



School of Computer Science & Information Systems
A Short History

Greetings from our founders, Andrew and Kathleen Booth



Kathleen and I send our greetings and best wishes to the students and Faculty of the Department of Computer Science at Birkbeck on the 50th anniversary of the foundation of the department in 1957. We wish that we could be with you but constraints of age and health make this impossible.

You may like to know that the original department was responsible for building one of the first operational computers in the World, the APEXC and its successors, the M series and the commercial version the HEC machines sold by the then ICT of which over 120 were produced.

Having produced the machines we needed teaching material and so produced the first systematic books on modern numerical analysis, programming and computer design.

On the research side we started research on Machine Translation, on thin film storage technology for digital storage, and magnetic drum and disc storage. Braille transcription, now touted as a recent IBM invention was actually the work of one of our Ph.D. students. And genetic, self modifying programs were also invented here.

These are only a few of our original activities and you are the carriers of a distinguished origin.

Kathleen and I (and the late Dr. J.C. Jennings the other member of the original faculty) send you our best wishes for the future. I do not expect to be with you in body in 2058 but I shall be with you in spirit.

**Andrew & Kathleen Booth
Vancouver Island, BC, Canada
April 2008**

1. Introduction

Birkbeck's historic mission of making university education available to the working people of London has created a unique institution. It attracts the fierce affection of students and staff alike. The many students who have subsequently joined the academic staff bear witness to its unique appeal. This short history records the story of the contribution of one department to, firstly, the life of the College, secondly, to the development of computing technology and, finally, to the computer industry.

The story starts with two men – firstly, J D Bernal one of the intellectual giants of the 20th century returning from government service in World War II and planning a new crystallography laboratory and, secondly, Andrew D Booth who had just gained a PhD studying the crystal structure of explosives and already experimenting with the automation of the large sets of calculations needed to determine crystal structures from X-ray images. By happy coincidence their paths crossed and J D Bernal invited Andrew Booth to join him at Birkbeck. Over the next 17 years Andrew Booth devoted his considerable energy to building numerous computers and experimenting with a large number of different applications

Fifty years ago he decided that this technology had reached a maturity which justified setting up a Postgraduate Diploma programme. Courses at Birkbeck could only be taught by a department and so October 1957 saw the establishment of a Department of Numerical Automation. From the beginning, computing courses have had a widespread appeal for Birkbeck students. Demand seems to fluctuate in roughly ten year cycles. Shortly after the millennium this reached an unsustainable peak with the dot.com boom and, worldwide, has tumbled further and faster in reaction although this year's recruitment suggests we may have finally passed the bottom of the cycle.

Birkbeck has always had to take care to live within its means. Its unique makeup leaves it exposed to the winds of maverick politicians and the law of unintended consequences. Small financial changes for most universities can seriously damage Birkbeck's finances. Consequently, the College has adopted Micawber style financial strategies – with successive Finance Directors usually managing, even in very unpromising years, to have the metaphorical sixpence left at the year's end!

So throughout the story that follows there are recurring references to space and resource limitations. Despite these periodic inconveniences and uncertainties, the School has continued to fulfil its prime mission of providing research led higher education. The enduring affection for Birkbeck of students and staff, not least in this School, are a testimony to the continuing value of our mission.

2. Early Years

The origins of computing at Birkbeck are inextricably linked with the names of Andrew Booth and his boss J D Bernal¹, the great crystallographer. Returning to Birkbeck at the end of WW2, Bernal started building a new research group to study crystallography. He appointed four assistants, one of whom was to lead on mathematical methods. He appointed Andrew Booth who had completed a PhD on crystal structures of explosives at Birmingham in 1944. His father was an engineer and part time inventor. Consequently it was perhaps not surprising that Andrew Booth developed devices to relieve crystallographers of the “tyranny of mathematics”. He started by building analogue devices and shortly after his arrival at Birkbeck he started to build his first electromechanical calculator, the **Automatic Relay Calculator (ARC)**, Figure 1. Due to a lack of space in Birkbeck the machine was built at the British Rubber Producers Research Association in Welwyn Garden City where he had been briefly employed between Birmingham and Birkbeck.

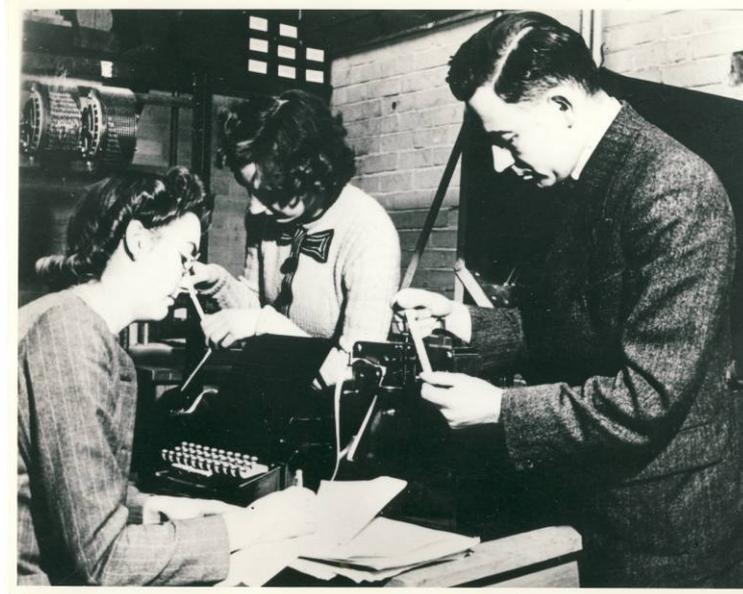


Figure 1 Kathleen Britten, Xenia Sweeting and Andrew Booth working on ARC in December 1946

In 1946 Bernal obtained funding from the Rockefeller Foundation for Andrew Booth to visit US researchers working on computers. Andrew Booth reported that only von Neumann (a friend of Bernal) at Princeton gave him any time.

