ALAN M. TURING

Centenary Edition

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with a Foreword by
Martin Davis

and an Afterword by
John Turing

CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town,
Singapore, São Paulo, Delhi, Mexico City

Cambridge University Press
The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org
Information on this title: www.cambridge.org/9781107020580

First edition published by W. Heffer & Sons, Ltd 1959
Second edition published 2012

Printed in the United Kingdom at the University Press, Cambridge

A catalogue record for this publication is available from the British Library

ISBN 978-1-107-02058-0 Hardback

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FOREWORD TO THE CENTENARY EDITION

Sara Turing, a woman in her seventies mourning the death of Alan, her younger son, a man that she failed to understand on so many levels, wrote this remarkable biographical essay. She carefully pieced together his school reports, copies of his publications, and comments on his achievements by experts. But Alan Turing was a thoroughly unconventional man, whose method of dealing with life's situations was to think everything through from first principles, ignoring social expectations. And she was trying to fit him into a framework that reveals more about her and her social situation than it does about him. Alan's older brother John trying to fill in the gaps he saw in his mother's account, also ends up revealing a good deal about his own attitudes.In these few pages I will discuss some of the questions that may occur to readers of these documents.

Alan Turing's War

In 1940, after France had been defeated, Britain fought on mainly alone. The merchant shipping on which the island was dependent was being sunk by German submarines at a rate that threatened to force the UK to yield. The radio communications between the submarines and their base concerning their operational plans were being picked up in Britain. If these plans were known, attacks could be mounted against the submarines. Merchant ships could adjust their routes so as not to go where they would encounter enemy submarines. But of course the data was encrypted.

For the purpose of decrypting enemy communications, an assorted group of classics scholars, mathematicians, and hobbyists who were good at solving puzzles were brought together in an estate called Bletchley Park near the present-day town of Milton Keynes. For much military communication the Germans used an enhanced version of a commercial enciphering machine called Enigma. Some Polish mathematicians had worked out a technique for decrypting German military messages coded on their Enigma, and had passed their work on to the English. But by the time war broke out in 1939, the Germans had added additional complications and the Polish techniques were no longer of any use. Not only were there several disks on the machine whose rotational position could be altered, but there was also a plug-board into which cables could be plugged in various ways. In order to decrypt a message, these precise settings had to be known. Taking advantage of certain weaknesses in the design of the machines as well as carelessness on the part of German cipher clerks, the Bletchley park code-breakers could rule out a large number of possible settings. That still left a number of possibilities to be attacked by trial and error. Turing played a major role in developing these techniques, and in working out a method for automating them. He designed a machine that would systematically try various settings, rejecting those that contradicted what was already known. These machines, many of which were built, strangely called bombes, were highly effective. What is truly remarkable is that, constructed to Turing's specifications, they worked as intended without the need for any fine tuning. Although Turing's contributions, and indeed the entire project of decrypting German military communications, were kept secret long after the war, Turing was awarded an O.B.E. (Order of the British Empire) for his contributions to the war effort.

Alan Turing's Universal Computer

Mathematical proofs use logical reasoning to get from assertions already accepted as true to statements called theorems, which thus

achieve acceptance as mathematical truths. The work of logicians in the nineteenth and twentieth centuries showed how, in principle, the individual steps in such "proofs" could be replaced by the mechanical manipulation of symbols. This situation gave rise to the problem of finding a mechanical process, an algorithm, for deciding in advance whether from some given statements accepted as true, another desired statement could be obtained by such a sequence of steps. The great mathematician David Hilbert declared that this problem, he called the *Entscheidungsproblem*, was the main problem of mathematical logic. (The long German word simply translates into "decision problem," but since many problems involve "decisions," it has been customary to use the German name.) The game of chess provides a useful analogy. The individual moves in a chess game, like the individual steps in a logical proof, are simple and mechanical. The *Entscheidungsproblem* is then like the problem of how to tell for a given initial position of the chess pieces, whether white can achieve a check-mate regardless of black's counter moves. As every chess player knows, this is very difficult if not impossible.

