsey/© Peter Lofts)
C.P. Snow wrote the series of novels Strangers and Brothers (1940-70) and "The Two Cultures" (1959), an essay on the divide between sciences and "literary intellectuals." G.H. Hardy's A Mathematician's Apology (1969) has a preface written by him.

Joan Robinson (née Maurice), 1931 (Lettice Ramsey/© Peter Lofts)
A contemporary of Piero Ramsey at Trinity College. In 1926 she married fellow Cambridge economist Austin Robinson; she established her reputation with The Economics of Imperfect Competition (1933), in which she analysed distribution, allocation, and the concept of exploitation.



Michael Ramsey, 1935 (Lettice Ramsey/© Stephen Burch)
Frank Ramsey's brother Mick, "my little brother the curate," was in 1955 Bishop of Durham, and from 1961 to 1974 a progressive Archbishop of Canterbury: "Establishment has never been one of my enthusiasms."

Angelica Garnett (née Bell), 1931 (Lettice Ramsey/© Peter Lofts, Stephen Burch)
Vanessa Bell's daughter by Duncan Grant, believed to be Clive Bell's daughter until coming of age in 1937. Vanessa liked to think that her daughter had two fathers "in reality". Angelica wrote in her memoir Deceived with Kindness (1984), "I had none."

Lettice Ramsey (III)

Bloomsbury Set portraits

Roger Fry, 1932 (Lettice Ramsey/ © Peter Lofts)
Art critic and painter, whose 1910 exhibition 'Manet and the Post-Impressionists' at Grafton Galleries in London brought Gauguin, Cézanne, Matisse, and Van Gogh to the English public and the term 'post-impressionism' into circulation. In 1933, he was appointed Slade Professor at Cambridge.

Vanessa Bell (née Stephen), 1932 (Lettice Ramsey/ © Peter Lofts)
Painter and interior designer, sister of Virginia Woolf, mother (by Clive Bell) of Julian and Quentin Bell and (by Duncan Grant) of Angelica Garnett. In 1905, Vanessa with Virginia and brothers Thoby and Adrian initiated the weekly meetings at their home at Gordon Square, Bloomsbury, out of which the Bloomsbury Group of artists, writers and intellectuals was born.

Julian Bell, 1933 (Lettice Ramsey/ © Peter Lofts, Stephen Burch)
Son of Clive and Vanessa Bell, a poet and pacifist, Julian became increasingly supportive of socialist and anti-fascist movements and decided to enlist in the Spanish Civil War – persuaded by his parents not to be a soldier, in July 1937 he met his death nonetheless as an ambulance driver.

Quentin Bell, 1932 (Lettice Ramsey/ © Peter Lofts, Stephen Burch)
Younger brother of Julian Bell, art historian and occasional ceramicist. Quentin Bell wrote a highly regarded biography of his aunt, *Virginia Woolf: A Biography*, 2 vols (1972).

Frances Partridge (née Marshall), 1931 (Lettice Ramsey/ © Peter Lofts)
Writer and diarist, close friend of Lettice and Frank Ramsey – in January 1930 she was alongside Lettice at Frank's deathbed – Frances Marshall was involved in the most famous ménage of Bloomsbury, along with Dora Carrington, Lytton Strachey, and Ralph Partridge (the latter whom she married in 1933).

Angelica Garnett and Virginia Woolf (née Stephen), 1932 (Lettice Ramsey/ © Peter Lofts, Stephen Burch)
Modernist author Virginia Woolf (*The Waves* was published the year before this photo was taken) and her niece, Angelica Garnett, here aged 14. The characters of Mr and Mrs Ramsay in *To the Lighthouse* (1927) may be partially based on Arthur and Agnes Ramsey (Frank attended the 1925 Cambridge psychoanalysis group led by Arthur Tansley, mutual friend of Virginia and Frank).

Leonard Woolf, 1932 (Lettice Ramsey/ © Peter Lofts, Stephen Burch)
Political theorist, author, publisher and civil servant, Leonard Woolf won a classical scholarship at Trinity College in 1899, where he was a Cambridge Apostle contemporaneously with Lytton Strachey, John Maynard Keynes, G. E. Moore, and E. M. Forster. He married Virginia Stephen in 1912, and five years later they bought a handpress for £19, and thereupon established the Hogarth Press.

Economics

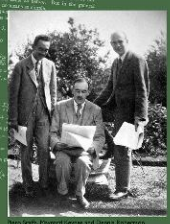
Ramsey, in his short life, made pathbreaking contributions in at least three fields of economics: the theory of subjective probability, the theory of taxation, and the theory of optimal growth.