In 1947 Booth undertook a 6 month US tour based at Princeton with von Neumann and accompanied by Katherine Britten who was soon to become his wife. This led to a redesign of the original ARC with a “von Neumann” architecture (sometimes referred to as ARC2). Andrew and Kathleen Booth set out the technological options for each of the components of a computer using a “von Neumann” architecture. This paper² circulated among the growing community of computer pioneers and they produced a second edition.

¹ J D Bernal - The Sage of Science by Andrew Brown, OUP, 2005, ISBN 0 19 851544 8

² A D Booth & K H V Britten, General Considerations in the Design of an All Purpose Electronic Digital Computer, (2nd edition), August 1947, Birkbeck College, London

Key to a “von Neumann” architecture was the memory. Andrew Booth was interested in building a low cost computer and so he started experimenting with magnetic oxide coated paper discs as then used in the USA for recording simple voice messages. However, it proved impossible to keep the disc flat when rotating at speed and so he moved on to using nickel coated drums which were built by his father. Thus it was that Andrew Booth built the **world’s first rotating store** albeit a drum rather than the now ubiquitous disc. This is now on display in the Science Museum, London, see Figure 2.



Figure 2 Booth's First Drum
Photo Courtesy of NMSI, London

During 1947 Andrew Booth met with Warren Weaver, Natural Sciences Division Director, Rockefeller Foundation, who had funded the trip. Andrew Booth asked if the Foundation would fund a computer for London University. Weaver said that the Foundation could not fund a computer for mathematical calculations but that he had begun to think about using a computer to carry out natural language translation and that the Foundation probably could fund a computer for research in that area. Thus Birkbeck became for the next fifteen years a leading centre for natural language research. Initially the tiny memory on computers meant it was very difficult to do any serious processing but Andrew Booth and his research students developed techniques for parsing text and also for building dictionaries. Numerous papers and several books were published.

These events gave rise to the first official reference to computing at Birkbeck, in the 1947-8 College Annual Report, which says:

An ambitious scheme is in progress for the construction of an Electronic Computer, which will serve the needs of crystallographic research at 21-22 Torrington Square; it will also provide a means of relieving many other fields of research in Chemistry and Physics of the almost crushing weight of arithmetic work, which they involve. A temporary building to house it is to be erected on the site of a neighbouring static water tank, and generous gifts of parts and money have been received from various sources, including the Rockefeller Foundation, New York.

Notwithstanding the Rockefeller Foundation's funding of a machine expressly for natural language processing, readers will note the emphasis here on the "unfunded" mathematical calculations although, in fairness, natural language processing was to feature in later years.

Andrew Booth, even in the days of cumbersome early machines, wrote about making computers available as widely as possible. Nonetheless the following extract from the College report for 1949-50 under the unpromising heading of "Desk Calculating Machines" seems well ahead of its time:

The Committee of the Privy Council for Scientific and Industrial Research have made a grant for a programme of research on desk calculating machines to be carried out over the next two to three years on behalf of the National Physical Laboratory by the Electronic Computer Laboratory at Torrington Square.

This project seems to have ended prematurely without a prototype being built but a copy of Andrew Booth's report from 1950 has recently been found in the Science Museum archives³. In it Andrew Booth evaluates the technical options for putting computers on, if not the desktop, at least the laboratory bench.

Around 1948/49, Andrew Booth redesigned the ARC2 as an entirely electronic machine which he called **Simple Electronic Computer (SEC)**. This was built by Norman Kitz (formerly Norbert Kitz), see Figure 3, and is written up in his 1951 MSc (Eng) dissertation⁴. This appears to make him the first computing graduate at Birkbeck and hence our earliest alumnus.



Figure 3 Norman Kitz working on SEC, December 1949

³ DEC – Desk Electronic Computer by A D Booth, 1950, unpublished report to DSIR, Science Museum Archives.

⁴ A Discussion of Automatic Digital High-Speed Calculating Machines with special reference to SEC – A Simple Electronic Computer, MSc (Eng) thesis by N Kitz, 1951

An interesting historical footnote is that Norman Kitz left Birkbeck to work for English Electric at NPL on the DEUCE computer. From there he moved to Bell Punch and designed the **world's first electronic desktop calculator**, called ANITA. So although Andrew Booth never built a desktop calculator at Birkbeck, possibly he inspired one of his students to do so.

Andrew Booth moved swiftly on to create his best known computers, the **All-Purpose Electronic Computers** (APEC). The 1951/52 College Annual Report proudly records that *“The APEXC calculator operated successfully for the first time on 2nd May 1952”*. A year later the 1952/3 Report records that:

The second digital computer APEXC [the first was SEC] has been completed and is in use. It has shown the expected speed of about several hundred times as fast as mechanical methods but has exceeded expectation in its reliability and freedom from breakdown. An improved model is almost complete and will take its place as soon as the first is sent to its owners, the British Rayon Research Association.

The Annual Reports are slightly confused with regard to the computers' names. It is possible the names changed over time. Andrew Booth subsequently refers to the Rayon Research machine as APE(R)C – R for Rayon - and the later APE(X)C – X for X-ray - was the Birkbeck crystallographers machine, see Figure 4.

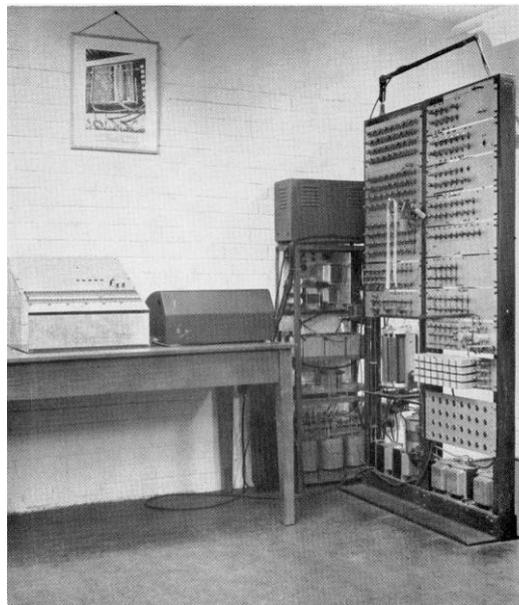


Figure 4 APE(X)C Computer in 1956

Accommodation at Birkbeck was at a premium and so Andrew Booth built his APE(R)C and probably others in a barn in Fenny Compton, Warwickshire where his father lived.