Alan Turing learned about the *Entscheidungsproblem* from lectures on the foundations of mathematics given by Max Newman at Cambridge University in 1935. People were not at all convinced that there could be an algorithm meeting Hilbert's requirements. The mathematician G.H. Hardy, a professor at Cambridge, said it forcefully:

> There is of course no such [algorithm], and this is very fortunate, since if there were we should have a mechanical set of rules for the solution of all mathematical problems, and our activities as mathematicians would come to an end.

Alan agreed, and considered how one could go about proving that no such algorithm exists. Apparently no one had ever provided a definition of "algorithm," and indeed there had hardly been a need for such a definition. As children, we all learned algorithms for adding and multiplying numbers. Later many of us will have

learned algorithms for solving equations, and even the algorithms from the differential calculus for computing derivatives. None of this required that we be told what an algorithm is. We recognized that the rules we used were explicit and mechanical. Once we learned them, we could carry them out without any creative thought. That was good enough. But to prove that there is no algorithm to carry out some task, more was needed than the words "explicit" and "mechanical."

Thinking about what people do when they "compute," that is carry out algorithms, Turing saw that it all seemed to amount to taking note of particular symbols and then writing other symbols. Although the work is done on a two-dimensional surface like a sheet of paper or a blackboard, Turing could see that, in principle, it could all be done on a paper tape in which the symbols are written as a linear string. He realized that it was crucial that no limit be placed in advance on the amount of space needed. Speaking somewhat metaphorically, the tape should be infinitely long to be sure that it doesn't get all used up before the computation is complete. Next he saw that the behavior of the person doing the computation could be represented by a simple table that indicated the next step to be carried out, writing a symbol and moving left or right on the tape. Finally a machine could be constructed that does what the table instructs it to do. Such machines have come to be called Turing machines.

Now he was off and running. He asked whether one of his machines could be what we may call a *tester*. What a tester would be required to do would be to determine whether a given one of his machines will eventually write some particular symbol, say "0", when started with its tape empty. One imagines writing the table for the machine being tested on the tape of the "tester" and expecting it to eventually halt with "yes" written on its tape if the machine being tested would eventually write "0," and "no" written on its tape, otherwise. Turing proved that no such tester could exist. Finally, he showed how to use symbolic logic to represent

much the vogue at the time when John Turing was writing. Alan himself angrily suggested something similar on an occasion when one of his advances had been rebuffed.

Nowadays, it is accepted that the specific sexual proclivities of an individual are simply one aspect of that person and are unlikely to be altered by any intervention. There is apparently some evidence to connect male homosexuality to hormonal influences in the womb. But the truth is that, at this time, it is just not understood why certain people are homosexual. In any case, if it is reasonable to want to understand why a specific individual has turned out to be homosexual, it is just as reasonable to seek to understand why another is heterosexual. The powerful force of sexual attraction remains deeply mysterious.

The Engagement

Although Sara Turing doesn't mention it, Alan was engaged to a young woman, Joan Clarke, a co-worker at Bletchley Park, for several months. Joan was a very talented mathematics student who had been recruited to work as a cryptanalyst. Although Alan let her know from the beginning of his homosexual "tendencies," she remained willing to continue the engagement. It was after they spent a week together on a bicycling trip in Wales, that he decided that it wouldn't work, and broke off the engagement. They were, and remained, very fond of one another and it was all very difficult. Many years later, she decided not to see the play *Breaking the Code* which was about Turing, because she would have found it too painful.

Joan dealt with institutional obstacles and social prejudices that faced anyone who was both female and a mathematician at that time. At Bletchley Park she was listed as a "linguist" because the designation "cryptanalyst" was not available to women. She later married a man with a great interest in Scottish history. She became

similarly interested and made a significant contribution to numismatics in that connection. She died in 1996.

John Turing dismissed Joan as "safe" (apparently meaning unattractive). In an earlier version of the document, he had referred to her "unwashed hair" and "problems of personal hygiene." This was in contrast with the "attractive and lively young women" that John had brought home for weekends who "cheered up" his father. Even allowing for the prejudices of the time, this denigration of a capable intelligent woman was truly appalling.