Frank Ramsey in the Austrian Tyrol, 1926. (Lennie Ramsey & Cheither Ramsey)

1926 F.P.Ramsey, 'Truth and Probability'
in The Foundations of Mathematics and Other Logical Essays, R.B. Braithwaite (ed.), preface by G.E. Moore, London: Kegan Paul, Trench, Trubner & Co., 1931

This work, while not in economics, formed the foundations of modern decision theory, leading to the notions of subjective probability and Bayesian probability. It helped economists learn how to handle subjective expected utility. Despite the fact that Ramsey's work on probabilities was of great importance, no one seemed to paid serious attention to it until publication in 1944 of 'Theory of Games and Economic Behavior' by John von Neumann and Oskar Morgenstern.

The International Library of Psychology, Philosophy and Scientific Method was monograph series published from 1922 to 1965 under the general directing of Charles Kay Ogden by Kegan Paul, Trench, Trubner & Co. in London.



Piero Sraffa, Maynard Keynes and Dennis Robertson

1927 F.P.Ramsey, 'A contribution to the theory of taxation'
The Economic Journal 37.1 (March 1927), 333–368

Joseph Stiglitz, Colombia University professor and recipient of the Nobel Memorial Prize in Economic Sciences in 2001, starts his article 'In Praise of Frank Ramsey's Contribution to the Theory of Taxation' (2015) with the words

"Frank Ramsey's brilliant 1927 paper, modestly entitled 'A contribution to the theory of taxation', is a landmark in the economics of public finance. Nearly a half century later, through the work of Diamond and Mirrlees (1971) and Mirrlees (1971), this paper can be considered as launching the field of optimal taxation and revolutionizing public finance."

In this paper, Ramsey also contributed to economic theory the elegant concept of Ramsey pricing, which is a policy problem concerning what prices a public monopoly should charge for the various products it sells in order to maximize social welfare (the sum of producer and consumer surplus) while earning enough revenue to cover its fixed costs.

John Maynard Keynes

When he died (second from his deathbead story knights, he still tried without effort in a more atmosphere than most economists care to breathe, and handled the technical apparatus of our science with the easy grace of one accustomed to something far more difficult. He has left behind him in print (apart from his philosophical papers) only two references to his powers—his papers published in the Economic Journal on "A Contribution to the Theory of Taxation" in March 1927, and on "A Mathematical Theory of Saving" in December 1928. The latter of these is, I think, one of the most remarkable contributions to mathematical economics ever made, both in respect of the intrinsic importance and difficulty of its subject, the power and elegance of the technical method employed, and the sheer purity of illumination with which the writer is gifted by the reader to gaze almost spellbound. The article is terribly difficult reading for an economist, and is not difficult to appreciate how scientific and esthetic qualities are combined in it together.

Richard Khan, 1931. (Lennie Ramsey & Cheither Ramsey)
Undergraduate at Kings 1929-31 (he died from 1931)

1928 F.P.Ramsey, 'A Mathematical Theory of Saving',
The Economic Journal Vol. 38 No. 152 (Dec., 1928), pp. 543-559

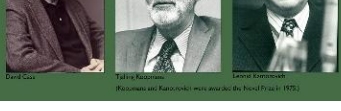
Arguably the biggest contribution Ramsey made to economics was the development of the Ramsey model, also called the Ramsey–Cass–Koopmans model (or the later economists extended Ramsey's work to develop the model). This was one of the first economics models to heavily employ calculus in its derivation.

The model is one of the backbones of model dynamic macroeconomics. Ramsey's goal was practical: "How much of a nation's output should it save for the future?" The main contributions of the model were firstly the initial question Ramsey posed on how much savings should be and secondly the method of analysis, the optimization of collective or individual utility by applying techniques of dynamic optimization.

The ingredients of Ramsey's theory are individuals' lifetime well-beings. Governpent House in his world maximizes the expected sum of the lifetime well-beings of all who are here today and all who will ever be born, subject to resource constraints.

Its most controversial idea was that the well-being of future generations should be given the same weight as that of the present one. Discounting the interests of future people, Ramsey wrote, is "ethically indefensible and arises merely from the weakness of the imagination."

On the top of the model being rather complicated and difficult for contemporaries to grasp, in the wake of the Great Depression the model did not fit the current circumstances (with unemployment peaking); only decades later did the paper's enormous impact arrive. Tjalling C. Koopmans and David Cass modified the Ramsey model in 1965, incorporating the dynamic features of population growth and technical progress, giving birth to a model named the Ramsey–Cass–Koopmans (RCK) model where the objective is to maximise household's utility function.



