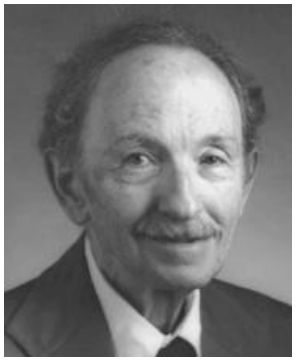
Irving John (Jack) Good

Born Isidore Jacob Gudak December 9, 1916, London, England,- cryptologist, statistician, and early worker on Colossus at Bletchley Park and the University of Manchester Mark I; major contributor, if not Promulgator, of Bayesian Statistics.



Education: major scholar of Jesus College, Cambridge, 1934; state scholar, 1934; BA, Cambridge, 1938; PhD, mathematics, Cambridge, 1941 (supervisor: G.H. Hardy, FRS.); MA, Cambridge, 1943; ScD,[1] Cambridge, 1963; DSc, Oxford, 1964.

Professional Experience: Foreign Office, 1941-1945; worked at Bletchley Park, Government Code and Cypher School, on Ultra (both the Enigma and a teleprinter encrypting machine) as the main statistician under A.M. Turing, FRS, C.H.O.D. Alexander (British chess champion), and M.H.A. Newman, FRS, in turn; lecturer in mathematics and electronic computing, Manchester University, 1945-1948; Government Communications Headquarters, UK, 1948-1959; visiting research associate professor, Princeton, 1955 (summer); consultant to IBM for a few weeks, 1958/59 (information retrieval and evaluation of the Perceptron); Admiralty Research Laboratory, 1959-1962; consultant, Communications Research Division of the Institute for Defense Analysis, 1962-1964; senior research fellow, Trinity College, Oxford, and Atlas Computer Laboratory, Science Research Council, Great Britain, 1964-1967; Virginia Polytechnic Institute and State University: professor (research) of statistics since July 1967, University Distinguished Professor since November 1969, adjunct professor of the Center for the Study of Science in Society since 1983, adjunct professor of philosophy since 1984.

Honors and Awards: Cambridgeshire Chess Champion, 1939; Smith's Prize, Cambridge (one or two Smith's Prizes are awarded each year for mathematical essays by graduate students), 1940 (supervisor: A.S. Besicovitch, FRS); fellow, Institute of Mathematical Statistics, 1958; one of the original six people designated the title “University Professor,” 1969; title changed to “University Distinguished Professor,” without change of meaning, in 1975; Horsley Prize, Virginia Academy of Science (shared with R.A. Gaskins), 1972, for the best scientific paper presented that year at the annual meetings; fellow, American Statistical Association, 1973; member, New York Academy of Sciences, 1974; fellow, American Academy of Arts and Sciences, 1985; honorary member of the International Statistical Institute, 1990.

Good rediscovered irrational numbers and the infinity of solutions of $2x^2 = y^2 \pm 1$ at the age of 9. He rediscovered mathematical induction and, in a sense, integration, at the age of 13.[2] In 1943, Good was one of

[1] “Doctor of science” is an advanced “postdoctoral” degree in the UK.

[2] Good states “I cannot legally prove these two statements but they are true.”

seven people who helped design Mark II of a large-scale (classified) binary electronic digital computer called Colossus (which was not entirely general purpose).[1]

Jack Good is probably one of the most highly multifaceted persons I have ever met. If we refer to Charles Babbage as a "polymath," a person of great or varied learning, then surely we must refer to Good as a "multimath." If we refer to John Vincent Atanasoff as the "Forgotten Father of Computing," then we must refer to Good as the "Overlooked Father of Computation." With over *900* papers to his credit, Good has used his learning and writing skills to give deep insights into not only the present state of science, mathematics, statistics, computing, and philosophy, but also into their future. Arthur C. Clarke used Good's name in 1968, along with that of Marvin Minsky, to explain the thinking capabilities of HAL 9000, his science fiction machine of the book and film 2001: A *Space Odyssey*. Good himself made some remarkable predictions of the future, including the 1962 speculation that by 1978 "a pulse repetition frequency of 10^{10} per second [i.e., a nanosecond] will be attained ... and a machine of a million units might well be large enough [to model the cerebral cortex], especially if it had an additional 10^{11} binary digits [about a gigabyte] of comparatively slow subsidiary storage....