Turing in Princeton

Although Alan had no way of knowing this, he had not been the only one working on the problem of characterizing algorithmic computability. In Princeton Kurt Gödel visiting from Vienna as well as Alonzo Church and his students at Princeton University discussed the same problem. This came to light at Cambridge when a copy of a mathematical periodical arrived in the mail containing an article by Church with the title "An Unsolvable Problem of Elementary Number Theory." It turned out that, in addition, Church had also published a proof of the unsolvability of the *Entscheidungsproblem*. So, in a sense, Alan had been preempted. But his approach was so different and so fundamental that it was clearly still important enough to merit publication. Also the notion of universality, with its implied consequences for a new understanding of the nature of computation, was entirely Turing's. It was decided that Alan should spend some time at Princeton so Church and he could explore their common interests, and Max Newman wrote Church to see what could be worked out. Turing did spend two years at Princeton followed by a year back in Cambridge before the war broke out. There was something anomalous about Alan's situation at Princeton. At that time, in England, a doctorate was not ordinarily considered part of the preparation for an academic career. As a Fellow, Turing was on the lower rungs of a ladder that,

if his research career proved successful, could eventually lead to a professorship. But the American system was different, and the simplest way for Turing to fit himself into it was as a candidate for the Ph.D. His dissertation was an important contribution to mathematical logic extending Gödel's work on undecidability.

Turing's ACE

After the war had ended, Alan was eager to help build a working Universal computer. He was offered a position at the National Physical Laboratory (NPL) to do just that. Full of enthusiasm, and harnessing the practical knowledge of electronics he had acquired from his war work, he wrote a detailed plan for a machine he called Automatic Computing Engine (ACE). This document and the machine it proposed anticipated a number of concepts that later were widely accepted. An address Turing delivered to the London Mathematical Society on the proposed ACE demonstrated Turing's expansive view of what came to be called computer science.

Unfortunately, the project ran into bureaucratic difficulties Turing had not expected, being used to the war-time atmosphere in which obstacles of that nature could be eliminated by a letter to Winston Churchill. In addition, engineers ignorant of the great success of Turing's "bombe" at Bletchley Park, wouldn't take seriously the pronouncements of this stuttering mathematician. He must have been terribly frustrated when computers did come to be built elsewhere, and their design moreover followed "the Americans" in solving problems by hardware rather than "thought." He left and accepted Max Newman's invitation to come to Manchester to work with the computer being built there. He did, but interacted with it not in pushing the kind of advanced software development he had outlined in his ACE report, but rather as a user to carry out computations related to the biological problems in which he had become interested.

Can Machines Think?

What led Turing to raise this question was that he saw in his ACE a first crude approximation to a human brain. He wrote a much-cited essay on the subject and even spoke about it on the radio. He sought an objective experimental test on the basis of which one could be justified in saying that a programmed computer was thinking, avoiding philosophical and religious objections that might be raised. The criterion he chose was the ability of such a machine to carry on a conversation that could not reasonably be distinguished from one by a person. He predicted that this would be achieved by the end of the twentieth century, but was far too optimistic about the task of programming computers to achieve a command of natural language equivalent to that of every normal person.

The Burglary

Alan foolishly went to the police when a few items had been stolen from his house. Alan's sex partner Arnold had mentioned Turing's posh house to someone named Harry, and Harry had gone to the house and helped himself. It turned out that Harry had been known to the police and had left his fingerprints behind after the theft. John Turing thought that Arnold himself was the thief and that there had been no burglary, but he was pretty clearly mistaken.

In any case, the police were more interested in what Alan and Arnold had been doing together than in the theft, and Turing found himself before a judge charged with "gross indecency." In order to spare Turing from a prison sentence, he was required to undergo a course of estrogen injections for a year, apparently in an effort to block his sex drive. What it did accomplish was to cause Alan to grow breasts.

Alan Turing's Death

Sara Turing would have it that it was her son's slovenly habits that led to his getting deadly cyanide on an apple he was eating. John

Turing was convinced that it was suicide. Alan Turing was a man who was privy to official secrets that, after his conviction, he was no longer entitled to have. Sex for him in England was evidently dangerous. In the Cold War atmosphere of the 1950s, he would surely have been warned about travel abroad. When a man he had met in Norway tried to visit Turing, the authorities saw to it that it wouldn't happen.