David Cass — Tjalling Koopmans — Lionel Kennedy

(Koopmans and Kantorovich were awarded the Nobel Prize in 1975.)

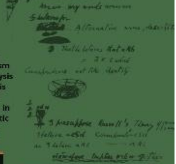
King's College, Cambridge.

V. P. Ramsey

Philosophy

Frank Ramsey in the Austrian Tyrol, 1928 (Lettice Ramsey) © Stephen Burch)

Ramsey made seminal contributions to philosophy, rooted in his thinking on the foundations of mathematics, and later incorporating a psychologism and pragmatism stemming, perhaps, from his explorations in psychoanalysis and in his forays into economics. While his brilliance was recognized by his contemporaries, some of his most important ideas were not appreciated until decades later; now better appreciated, his ideas continue to flourish in contemporary philosophy. In his time he ushered in a new phase of analytic philosophy, supplanting Russell and early Wittgenstein (it remains but to imagine how the Ramsey–Wittgenstein dialogue might have continued).



THE FOUNDATIONS OF MATHEMATICS

By F. P. Ramsey.

1925

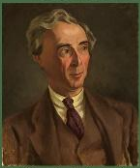
F. P. Ramsey, 'The Foundations of Mathematics', Proceedings of the London Mathematical Society (Series 2), 25: 338–384

Ramsey aimed in 'The Foundations of Mathematics' to reduce mathematics to logic by means akin to *Principia Mathematica*: first reduce mathematics to type-theory, and then show that the type-theoretic reductions of mathematical truths are logical truths. However, Ramsey's conceptions of logic and of type theory were quite different from Russell and Whitehead's. Ramsey took his conception of logic straight from the *Tractatus*: all logical truths are tautologies, and vice versa. But Ramsey's conception of type-theory was all his own.

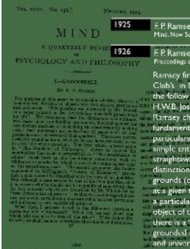
Hardy arranged for Ramsey to present the paper first in Oxford on 10 August 1925, and then at the London Mathematical Society on 12 November 1925.

Godfrey Harold Hardy, 1920s. At Oxford during Ramsey's time, Hardy was President of the London Mathematical Society 1926-8.

Alfred North Whitehead, c. 1924 (Harvard Univ.)



Portrait of Bertrand Russell by Roger Fry, c. 1923 (NPG London)



Vol. xxxiv. No. 136.] [October, 1925.

MIND

A QUARTERLY REVIEW OF PSYCHOLOGY AND PHILOSOPHY

I.—UNIVERSALS.

1925

F. P. Ramsey, 'Universals'
Mind, New Series, Vol. 34, No. 136 (Oct. 1925), 401–417

1926

F. P. Ramsey, 'Universals and the "Method of Analysis"'
Proceedings of the Aristotelian Society 6: 17–26

Ramsey first read 'Universals' at the Moral Sciences Club's in May 1925. A resulting symposium saw the follow up paper responding to critiques by H.W.B. Joseph and R. B. Braithewaite. In 'Universals' Ramsey challenges the presumption that 'there is a fundamental division of objects into two classes, particulars and universals'. By 'objects' he means the simple entities spoken of in basic statements. He straightaway puts aside as irrelevant to his concerns distinctions that might be proposed on 'physical' grounds (e.g. that a particular exists only at one place at a given time) or in relation to cognition (e.g. that a particular is an object of perception, a universal an object of thought). Ramsey's concern is whether there is a 'logical' basis for the distinction, one grounded in the different ways terms for particulars and universals function in basic statements.

G. E. Moore, 1931 (Lafayette)

Richard Braithwaite, 1930s (King's College Library)
Compiled and edited a selection of Ramsey's work soon after his death.

Two drafts of a letter responding to Wittgenstein's letter of 1927 that argued Ramsey's modification in 'The Foundations of Mathematics' of the definition of identity in *Principia Mathematica* was nonsensical.

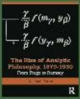
THE MATHEMATICAL GAZETTE

1926

F. P. Ramsey, 'Mathematical Logic'
The Mathematical Gazette, 13(184): 185–94

Intended to be part of an accessible book on the foundations of mathematics, which he had promised to Ogden, this paper was presented in Oxford at a meeting of the British Association for the Advancement of Science. The paper and the proposed book tilled the same ground as his undergraduate thesis, 'The Foundations of Mathematics'. He discusses the intuitionism of Brouwer, the formalism of Hilbert, and Wittgenstein on general propositions.