It was to this barn in March 1951 that a three man team led by Dr Raymond “Dickie” Bird⁵ from British Tabulating Machines (BTM) came to visit. BTM were the UK’s leading supplier of punch card systems and their management had decided that they needed a small computer to improve the calculating power of their tabulators, specifically to add sterling currency capability.

⁵ The Design of an Electronic Digital Computing System, PhD thesis, R Bird, Birkbeck College, London 1957

BTM copied Andrew Booth's circuitry and after they returned to BTM's factory at Letchworth they added extra I/O interfaces and named the resulting computer the Hollerith Electronic Computer (HEC), see Figure 5. This prototype computer is one of the world's earliest surviving electronic computers, and unlike so many early machines which were dismantled when no longer needed, is now in store in the Birmingham Museum together with a unique electro-mechanical drum and two early electronic drums all designed by Andrew Booth.



Figure 5 BTM HEC 1 Prototype in store at the Birmingham Museum

BTM moved ahead rapidly getting HEC1 to work by the end of 1951. BTM management decreed that the HEC would go to the Business Efficiency Exhibition in 1953 and so a new machine (HEC2) had to be built contained in a smart metal cabinet. Eight similar machines were sold as the HEC2M mainly for technical applications. The successor was the HEC4 which was a data processing machine of which about 100 were sold in the UK and abroad. At the end of the 1950s this was the UK's best selling computer by volume. After BTM merged with Powers SAMAS to form ICT the HEC4 became the ICT 1200 range, see Figure 6.

Over the next few years the Department grew and there was a steady flow of journal and conference papers and notably a series of books, several going into more than one edition. One notable landmark was Kathleen Booth's book on programming the APEC computers⁶.

⁶ Programming for an Automatic Digital Calculator by K H V Booth, Butterworths, London, 1958.



Figure 6 ICT 1201 of 1956

This was an early book on programming and unusual in having a female author. She did most of the programming while Andrew Booth built the computers. Many papers were published on text processing including creating Braille output and natural language translation. On November 11th 1955 the laboratory gave a **public demonstration of machine translation**, see Figure 7.

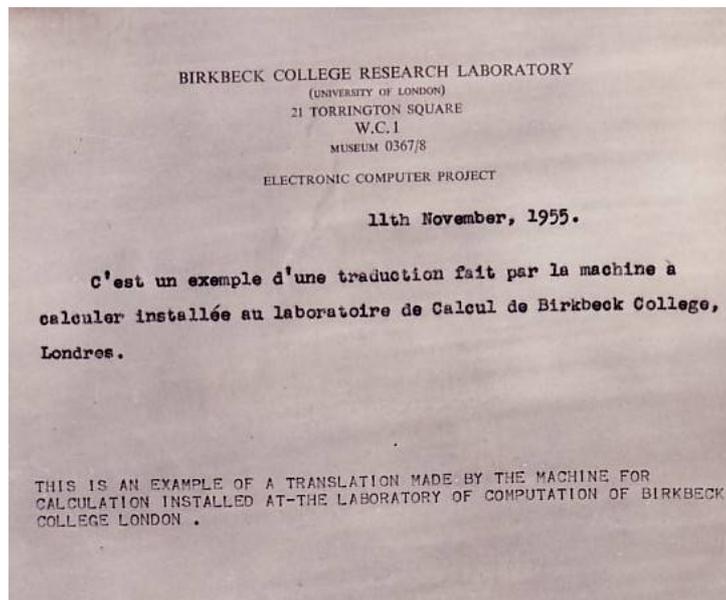


Figure 7 Machine Translation of Natural Language 1955

One feature of Andrew Booth's time at Birkbeck were two prizes given in memory of his parents and a research studentship. The Catherine Jane Booth prize was awarded alternately in the departments of Classics and History of Art and the Sidney Joseph Booth prize in Mathematics, preference being given to Applied Mathematics. These continued for many years after he left. Finally, from the 1955/56 session, there was the Hollerith research studentship, funded by the BTM Company Ltd, of £325 per annum for competition by graduates to read full-time for a higher degree on "digital computers or kindred subject".

The College Report of 1956/57 reported change was in the air as a University computer service was established. It reports:

The work of the [Birkbeck] Computer Laboratory has changed its emphasis from computing to development because the former function will now be adequately fulfilled by the new University Computational Unit.

However, language processing work continued apace:

Work on machine translation of languages has, however, continued at full speed and with the completion of the French programme for scientific texts attention has been transferred to German and to aspects of Platonic chronology. The laboratory was fortunate in having Dr Rais Ahmed, from the University of Aligarh, as a guest during part of his sabbatical leave and his presence gave considerable impact to the work on spoken word recognition.

One of the College's best known former students and now a College Fellow, Dame Steve Shirley, who later founded a major UK software house remembers, as a student of mathematics and computing at that time:

intoning "one, one, one two, two, two" into a tape recorder for some very early voice recognition research led by Andrew Booth

However, the high point of the 1956/57 academic year was the Governors' resolution on July 18th 1957 that:

From the beginning of the next session the Computer Laboratory be constituted as a separate Department under the Headship of Dr A D Booth

The author has been told that the Department of Numerical Automation was the **first department established to teach computing** in a UK university, elsewhere the courses were still taught in Computer Laboratories. This is a difficult claim to verify and the author would welcome any information of earlier departments.

Outside the Department, Andrew Booth's played a key role through his appointment as chairman of a committee formed to set up a "National Computer Society". The 1956/57 Report notes that when it was formed in June 1957 he was elected to serve on the first Council of the **British Computer Society**.