In any case, there is reason to believe that Alan did take his life, and that moreover he had staged his suicide in such a way that it would be clear to friends what he had done, while to his mother it would appear as a vindication of all her warnings about his slovenly habits. He had been much impressed by the Walt Disney film *Snow White and the Seven Dwarfs* and particularly the scene in which the wicked witch holds an apple in a steaming pot of poison chanting:

> Dip the apple in the brew
> Let the Sleeping Death seep through.

We are told that Alan enjoyed chanting those lines. Perhaps this was the very song he sang as he prepared the deadly concoction and took his bite.

Other Reading

First and foremost, there is Andrew Hodges's biographical masterpiece, *Alan Turing: The Enigma.* A much shorter and very worthwhile account is David Leavitt's *The Man Who Knew too Much: Alan Turing and the Invention of the Computer.* Finally I venture to mention my own *The Universal Computer: The Path from Leibniz to Turing* which tells the story of developments leading up to Turing's breakthrough, now available in an updated edition for the Turing Centenary.

Martin Davis

He was a wonderful chap in many ways. I remember how he came to my house late one evening to talk to Professor J.Z. Young and me after we had been to a meeting in the Philosophy Department here, arranged by Professor Emmet. I was worried about him because he had come hungry through the rain on his cycle with nothing but an inadequate cape and no hat. After midnight he went off to ride home some five miles or so through the same winter's rain. He thought so little of the physical discomfort that he did not seem to apprehend in the least degree why we felt concerned about him, and refused all help. It was as if he lived in a different and (I add diffidently, my impression) slightly inhuman world. Yet he had some warmth, I know – for you in particular, for he told me so in a revealing couple of hours that we had together not very long before he died. . . . Alan, as I saw him, made people want to help and protect him though he was rather insulated from human relations. Or perhaps because of that we wanted to break through. I personally did not find him easy to get close to.

We all marvelled at his indifference to creature comforts – for example, his staying at YMCA Hostels when he could easily afford a first class hotel. But was he so indifferent? He always appreciated finding himself warm and well-fed in a strange house during the difficult winters after the war. But he was at least half a Spartan and did not believe in expending much trouble and expense on physical comforts. He was Spartan rather than Bohemian. At Bletchley during the war when crockery was scarce and expensive, it was a nuisance if one's tea mug disappeared and Alan with characteristic thoroughness brought a padlock and chain and locked his mug to the radiator in his room. He was genuinely furious when some wag took the trouble to pick the lock and hide the mug.

Alan certainly had less of the eighteenth and nineteenth centuries in him than most of his contemporaries. One must go back three centuries (or *on* two perhaps) to place him; and yet of all the great minds most likely to understand and appreciate him, I should place Tolstoy first. A couple of years before he died I pushed first *Anna Karenina* and then *War and Peace* into his hands. I knew that

he read Jane Austen and Trollope as sedatives, but he was totally uninterested in poetry and not particularly sensitive to literature or any of the arts, and therefore not at all an easy person to supply with reading matter. *War and Peace* proved to be in a very special way the masterpiece for him and he wrote to me expressing in moving terms his appreciation of Tolstoy's understanding and insight. Alan had recognized himself and his own problems in *War and Peace* and Tolstoy had gained a new reader of a moral stature and complexity and an originality of spirit equal to his own.

With ninety-nine people out of a hundred Alan protected himself by his off-hand manners and his long silences – silences finally torn up by the shrill stammer and the crowing laugh which told upon the nerves even of his friends. He had a strange way of not meeting the eye, of sidling out of the door with a brusque and off-hand word of thanks. His oddly-contoured head, handsome and even imposing, suddenly from another angle, or in a different mood, became unprepossessing. He never looked right in his clothes, neither in his Burberry, well-worn, dirty, and a size too small, nor when he took pains and wore a clean white shirt or his best blue tweed suit. An Alchemist's robe, or chain mail would have suited him, the first one fitting in with his abstracted manner, the second with that dark powerful head, with its chin like a ship's prow and its nose short and curved like the nose of an enquiring animal. The chain mail would have gone with his eyes too, blue to the brightness and richness of stained glass. They sometimes passed unnoticed at first; he had a way of keeping them to himself, and there was also so much that was curious and interesting about his appearance to distract the attention. But once he had looked directly and earnestly at his companion, in the confidence of friendly talk, his eyes could never again be missed. Such candour and comprehension looked from them, something so civilized that one hardly dared to breathe. Being so far beyond words and acts, that glance seemed also beyond humanity.