Good's career can be divided into four periods:

- His early prewar years when he developed his self-learning abilities.
- The wartime years with Max Newman, Donald Michie, and Alan Turing.
- The immediate postwar years at the University of Manchester, the Government Communications Headquarters (GCHQ), and Oxford University, and his early visits to the US.
- His years at Virginia Tech, the longest period in which he remained in one spot.

In each of these periods he achieved significant advances in philosophy and sciences. Two things have prevented him from being given the recognition he really deserves-the still-classified nature of his wartime work on cryptanalysis and the application of statistical methodology to code breaking, and his own reticence for showmanship. Within limits Good will talk about what happened around him at Bletchley Park and the University of Manchester. But one really has to "pry" about Good's own contributions.

Born of an immigrant London shopkeeper, Good discovered mathematics independently at the age of 9 and, through readings of library books, extended his knowledge and interest of mathematics and probability. During his adolescent years Good learned about cyphers and substitution codes, and amused himself creating and breaking simple codes. Good entered Jesus College, Cambridge, well equipped for advanced studies and eventually completed a doctorate degree under the direction of the well-known mathematician G.H. Hardy. Having completed his studies he was put on the "reserve list," rather than being called directly into the military. Good was interviewed by Hugh Alexander, British chess champion, for a job with the civil service, and after a

[1] The two principal designers were M.H.A. Newman and TH. Flowers. Flowers headed the engineering group among whom the next most influential were S.W. Broadhurst, W.W. Chandler, and A.W.M. Coombs. The main users were Max Newman, Donald Michie, and Good, and later about 20 mathematicians. Good was the best user and produced more than half the theory for its use.

background check, was recruited to join a band of Cambridge dons and graduates at the Government Code and Cypher School (GCCS) at Bletchley Park.[1] Alexander and Good were acquainted through their interest in chess, though Good was not of the caliber of Alexander, except when playing "five minute" chess. While the interview did not reveal directly the type of work which Good was to undertake, Bernard Scott, a friend of Good's, who was interviewed at the same time, had guessed the reason for the interest in their mathematical backgrounds. Scott had gone so far as to suggest that Good downplay his student style of dress by putting his collegiate scarf inside his coat instead of wearing it in the common nonchalant style.

Alexander met Good at the railroad station on the day he reported to Bletchley Park, and while walking across the fields to the main building, told Good of the work of the "school." Coincidentally that was the day (May 27, 1941) that the Royal Navy sank the German battleship *Bismarck.* The Enigma was a cipher machine which was being used for encipherment by each of the German Armed Forces. The German Air Force (Luftwaffe) and Army Enigma codes had already been broken, but the Naval Enigma was still a major problem-and a problem of significant proportions during the Battle of the Atlantic, when Britain's supply lines from North America were being strangled by the U-boat war.

Initially Good was assigned to Hut 8 in the grounds of Bletchley Park working with Alan M. Turing, Hugh Alexander, Peter Twinn, Joan Clarke, and others. Hut 8 was already using the machines known as "Bombes" to discover the Enigma wheel settings.[2] Turing had come up with the method of disproving the validity of conjectures by contradiction, instead of merely searching for the one elusive solution. Using "cribs," conjectures of the contents of elements (usually the header) of messages, the techniques and methods of determining the wheel settings became algorithmic. During this early period, Max Newman, another Cambridge don, working in another hut, had become disenchanted with the hand methods of code breaking and had established a program to use electronic methods of decipherment. He had recruited Donald Michie, an undergraduate classics student from Balliol College, Oxford, to examine linguistic methods of solution. Good joined this group about the time that a new line of machines, named the "Robinsons," were introduced to Bletchley Park.[3] Good and Michie began to use their joint backgrounds in statistics and linguistics to further the code-breaking technologies that eventually led to the development of the Colossus machines and the breaking of a family of codes known as "fish." These machines were, arguably, the first working, special-purpose, electronic computers, developed just in time to have an impact on the invasion of "Fortress Europe" in June 1944.

Following the war, the staff of the GCCS dispersed to various locations, but still restricted by the official secrets act. It was not until 1974 that their code-breaking work, the development of their machines, and the impact of their endeavors were revealed to some extent.

---

[1] Also known as the "Golf Club and Chess Society."

[2] Good 1979.

[3] The various machines were called the "Heath Robinson" (after the cartoonist in Great Britain who Parallels the American Rube Goldberg), "Peter Robinson," and "Robinson and Cleaver " (a restaurant in London).