Despite the start of a university computing service, Andrew Booth continued to build new machines. After the APEC machines, came MAC (Magnetic Automatic Calculator). Three examples of a development of MAC named M.2 were built by Wharf Engineering Ltd, a company established by Andrew Booth and his father and which operated from Fenny Compton. These were for UCL, Kings College and Imperial College. The machine delivered to Kings College is shown in Figure 8. The Governors' minutes of July 18th 1957 record a grant from Imperial College of £8,000 for the construction of their machine. The Annual Report for 1957/58 notes

The keynote of the M.2 is, as in previous machines, small size and simplicity, and an idea of what has been achieved is provided by the fact that M.2 occupies a space rather less than that of an office desk, consumes as much power as an electric fire, but has roughly the speed and capacity of the much larger commercial machines which are being provided for some of the smaller Universities.



Figure 8 M.2 awaiting delivery to KCL in 1959 with Department Secretary, Jill Metherell

The College Annual Report of 1958/59, in a foretaste of much more recent work, reports Dr Kathleen Booth developing a program to simulate a neural network to investigate ways in which animals recognise patterns. The following year reports a neural network for character recognition.

The 1960/61 College Report records with some hyperbole that:

In the early summer [1961] the College received the greatest benefaction in its history, when International Computers and Tabulators Ltd. offered to make available to the Department of Numerical Automation the I.C.T. Type 1400 Computer, of which the market value is little less than a quarter-of-a-million pounds. The generous action was a notable compliment to Dr A.D. Booth for his pioneering efforts in the computer field, and especially for his work on mechanical translation and in promoting the study of the analysis of language. The availability of this new giant will greatly enhance the possibilities of highly successful progress in these studies. Suitable accommodation is being sought for its housing. The Nuffield Foundation made a generous grant of £10,000 towards the cost of installation and commissioning.

The department estimated that the machine was roughly ten times as fast as the University Ferranti Mercury. The following year the College Report records that the ICT 1400 would be housed in the London School of Hygiene and Tropical Medicine. However, it also recorded that Andrew and Kathleen Booth resigned at the end of the 1961/62 academic year. Andrew Booth has given his account of the circumstances in two places^{7,8}; mainly due to the College not conferring a Chair on him. In retrospect this was a massive loss to the College and, from today's perspective, totally incomprehensible given his key contributions to computer technology and his huge research output. Andrew Booth moved to Canada where he continued his distinguished career in computing initially at the University of Saskatchewan and subsequently as President of Lakehead University, Ontario.

The impact of his departure was bound to be considerable. The problems were compounded by the College failing to appoint an experienced academic to lead the

⁷ Andrew D Booth, an autobiographical sketch in *Annals of the History of Computing*, Vol 19, No 4 (1997) pp57-63.

⁸ Pioneers of Computing interviewed by Christopher Evans for the Science Museum, London 1976.

department. For the interim, Mike Levison, who had joined as an assistant lecturer two years earlier, was appointed Acting Head of Department.

The installation of a large computer into space not planned for it inevitably gives rise to problems. The first difficulty, in what would become a long running, sad saga, was a long delay until the start of the 1962/63 academic year waiting for the installation of the special power supply. The following year records better than expected progress following the acquisition of paper tape I/O equipment. The report ends optimistically “some useful time should be available next session”.

Of more long lasting significance is the final sentence in the Annual Report that

From the start of the next session [1963/64] the title of the department will be changed to **Department of Computer Science**.

The Annual Report for 1963/64 reports that during the session the line-printer had been commissioned and towards the end of the session a magnetic tape unit was brought into service. Overall, the machine is reported as being “in use for a high proportion of the time each day”. Alan Sentance and Frank Burgoyne developed “several new programming aids”. A year later the punch card reader was working and Simon Evans had joined “to write a CHLF 3 Autocode compiler for the computer which will benefit the majority of users”. Without such a compiler, users were obliged to write programs in assembly language.

However, while peripherals and system software progressed, the Annual Report for 1965/66 ominously reported:

The reliability of the machine gave cause for considerable concern. The underlying reasons for this were carefully investigated with the assistance of one of the original machine designers from I.C.T., and a number of modifications made. As a result the machine and tape decks are now operating satisfactorily.

The report concludes by noting the appointment of our longest serving colleague Trevor Fenner as an assistant lecturer for the academic year 1966/67 and who is happily still in the School today.

The following year, 1967, was a momentous year for Birkbeck. The College adopted the recommendations of the Ashby Report⁹ into the future role of the College which specifically turned the College away from teaching full time undergraduates. The College heeded the advice of the then Chairman of the Universities Grants Committee (UGC). However, the College finances took a heavy blow when the following year the funding to match the UGC’s suggestions failed to materialise. After this unpromising start the Annual Report continues

We need urgently to put our Computer Science department on a firm footing and to add to the strength of our Statistics Department, both the subject of rising part-time demand.

As a result a Chair in Computer Science was established and a search was started for a suitable candidate.

⁹ Report of the Academic Advisory Committee on Birkbeck College, “Ashby Report”, May 1967.

Given the financial position of the College it is not surprising to read in the departmental section of the Report:

During the year it was finally decided that the 1400 Computer had outlived its usefulness, and the machine was dismantled. In the coming year the College is to receive a 217 Data Link to the CDC 6600 Computer, which the University is to install at a site in Guilford Street.

This brought to an end the sad story of the ICT 1400 which had arrived to such fanfares in 1961. Departmental staff who only remember using the Ferranti Atlas so it seems likely that it never provided a useful service. Some years later an official history of ICL was published which provides an interesting contrast to the Birkbeck version. It records:

The 1400 series was ICT's prestige computer project. It had been heavily publicised since 1958; but during 1959 not a single sale had materialized. The 1400 was a first generation machine based on thermionic valves, and this technology was being rapidly overtaken by the new transistor electronics. ... There was no prospect of selling the machine in the 1960s. As a result the entire project was scrapped, and the prototype sold off to Dr Andrew Booth at Birkbeck College for a token £5,000.