It was more than fortunate for Alan that his mother took such pains to select a public school to suit him. I find the account of his years at Sherborne fascinating. His mother and his housemaster, of one mind about him throughout, saved Alan from what threatened to be a career of scientific pranks. It was through Sara Turing's appreciation at a very early stage both of his brilliance and his difficulties, that he went to Sherborne and went in good heart, and there in a housemaster of unique perception and tact, he found someone able to carry on the difficult task of discouraging the misfit without discouraging the genius. It was at Sherborne, in his deep attachment to Christopher Morcom, the brilliant boy who died at eighteen, that Alan saw a vision of human relationships which sent him questing for the rest of his life.

To those who like myself came to know Alan only in the last ten years of his life, there is the answer to many questions in this short book. He carried so many odd suggestions of his past as well as his present about with him, almost like a pedlar's wares festooned about his person, although without any notion of showing them off. From his being in part still a child and an adolescent and an undergraduate, as well as a don and a Fellow of the Royal Society, arose the extraordinarily wide range of his friends. No one I have ever known proved compatible with so many people who would themselves have been incompatible with one another; partly through his divine tardiness to notice the faults of anyone who had won his regard, no matter by what trifling service. Yet it was characteristic of his honesty and detachment that he would listen to criticisms of his friends with the same humility as he accepted criticisms of himself – never apparently suspecting that people can find fault except honestly and from the best motives. He himself found the idea of deceiving others so distasteful that he supposed it equally so to almost everyone.

It is hard to remember a single instance of Alan's acting in imitation, even unconscious imitation, of another person. His originality was something quite by itself in its extent and depth. Sara

Turing quotes his writing to her as a little boy from his preparatory school saying: "I seem always to want to make things from the thing that is commonest in nature." This throughout was his ruling principle, and some of the ways that it guided and affected his research are described in this book. The specialist will be able to trace it in many of his more. important interests. To others it was particularly evident in his long-distance running. In that he achieved by mere legs and feet what most of us achieve only with the help of horses or wheels and the internal combustion engine. In the Easter holidays of 1949 Alan stayed with us[1] at Criccieth (the Pearsons having lent us their charming house in Marine Terrace). One afternoon of overcast skies and threatened rain, Alan changed into blue shorts and disappeared for a short time. When we asked him where he had been he pointed out a promontory of Cardigan Bay seven or eight miles north-west, inaccessible by road. We might have entertained the idea of walking there, but not without carrying a meal and macintoshes with us, scarcely without resting an hour or so on the way. For us it would have been a day's outing, but Alan did it between lunch and tea. From that day-although his normal walking gait was uninspired and almost shambling-we all felt awed, as if Mercury had joined our circle of acquaintances.

That sentence from his childish letter without other evidence would stamp him as a genius. He was not merely doing something extraordinary in a small boy but *recognizing it as extraordinary*, and it is the recognition of self that carries genius through to achievement. I recommend this record to anyone who has an interest in the nature of what we call genius. We are very ignorant still about its origin and character and it is hard to see how this ignorance can be readily mended, owing to the lack of material to study. There are very few men and women of genius in any century, and of these few some are certain to be overlooked in their own time and possibly in all time. Of those who are known the material for biography

[1] Professor and Mrs M.H.A. Newman.

is often thin and dull, and particularly with men of science much has to be made of little. Sir Isaac Newton remains a mystery to us after every recorded morsel has been displayed and examined. A new anecdote of his youth would be seized as a treasure by the entire learned world, no matter how slight and trivial an anecdote it might be, for it is particularly the child and the boy that excites most curiosity. We want to know where and how a nature and mind so unlike the normal first showed its divergence.

Sara Turing survives her son owing to the tragic earliness of his death, and with great courage and faith she has taken the opportunity that his death offered and made this source-book for a future biographer. For it does show unusual courage not to be ashamed of putting down the trifling memories, the details of childhood and family affairs, the little events that are almost insignificant and yet have just that faint signature in the corner, "A.M.T.," which made them so well worth preserving. Nothing that science can ever offer is more valuable than the knowledge of how a scientist develops.

Lyn Irvine.