G.H. Hardy and Eric Neville, the colleague of Hardy's at Trinity who had persuaded the Indian prodigy Ramanujan to come to Cambridge, suggested that Ramsey's paper be published in the *The Mathematical Gazette*.



English translation of Wittgenstein's *Logisch-Philosophische Abhandlung* by Ogden and Ramsey.

In the Lent term of 1921, under the guidance of C. K. Ogden, Ramsey translated Wittgenstein's *Tractatus Logico-Philosophicus*. Wittgenstein had completed the Tractatus in 1918 while on leave from the Austrian army. But he had great difficulty in getting it published, and it was not until late 1921 that Ogden undertook this task and arranged for Frank, aged 18, to carry out this translation.

Translating the Tractatus was an event of greatest importance in Frank's life, for it led to a close, if intermittent, friendship with Wittgenstein. It arose out of his friendship with Ogden, which dated back to his final Winchester vacation. Ogden knew that, in order to win the school prize for German, Frank had deliberately read as much philosophy in German as he could. As a result of doing the translation, Wittgenstein, then still in Austria, asked for Frank to come and talk to him. So in 1923, just after taking his degree, Frank went to Vienna, and spent a fortnight in Puchberg going over the Tractatus with Wittgenstein.

(Margaret Paul, Frank Ramsey. *A Sister's Memoir*, 2012, ch. 8)

II.—SYMPOSIUM: FACTS AND PROPOSITIONS.

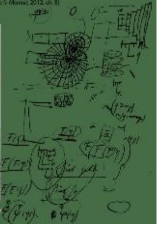
1927

F. P. Ramsey, 'Facts and Propositions'
Proceedings of the Aristotelian Society (Supplementary Volume), 7 (1927): 153–170

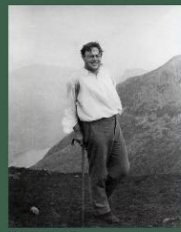
'Facts and Propositions' can be seen as Ramsey's official rejection of much of the logical analyst theory that so attracted Moore, Russell, Wittgenstein, and the Vienna Circle. Ramsey thought that his alternative would have significant payouts for seemingly intractable philosophical problems. By moving the discussion away from the truth of independently existing propositions and leaving the route clear for an analysis of true human belief, it would solve the problem of negation and make possible an understanding of partial belief.

Photo booth portrait of Ludwig Wittgenstein, c. 1930 (Collection Milo Palm, Vienna)

Ludwig Wittgenstein, 1930 (Moriz Nähr/ ÖNB)



Mathematics (I)
Ramsey's theorem



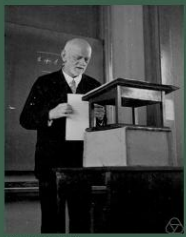
Frank Ramsey, 1925

1930 F. P. Ramsey. On a Problem of Formal Logic
Proc. London Math. Soc. 30 (1930), 364-386

Remarkably, Frank Ramsey wrote just one mathematical paper. He was motivated by the problem known as the Entscheidungsproblem, due to David Hilbert. The problem asks for a procedure (in modern terms an algorithm) which decides for every formula whether it is valid or false.

Offprint of 'On a Problem of Formal Logic' (collection of J. Nešetřil)

Hilbert's initial optimism (reflected also by original positive solutions by Bernays–Schönfinkel and Ramsey) was dampened by general negative results by Kurt Gödel, Alonzo Church, and Alan Turing. Ramsey's paper (and the key Ramsey Theorem) pushed the validity to the limit: For formulas of the form $\exists^n\forall^n\varphi$ one has a decision procedure while for one more alternation of quantifiers the problem is already undecidable (Trakhtenbrot).



David Hilbert, 1932

Kurt Gödel, 1925

Alonzo Church, c. 1925-30

Boaz (Boris) Trakhtenbrot, c. 1970

Alan Turing, 1928. (Turing went up to Cambridge to read mathematics at King's College 1931-34.)

Thoralf Skolem, c. 1930-5
(Bybrottsmk samling, Oslo Museum)

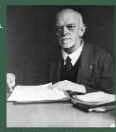
Mathematics (II)
Early "Ramsey-type" statements

THEOREM A. *Let Γ be an infinite class, and μ and τ positive integers; and let all those sub-classes of Γ which have exactly τ members, or, as we may call them, all τ-combinations of the members of Γ be divided in any manner into μ mutually exclusive classes C_i ($i = 1, 2, \ldots, \mu$), so that every τ-combination is a member of one and only one C_i; then, assuming the axiom of selection, Γ contains an infinite sub-class Δ such that all its τ-combinations belong to the same C_i.*

$$\rightarrow (\Delta)^1_2$$

1892 David Hilbert: Über die Irreduzibilität ganzer rationaler Funktionen mit ganzzahligen Koeffizienten, J. Reine Angew. Math. 110 (1892) 104-129

"Ramsey theorem for distributive lattices" in the context of algebra and analysis.