Thus it appears that far from being the "greatest benefaction in its history" as the Master wrote in the 1961 report, the College was effectively given an obsolescent prototype computer, which no longer had any value for its builders. It is beyond the author of this short history to sort out how this sorry chain of events came about or to explain the motives of the various parties involved!

However, on a more optimistic note, 1967 was not without significant benefit to the School with the arrival in January of a new lecturer, George Loizou, who, now as an Emeritus Professor, is still actively researching and publishing here.

The next academic year brought the very difficult 1960's to a close with substantial promise for the future. The Department's contribution to the Annual Report was fuller than usual and noted several important developments. In November 1968, 29 students were awarded M.Sc's, seven with distinction. Demand for the M.Sc remained buoyant with 400 applications for the less than 40 places available. It records that, in June 1969, the College was connected to the new massive CDC 6600 via a punched card remote job entry terminal. This transformed the College's computing facilities.

The report ends with staffing changes, where two more stalwarts of the School joined the lecturing staff, Tom Westerdale from the USA and Mick Farmer who had previously been on the research staff. Finally, only seven years after Andrew Booth's departure it notes that:

During the summer vacation the Department learned that Mr P J H King, Head of the Computer Unit at the University College of Wales, Aberystwyth (and also Treasurer of the Court of Electors [alumni association] at Birkbeck), had been appointed to the vacant Chair in the Department. He takes up his appointment on the 1st January 1970.

Thus the department was finally able to put behind it the uncertainties and disappointments of the 1960s and with student demand buoyant and greatly enhanced computing facilities it could move forward to greet the challenges of the 1970s.

3. The Making of the Modern School

The Ashby Report in 1967 on the future options for Birkbeck had highlighted the urgency for the College to put the Department of Computer Science on a proper footing as it was clear that there was significant demand from students for courses and so the area had significant growth potential. Peter King took up the Chair of Computer Science on January 1st 1970, not a Bank Holiday in those days! The Annual Report records a small but very familiar list of other academic staff – Mick Farmer, Trevor Fenner, George Loizou and Tom Westerdale together with Mike Levison who was about to leave for Canada to be replaced by Jim Inglis.

By the following year the new direction for the department was becoming clear. The 1970/71 Annual Report records that

Research activity included participation in the current discussion in the industry on data base technology and Professor King lectured at the one-day conference of the BCS in October on the DBTG proposals emanating from CODASYL.

The College Calendar for 1970/71 is the first to acknowledge “Computer Staff” as a distinct group, comprising two programmers, two operators and four computer assistants who prepared paper tape and punched cards. The IT support staff of the College and the Department all reported to the Head of the Computer Science Department. This arrangement continued for many years until a separate College Computer Service was created.

November 1971 saw the appointment of Betty Walters as the department’s secretary. Betty finally retired in 2007 having seen the department through almost every challenge and drama that academia can provide over 36 years.

The research activities of the department by the early 1970s lay in the areas of Data Management and Artificial Intelligence, which have continued to be developed and enhanced right up to the present day, leading to the School’s current major research groups in and Information Management & Web Technologies and Computational Intelligence.

A notable event was the College Open Day on Friday July 13th 1973. The Annual Report notes that

The computer services section did a splendid job in entertaining and enlightening the populace as well as assisting members of staff and postgraduate students with the more specialist equipment demonstrations.

However, the high spot was the visit of the relatively unknown Secretary of State for Education, Mrs Margaret Thatcher. Luckily a photographer was there to record her meeting with a young Peter King, see Figure 9.

The University of London’s Institute of Computer Science in Gordon Square had developed from the earlier University Computational Unit initially running a Ferranti Orion later replaced by the Ferranti Atlas computer. It taught courses leading to the University M.Sc in Computer Science which allowed students registered at one participating institution to take courses for credit at another. The result was a healthy

interchange of students between, among others, Birkbeck and the Institute. However, with the coming of the University of London Computer Centre in Guilford Street running a university wide service on their CDC 6600 and the ending of the Atlas service, one key role of the ICS disappeared. In the consequent review the decision was made to close the ICS in 1972. The staff were transferred to other colleges and



Figure 9 Peter King meets Margaret Thatcher at the 1973 Open Day

the former Head of the Institute, Prof Dick Buckingham, moved to Birkbeck as Professor of Computer Education together with his secretary until his retirement in 1978.

The promotion of John Florentin to a Chair in 1977 meant that for a short while the department had three professors, a situation that was not to recur until the early 1990s.

In 1978/79 it became known that the Department was finally to be united on a permanent basis on a single site accommodating all its staff, research staff and students and its equipment in Senate House. This brought to an end the long period of inconvenience and uncertainty throughout the 1970s. The Annual Report discusses briefly the technological advances made in the 1970s before concluding with the masterly understatement that

Failures in software engineering techniques will undoubtedly cause many disappointed hopes in the 1980s. The area remains a considerable challenge.

The department entered the 1980s with two professors and seven lecturers although George Loizou was shortly to be promoted to a Readership. However, the department was about to be changed significantly by a government scheme to offer a very generous early retirement scheme to older staff and a “New Blood” scheme to attract younger staff. The result was the arrival of the author in 1983 (at age 37 some thought not very “New Blood”!) but offset by the retirement in September 1984 of Peter King and also David Cairns who had been running the Diploma in Computer Science, although Peter King was subsequently re-engaged as a part-time Senior Research Fellow which he combined with the headship of the department until a successor was appointed. The

following year John Florentin also took early retirement leaving a staff in October 1985 of one Reader, one Senior Lecturer and five lecturers.