Family Background

The Turing family is of Norman extraction and the family tree goes back to 1316 AD, the family motto being *Fortuna audentes Juvat*. Having arrived in Scotland the members settled in Angus in a barony of that name, whence they removed to Aberdeenshire early in the fourteenth century and came into possession of Foveran, which remained the family seat until recent times. The name was variously spelled Turyne, Thuring, Turin, Turing. William Turin received the honour of knighthood from James VI of Scotland (James I of England) and thereafter Sir William added the final "g" to the name.

John Turing of Foveran was created a baronet by Charles I in 1639 for loyal service, and was at the battle of Worcester; but his loyalty cost him the loss of lands which had been in the family for 300 years. Records show Turings holding positions of trust and responsibility in the County of Aberdeen.

By the eighteenth century some Turings were venturing further afield. Thus Sir Robert Turing (Bart.), born in 1744, was a doctor and amassed a considerable fortune in the East Indies and then retired to Banff in Scotland where he made himself very useful and popular. One kinsman in the Honourable East India Company took part in the defence of Seringapatam. Others in the nineteenth century lived in Holland; two, father and son, were successive British Consuls in Rotterdam. Some of their descendants have now become domiciled in Holland. Alan's great grandfather, presumably through this Dutch connection, had some occupation in Batavia, maybe in some shipping concern. He was John Robert

Turing (1793–1828) who married Jane S. Fraser, and it was, I think, on a voyage back from Batavia that his family were involved in a shipwreck.

His son, another John Robert Turing, who was Alan's grandfather, was admitted to Trinity College, Cambridge, in May, 1844, and in the Mathematical Tripos 1848 was classed eleventh among the "Senior optimes." At Trinity he was notorious for sleep-walking on the leads. In 1848 he was ordained Deacon, and Priest in 1849, and was Chaplain of Trinity College from 1859 to 1871, and simultaneously from 1859 to 1864 was Curate at Great St. Mary's, Cambridge. Marrying Fanny Montagu Boyd he had ten children of whom eight survived. It was when he was Rector of Edwinstowe, Nottingham, that his son, Alan's father, Julius Mathison Turing, was born, 9th November, 1873. On the death of his father, when Julius was ten, the family moved to Bedford: later from Bedford School Julius won a history scholarship to Corpus Christi College, Oxford, and thence passed into the Indian Civil Service, and was posted to the Madras Presidency. He inherited none of his father's mathematical ability, in fact algebra was just mumbo-jumbo to him and as for the claimed result of one minus quantity multiplied by another minus quantity – that for him was beyond human comprehension.

On the maternal side Alan was descended from the Stoneys. According to Burke's Landed Gentry of Ireland the Stoneys are believed to be descended from a Danish family which settled near Kettlewell in Craven in Yorkshire about the ninth century and were known by the name 'de Stanehow,' or 'Stonehow.' One member of the family was Rector of Kettlewell about the time of Edward I and others were among those who paid Richard II's Poll Tax in 1379 at Buckden, three miles from Kettlewell. Sundry domestic events are recorded in the register of the Church at Rilston, Yorkshire, among these the marriage on 6th January, 1675 (date according to "old style" – by our reckoning 1676), of George Stoney of Kettlewell and

Mary Moorhouse of Rilston, direct ancestors of the Irish Stoneys.[1] George and Mary Stoney emigrated to Southern Ireland at the end of the seventeenth century obtaining land under the William and Mary scheme which offered inducements to English Protestants with capital to settle there. George Stoney took up his abode at Knockshegowna (Hill of the Fairies) in the northern extremity of Tipperary. Alan's great-great-great-great-uncle, Andrew Robinson Stoney, subsequently known as Bowes, married the Dowager Countess of Strathmore; under her father's will any person whom she married had to assume her maiden name to assure her inheritance. Hence the coupling of the name Bowes with the family name, Lyon, of the Earls of Strathmore. It is an understatement to add that Andrew Stoney Bowes was no adornment to the family.