David Hilbert, 1932

$$C \rightarrow (B)^A_k$$

1916 Issai Schur: Über die Kongruenz $x^m + y^m = z^m \bmod p$, Jahresber. Deutsche Math.Verein 25 (1916), 114-117

"Ramsey theorem for sums" in the context of the modular version of Fermat's conjecture

Issai Schur, c. 1905
(Oberwolfach Photo Collection)

1927 Bartel Leendert van der Waerden: Beweis einer Baudetschen Vermutung, Nieuw Arch. Wisk. 15 (1927), 212-216.

"Ramsey's theorem for arithmetic progressions". (the problem was independently posed by I. Schur)

Bartel van der Waerden, c. 1920-25

1933 Richard Rado: Studien zur Kombinatorik, Math. Zeit. 36 (1933), 424-480.

"Ramsey's theorem for linear equations with full characterization" (Rado was Schur's student in Berlin)

Richard Rado, 1960s

k	1	2	3	4	5
$r(k)$	1	2	5	18	?

$$\sqrt{2}^k \leq r(k) \leq (4-\varepsilon)^k$$

1935 Pál Erdös and György Szekeres: A Combinatorial Problem in Geometry, Compositio Math. 2 (1935) 464-470.

"Ramsey's theorem for convex sets" in the context of geometry

Paul Erdös, 1930s

György Szekeres and Esther Klein, 1930s

Mathematics (III)

DIMATIA

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J. Hubička & J. Nešetřil

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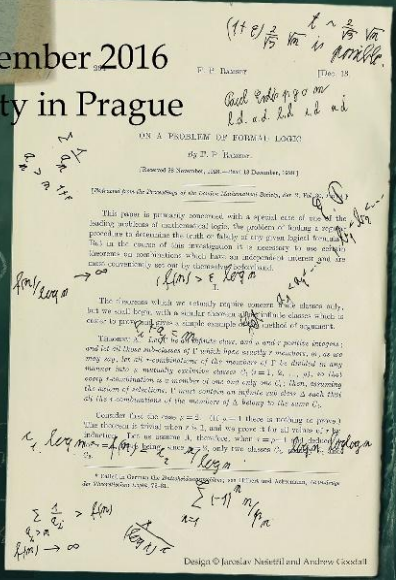
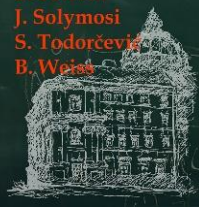
Ramsey Theory
DocCourse

September - December 2016

Charles University in Prague

D. Bartošová
D. Conlon
D. Evans
J. Fox
R. Morris
L. Nguyen Van Thé
M. Pinsker
V. Rödl
S. Solecki
J. Solymosi
S. Todorčević
B. Weiss





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Mathematics (IV)

Legacy

F. P. RAMSEY.

ON A PROBLEM OF FORMAL LOGIC.

The unbelievable effectivness of Ramsey's ideas in the sciences: his work has led to two Nobel Prizes (economics), two Fields Medals (mathematics), and two Abel Prizes (mathematics).

People active in Ramsey Theory in recent times: Noga Alon, Manuel Bodirsky, Béla Bollobás, Jean Bourgain, David Conlon, Walter Deuber, Paul Erdős, Hillel Furstenberg, Fred Galvin, Tim Gowers, Leo Harrington, Jan Hubička, Klaus Leeb, Vitali Milman, Rob Morris, Jaroslav Nešetřil, Jeff Paris, Hans Jürgen Prömel, Christian Reiher, Vojtěch Rödl, Bruce Rothschild, Slawomir Solecki, Joel Spencer, Endre Szemerédi, Stevo Todorčević, and many others.

Exhibition curators

Dr. Andrew Goodall studied at the University of Oxford and since 2012 has been working at the Computer Science Institute of Charles University at MFF; he is also a lecturer in English at FSV. He works mainly in combinatorics and algebra. He is known also for his photography, having had several exhibitions in Prague.

Prof. Jaroslav Nešetril is employed at the Computer Science Institute of Charles University at MFF. He works in many areas of mathematics and computer science. He collaborated with Jiří Načeradský for 20 years and together they created an extensive oeuvre (see, for example, J. Načeradský, J. Nešetřil: Antropogeometrie I, II, Rabasova Galerie 1998, ISBN 80-85868-25-3).

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