The start of the academic year 1986/87 saw significant change with the appointment of Clement Leung from UCL to a Chair of Computer Science and Head of Department. He had published extensively on performance studies of disc units and so complemented the work of a number of the other academics on data base management. It also saw the arrival of three stalwarts of the department – Keith Mannock who came with Clement Leung from UCL, Nigel Martin (who had been a temporary lecturer in 1985/86), and Roger Mitton; the latter two following the familiar pattern of having graduated well from our postgraduate programmes.

1985 had seen the College struggling with one of its periodic financial crises. A report was produced by a committee under the chairmanship of Barney Hayhoe, MP, a College governor, which recommended that the College to improve its financial management of its core academic business by grouping departments together into Resource Centres. The buoyant Computer Science department was grouped with the struggling department of Mathematics to form one such Centre. The author was appointed to head this Resource Centre. The department of Statistics chose for its own reasons to join Geography and Economics in another Resource Centre. The Resource Centre Heads provided a “kitchen cabinet” for the then new Master, Dr Tessa Blackstone.

The School had a heavy preponderance of researchers on data management, probably the largest in the UK at that time. Consequently it was natural that members of the department played a major role in organising the Very Large Data Base (VLDB) conference in 1987 which was held at the Brighton Conference Centre and attended by over 700 delegates from all over the world.

The continued decline in Mathematics student numbers meant that the department was able to benefit from the transfer from that department of Ken Thomas and Keith Gibson in 1988 who rapidly settled into their new home.

In 1991 the College reviewed the operation of the Resource Centres and concluded they were working effectively but that some were too small. Consequently Computer Science and Mathematics were merged with Economics, Geography, Management and Organizational Psychology and Statistics to form a larger Resource Centre led by David Rhind. His departure the following year resulted in the author resuming the post of Head of Resource Centre. The department thought carefully about whether to join this “social sciences” group or to opt to join the “science” grouping. The decision to opt for the former was influenced by several factors including the preponderance of postgraduate students in the social sciences group and the shared undergraduate teaching with Management. This decision to join “Resource Centre C” was, after subsequent adoption of faculties, to result in the uncommon situation of having a School of Computer Science and Information Systems in a Faculty of Social Sciences.

As the College recovered from its financial difficulties, Tessa Blackstone embarked on a substantial round of fundraising. About 1991, following a lunch with Lord (David) Young, who was a government minister under Margaret Thatcher, the department received a request from the Master’s office to prepare a proposal for Cable & Wireless,

of which he was then Chairman, for a new development in “business information systems”. The result was the endowment of the Cable & Wireless Chair in Information Systems, held by Guy Fitzgerald, and the creation of the department’s own undergraduate programme jointly with the Department of Management described more fully in section 4. Tessa Blackstone then obtained further funding from Camelot to provide initial funding for a further lectureship in Information Systems, held since then by David Wilson.

The new B.Sc course proved a winner from the start. The course has proved among the most consistent recruiting courses with first year intakes restricted in some years by the capacity of the computing laboratories. The College has endeavoured to respond to student growth with additional staff posts and so through the later 1990s additional staff joined the department. By 2002 this had reached 21 academic staff.

The staff of the Department continued to contribute to advancing the profession and research. In 1992/93 the author served as President of the British Computer Society. In 1997 the department hosted two conferences, firstly the 15th British National Conference on Data Bases (BNCOD) and secondly the 2nd International Symposium on Intelligent Data Analysis (IDA-97).

The School’s portfolio of courses increased still further in 1998 when the then College Secretary asked if the department would wish to take over a Certificate and Diploma programme in IT Applications from the Centre for Extra Mural Studies (CEMS). The costs of this course to CEMS were substantial as they had to hire expensive computer workstation rooms. Since the course was taught both in the evenings and at the weekends the department could largely use its own workstations. This addition brought Janet Billinge and Ian Harrison on to the department’s staff. It also meant that the department, uniquely in the college, was offering a portfolio that covered short courses, undergraduate, postgraduate and research degrees. These vocational short courses have proved extremely popular with typically over 400 attendees each year.

In research, the 1990s saw further expansion into bio-, medical and neural informatics, information systems, and software engineering, with further increases in the School’s numbers of research students, both full-time and part-time.

In 1999 it was agreed to replace the College’s unusual “Resource Centre” structure by more conventional faculties and to re-designate Departments as Schools. “Resource Centre C” became a more intelligible Faculty of Social Sciences, Resource Centre Heads became Deans and the Department of Computer Science adopted its current name of School of Computer Science and Information Systems.

The next major event came with a government initiative to establish Foundation Degrees (FD) which would combine traditional academic study with workplace skills. The Foundation Degree was one of four launched in January 2002. This has proved to be another very popular course and is described in more detail in section 4.

At this time, the College gave its highest accolade, a College Fellowship, to two members of the Birkbeck community who had made distinguished contributions to the advancement of computing. Firstly, in 2002, to Dame Stephanie Shirley, Figure 10, who created a major UK software house whose workforce for many years was

composed principally of women working from home and who has subsequently done much to promote the responsible application of IT and other charitable activities, especially in the field of autism. Secondly in 2003 it awarded a College Fellowship to Andrew Booth in recognition of his lifetime contribution to computing.



Figure 10 Dame Stephanie Shirley (left), on the occasion of her installation as a College Fellow in 2002 with Dame Judith Mayhew, Chairman of the Governors

The School's research activities in the 2000s have expanded further, into advanced logics, computer vision, ontologies, personalisation, web technologies, and ubiquitous computing, with the appointment of several new members of academic staff. The School's current staff complement stands at 21 academic staff – 5 Professors, 2 Readers, 4 Senior Lecturers, 10 Lecturers; 4 academic-related staff; 8 research staff; 3 teaching assistants; 5 systems support and 6 administrative staff.

2004 saw the School embark on its biggest ever initiative, in partnership with the neighbouring Institute of Education. This was the establishment of the London Knowledge Lab (LKL) bringing together in one shared building academics with interests in education, sociology, culture and media, semiotics, data mining, information management, personalisation and ubiquitous technologies. The project was made possible by a £6 million grant from the Science Research Investment Fund, see Figure 11.