The *Annals of the Stoney Family* show its members leading the ordinary life of the "landed gentry" in County Tipperary and King's County, occasionally sending sons to England for education and occupied with the supervision of their estates and livestock and with hunting. Some held positions of responsibility as J.P.s and so forth, one being Deputy Governor of Tipperary. There is something pleasantly feudal in the account of my father's great-grandfather, the principal magistrate in the neighbourhood usually holding a petty sessions court on his front door steps, while an arm-chair in the porch served as the "bench." Sundays saw large dinner parties of twenty to thirty guests at his home, Arran Hill, to which relations and intimate friends had standing invitations. He always enjoyed showing visitors his deer park and herd of Devon cattle. Open house was kept: guests stayed as long as they liked to hunt with their host's private hounds. In the little church at Borrisokane the Stoney's pew was a small room off the chancel with its own open fire – all very snug. It was the privilege of the eldest son to occupy a comer seat whence he could survey the congregation. This room

[1] Here I follow the record given in *Annals of the Stoney Family* by Major F. S. Stoney, R.A.

is now put to another use and houses the stove to heat the church, but a tablet above the door commemorates its having been the "Stoney Pew."

Thomas George Stoney, J.P., of Kyle Park, Co. Tipperary, Alan's maternal great-grandfather, married in 1829, Anna Henrietta Waller, a member of the family of Wallers, among whom were Sir William Waller (known by Londoners as "William the Conqueror"), a highly skilled General in Cromwell's army, and his first cousin, Hardress Waller. The latter was one of the Regicide Judges; but in 1660 he professed his penitence, adding that he "did appear more to preserve the King upon trial and sentence than any other." His petition for pardon is among the Egerton manuscripts in the British Museum.

This Thomas George Stoney (my grandfather) was a man of considerable enterprise. Over a hundred years ago he introduced on his lands mechanical reapers which had to be conveyed about sixty miles from the nearest railway. I have seen both a model of the school which he intended for the children of his employees and a specimen of the £1 notes signed and issued by him for use on his estates. However he "wasted his substance" on building and horses; so two of his sons, Francis G.M. Stoney and Edward Waller Stoney (my father), became civil engineers. The former, Alan's great-uncle, invented the "Stoney Sluice" used on the Assuan Dam, the Manchester Ship Canal, in the bridge over the Thames at Richmond and at numerous other places the world over; he was also the inventor of the "Titan Cranes." The story is told that Francis Stoney, on going up to be interviewed for a certain post, took a model of his sluice, the working of which he demonstrated to the other waiting candidates. Francis was the first to be summoned to the interview – when he emerged he found the waiting room empty; the other candidates, completely discouraged, had disappeared.

Edward Waller Stoney, C.I.E., Alan's maternal grandfather, spent most of his professional life as an engineer of the Madras and Southern Mahratta Railway, of which he later became Chief Engineer.

His inventiveness came out in the original methods he devised for the construction of bridges over some of the great Indian rivers, notably the Tangabudra. In connection with railways he brought out various patents, but to Anglo-Indians he was best known as the inventor of "Stoney's Patent Silent Punkah-wheel." Previously sleep was much disturbed by the creaking punkah- wheels. In 1903 he was made a Companion of the Indian Empire.

A distinguished collateral relation of Alan's was Dr. George Johnstone Stoney, F.R.S., president of the Royal Dublin Society. He pre-supposed the existence of the electron and in its hypothetical stage named it and also gave the name to ultra-violet rays. He was known as "Electron Stoney": with all his learning he used to say, "we know so little." He was one of the great who nevertheless retained into old age a childlike simplicity. I well remember him in his eighties with his long, flowing, snow-white beard. Age had not dimmed his enthusiasms. Gramophones were a new invention and he owned the most enormous one, from which he derived great pleasure. His knowledge of music was such that he used to compose himself for sleep by reading musical scores. Another great interest of his old age was the study of Esperanto, which he believed had a great future. His son, George Gerald Stoney, F.R.S., made his name in connection with work on steam turbines in collaboration with Charles, later Sir Charles, Parsons. From his father he had learned much about the technique of silvering of mirrors, which led to his appointment in 1893 as Manager, in addition to other duties, of the Searchlight Reflector Department of Messrs. C.A. Parsons & Co. Though he had resigned from the firm in 1912 he gave much advice on the re-organization of the searchlight mirror department which in the 1914–18 war had become the largest of its kind in the world. He likewise served on Lord Fisher's board of invention and research, and later on the Lancashire anti-submarine committee. (These activities are interesting to compare with Alan's work for the Foreign Office in the Second World War.)