In 1945 Good accepted the invitation of Max Newman to join him at the University of Manchester where Newman planned to build a computer based on Turing's designs, but with the intention of using it primarily in the exploration of “pure” mathematical notions, rather than numeric computations. Along with Tom Kilburn and Fred Williams, Good took his place in the computer development that created the Manchester Mark I, which is credited as the first computer in the world to be controlled from an internally stored program. During this period Good suggested his idea of “Machine Building,” which may have been an early form of microprogramming. At the same time Good was developing ideas that resulted in his first book, *Probability and the Weighing of Evidence,* which expanded on the concept of Turing's unit “deciban,” which measured the smallest weight of evidence perceptible to the intuition.

In 1948 Good returned to government service within the Government Communications Headquarters (GCHQ) and in 1959 he joined the Admiralty Research Laboratory. After several other sojourns, including a visit to the Institute for Defense Analyses in Princeton, NJ., Good returned to the academic life at Trinity College, Oxford, and was associated with the Atlas Computer Laboratory, sponsored by the Science Research Council of Great Britain, and directed by Jack Howlett. In 1967 Good chose to move his base of operations to the US: “I found [Oxford] a bit stiff actually, taking meals and all that stuff. You couldn't easily converse at the high table. The table was rather wide and the students were noisy, so it was difficult to talk to people on the other side. You could only really talk with the people to your left and right; also it was somewhat taboo to talk shop at dinnertime. One could talk about cricket, and things like that. That was all right. I wasn't sorry to leave to come to America.” As a University Distinguished Professor at Virginia Polytechnic Institute and State University (Virginia Tech), Good has continued his prolific writing habits and slowly, as permitted, revealed more and more of his wartime exploits. His “vanity” car license plate is 007 IJG.

QUOTATIONS

“All 'analogue' (= continuous) records gradually deteriorate. The only form of storage of unlimited life is discrete (e.g., digital): when it begins to deteriorate it can be regenerated in a mint copy. I suggest that the greatest works of art should be stored discretely in order that they should have a chance of literal immortality. This suggestion would already be practical for all musical performances (by means of pulse code modulation). It will become practical for films and painting in due course, and ultimately even for the legitimate theatre.” (Good 1962)

As important as are quotations *by* Good, quotations *about* Good are equally illuminating:

“When I first met Jack, he held out his hand and said 'I'm Good.' And he has been getting better ever since.”(Donald Michie)

“In the 1980s, [Marvin] Minsky and [Jack] Good had shown how neural networks could be generated automatically—self replicated—in accordance with any arbitrary learning program. Artificial brains could be

grown by a process strikingly analogous to the development of a human brain."(Arthur C. Clarke, in 2001: A *Space Odyssey,* 1968, p. 92 .[1])

Of the people at Bletchley Park, Winston Churchill complimented them as "the geese who laid the golden eggs but never cackled."

BIBLIOGRAPHY

Biographical

Good, I. J., "Early Work on Computers at Bletchley," *Ann. Hist. Comp.,* Vol. 1, No. 1, 1979, pp. 38-48.

Good, I. J., "Pioneering Work on Computers at Bletchley," in Metropolis, N., J. Howlett, and Gian-Carlo Rota, *A History of Computing in the Twentieth Century,* Academic Press, New York, 1980, pp. 31-45.

Good, I. J., "Enigma and Fish," in Hinsley, Sir Harry H., and Alan Stripp, *Code Breakers: The Inside Story of Bletchley Park,* Oxford Univ. Press, Oxford, 1993, pp. 149-66.

Significant Publications

Good's published writings run to about two million words and receive many citations in the *Science Citation Index.* He numbers his publications, but skipped numbers 1901-2000, so as to not cause confusion with year numbers!

Good, I. J., *Probability and the Weighing of Evidence,* Charles Griffin, London, 1950. The first book on subjective (personal) probability.

Good, I. J.., *The Scientist Speculates,* Heinemann & Basic Books, New York, 1962. (There were French and German translations, and a paperback in 1965.)

Good, I. J., *The Estimation of Probabilities,* MIT Press, Cambridge, Mass., 1965.

Osteyee, D. B., and I. J. Good, *Information, Weight of Evidence, the Singularity between Probability Measures and Signal Detection,* Lecture Notes in Mathematics, Springer-Verlag, New York, 1974.

Good, I. J., *Good Thinking: The Foundations of Probability and Its Applications,* Univ. of Minn. Press., Minneapolis, 1983.

UPDATES

[1] Good has since wished that Clarke had said the "1990s" but then the Space Odyssey may have had to have been postponed for 10 years to become "2011! "

Good died April 5, 2009 (MRW, 2012)

Portrait replaced (MRW, 2012)