This has created a unique mix of over 50 researchers who can tackle issues from many different perspectives, and this is reflected in the LKL's mission, which is to:

- Understand the place of digital technologies and media in our cultural, social and educational relationships with knowledge – finding, acquiring, creating, and sharing it;
- Design, build and evaluate systems, processes and interfaces that enhance learning, both formal and informal, throughout life; and
- Examine critically the assumptions about knowledge and learning that underlie the increasingly wide range of applications of digital technologies.

The ways in which we learn, and what we need to know, are changing. The LKL's research aims to explore and invent the roles of technology in this process, and to understand how technology relates to broader social, economic and cultural factors. The LKL has two Co-Directors, one from each institution. The first Computer Science Co-Director was Mark Levene who was succeeded by Alex Poulouvassilis.



Figure 11 Ground Floor of the London Knowledge Lab

January 2008 saw the School embarking on its latest initiative. This was to run the College's first degree programme in Stratford. With strong support from the Higher Education Funding Council for England (HEFCE), the College is working in partnership with the University of East London to bring the Birkbeck tradition of research-led higher education to a new campus in Stratford in east London. Not surprisingly, preliminary market research showed keen interest in computing courses. In response the School has advertised its successful Foundation Degree in IT and 17 students formed the first cohort of students.

Life in our discipline is never dull. The rapidly evolving technology is always opening up new application areas while new challenges from the real world drive the technology developers to continually push the frontiers forward. Technology development is now largely in the hands of large industrial corporations while the universities are increasingly focussed on novel uses of the technology.

4. Courses

The Department has always been characterised by a strong series of postgraduate degree programmes supplemented more recently by a B.Sc degree programme, an IT Skills Certificate and Diploma programme and most recently by a Foundation degree.

The earliest references to teaching are in the College Calendars for 1949/50 and 1950/51 where it states that Dr Andrew Booth will give a lecture series entitled the “Theory and Design of Computing Machines” although for both years it is marked “Courses to be arranged”. They disappeared as suddenly as they appeared so possibly they were ahead of their time!

The next reference is in the Calendar for 1956/57 which describes an “Academic Postgraduate Diploma in Numerical Analysis”. It says that the course is

.... intended for Honours graduates in Mathematics, Physics and Engineering. It provides training in the programming and design of automatic computing machines as well as in numerical analysis. The course extends over two years for part-time students and consists of lectures and practical work on problem preparation, both for hand machines and for an automatic digital calculator.

The 1958/59 Calendar gives us a breakdown of the course content:

Dr A D Booth	Numerical Methods, The design of Computing machines
Dr Kathleen H V Booth	Programming
Dr D R Cox	Monte Carlo methods
Dr J C E Jennings	Finite difference processes and ordinary differential equations

The following year, Practical Numerical Analysis was added to the Diploma, taught initially by Mr (later Prof) A J T Colin. The first three successful graduates are listed in the 1961/62 Calendar as Ronald Ades, Ian Brighton and Arthur Nice to be followed in the 1961/62 Annual Report by William (Alan) Sentance, who like many later graduates decided to stay at Birkbeck by joining the staff!

The next development in teaching was the re-designation of the Diploma for the 1965/66 academic year as an M.Sc in Computer Science covering three topics – Basic Computer Science, Algorithmic Languages and Compilers, and Numerical Methods. In addition the Department also started offering undergraduate modules for the College B.Sc degree scheme. The M.Sc was an instant success with over 100 applications reported for the 30 places in 1965/66 with many more received for 1966/67. The first 11 graduates (3 with distinction) are listed in the Annual Report in 1967/68 and 27 the following year.

At the same time as launching the M.Sc the Department substantially increased its range of undergraduate modules offered to any student on the modular B.Sc degree. This increased numbers of undergraduates studying with the Department to over 100 although there was never a B.Sc in Computer Science. This pattern of teaching continued throughout the 1970s although the number of undergraduate modules offered slowly declined. This was reversed in the late 1980s when the Department rapidly expanded its undergraduate provision on the B.Sc in Mathematics, Statistics and Computing programme but the programme ceased to be offered in 1997/98.

Following Andrew Booth's departure the production of PhD candidates diminished and only resumed with that of the author, in 1974. Recruitment to the MPhil/PhD degrees continued thereafter and increased steadily from the 1980s to the present day, when there are currently over 40 research students in the School.

Following the closure of the Institute of Computer Science in the early 1970s, Dick Buckingham brought with him a Diploma in Computer Management Studies which ran for several years until his retirement. This was a course on the management of computer centres, aimed at mature international students mainly from then newly independent Commonwealth countries and who received support from UNESCO.

The Annual Report for 1978/79 noted that the department had formally transferred teaching of Numerical Analysis to the Department of Mathematics with the comment

This rationalisation was somewhat overdue ... and accords with the generally accepted view among computer scientists. This department continues its two undergraduate service courses, Introductory Computing, and Computer Systems and Programming, for which there continues to be a demand.

The growing number of undergraduate computer science courses in universities meant that the range of prior knowledge and experience of MSc applicants was dramatically widening. Some students were seeking advanced study following an undergraduate computing degree while others had only limited computing experience. The decision was taken to offer two separate courses, namely the existing Masters degree for those with a computing related first degree and a new course for those studying computer science for the first time. The result was the introduction of a Diploma in Computer Science in the 1977 Calendar. The new Diploma is described as "essentially a 'conversion' qualification but applicants should already have some practical computing experience."

This pattern continued successfully until the end of the 1980s when student numbers on the Diploma started to decline as most other UK universities offered an M.Sc to successful "conversion" course students. The decision was taken to re-designate the Diploma as an M.Sc in Computing Science (to distinguish it from the advanced M.Sc in Computer Science) and to rename the M.Sc in Computer Science as an M.Sc in Database and Information Systems. Inevitably this took several years due to both courses being offered full and part time. However, the Calendar for 1990/91 shows both of the new names in place.

The M.Sc conversion course is unique at Birkbeck by being offered full time, part time and day release. Given the substantial numbers of full time students that joined the course each year and the limitations on workstation facilities it was customary to teach most modules twice – once in the day and once in the evening. It took only a little re-arrangement of the timetable in the mid 1980s to offer part time students an opportunity of studying for one whole day and one further evening rather than on three evenings. This continues to be a popular mode of study for around 20% of part timers.

The case for the Cable & Wireless Chair in Information Systems stipulated the creation of a new B.Sc course in Information Systems and Management. The College had established a new Department of Management in 1992 whose initial degree programmes were BA degrees in Management and a language – French, German or

Spanish. Consequently it was relatively easy to reuse the Management part of these programmes and to combine it with a new Information Systems programme composed of mainly new modules covering computing topics with a strong emphasis on the application of IT to modern organisations. From its start in October 1993, this course proved a major success and for many years has been amongst the best recruiting undergraduate programmes in the College.



Figure 12 Happy M.Sc Computing Science students in 1995 working in the then recently refitted workstation room 131

In 1998, the department was asked by the then College Secretary if it would be interested in taking over a Certificate and Diploma programme in IT Applications taught in the Centre for Extra Mural Studies. The programme consisted of a wide variety of skills based modules, each taught over 6 week periods both in the evenings and at weekends. Successful completion of 6 modules gave the student a Certificate and a further 3 modules plus a project resulted in a Diploma. These modules proved popular with some students taking just one module while others went on to obtain a Certificate or Diploma. Each year students register in total for around 400 modules.

The number of students coming forward to the M.Sc in Database and Information Systems fell steadily during the 1990s and the decision was reluctantly taken to close the course with the last cohort starting the course in October 1997.

The next addition resulted from an approach from colleagues in Economics who had observed the way leading US universities were responding to the early growth of the dot.com boom. They proposed to the departments of Management and Computer Science that we should jointly mount a Postgraduate Diploma in E-commerce with successful students being able to study for a further year to obtain an M.Sc in E-commerce. Formal approval was rushed through the College in the Spring of 1999 and the course started in October 1999 with around 40 students. Over the succeeding few years applications far outstripped places as the dot.com boom grew but with the dot.com bust numbers fell away. In 2004, it was renamed as an M.Sc in E-business. As

much of this novel technology becomes mainstream in the industry, the justification for a special course decreases and the course's future is currently under discussion.

January 2002 saw the launch by the College of four Foundation degrees which take 8 terms to complete part time compared to 6 terms full time in other universities. The courses have a strong emphasis on employer engagement. This latter issue has proved a challenge for our students in full time employment but often not working in an IT related position. To address this, staff have developed innovative work related modules combined with small scale project work for external organisations such as local charities. The first two terms of the programme use modules from the IT Applications programme.

The Foundation degrees broke with convention by starting in January so that successful graduates could progress to an honours degree. For successful students on the Foundation degree in IT they are able to progress to a two year B.Sc in Information Systems and Computing which is largely derived from the information systems and computing modules on the B.Sc in Information Systems and Management degree.

Although the earlier advanced M.Sc course had closed, staff continued to receive enquiries from suitably qualified applicants and it has launched a suite of three advanced M.Sc courses in Advanced Information Systems (2003), Web Information Management (2005) and Intelligent Information Systems (2006). These courses have concentrated on the School's collective research strengths in the areas of data and knowledge management, web technologies and intelligent information processing. The School also introduced an M.Res course in 2003 as a pathway to research within the School. The taught part of the M.Res shares modules with the advanced M.Sc programme.

In October 2007, another course began in conjunction with the School of Economics aimed at the needs of the City. This is a Graduate Diploma in IT for Finance. This course is aimed at the growing shortage of IT staff with an understanding of the needs of financial markets. It is composed of modules drawn from the two Schools and covers programming in C++ with special reference to finance applications, quantitative and computational techniques for finance and an introduction to financial markets.

Birkbeck is committed to widening access. The Higher Education Funding Council for England has funded Birkbeck to start a new campus at Stratford in east London. The School was very pleased to launch Birkbeck's first degree programme at the new campus when in January 2008 a cohort of students began to study for the Foundation Degree in IT entirely at the Stratford campus.

Finally, autumn 2008 sees the launch of a new M.Res in Information Systems & Management aimed at attracting students from the B.Sc course who wish to study further with the possibility of ultimately conducting research for an M.Phil/Ph.D..

Our students have always looked for vocationally relevant courses. In a fast changing area like computing this imposes a major burden on staff to continuously update curricula and regularly enhance the portfolio of courses. The popularity of many of these programmes over many years is the result of the School's continuing commitment to provide courses which are attractive to study and also vocationally rewarding.

5. Locations

The first home for the post-war Physics and Chemistry departments was in the laboratories of the Royal Institution but by 1947 they had moved into two bomb damaged houses 21/22 Torrington Square, see Figure 13. The Physics department occupied no. 22 (the left hand house in the picture) and Bernal had a flat at the top of the building.



Figure 13 Nos 21 and 22 Torrington Square (No 22 on left and slightly set back)

Everyone was packed in very tight and there was no room to build a computer. Consequently Andrew Booth looked for space elsewhere. The first ARC computer was built at the British Rubber Producers Research Association facilities in Welwyn Garden City as they were funding his work. He later started building computers at his father's home in Fenny Compton. However, in 1949 the wartime static water tank between nos 22 and 27 was made into a one storey basement building behind the wall in Figure 14. This became the home for Birkbeck's Electronic Computer Laboratory,



Figure 14 Location of the Static Water Tank shortly before building of Clore Management Centre

The department remained in the static water tank for some years. Most photographs of early Andrew Booth computers surrounded by painted brickwork were taken in this building. By the late 1960s a new home was needed for the growing number of staff being recruited. The building subsequently passed to the Department of Organizational Psychology and continued in use until the construction of the Clore Management Centre, which opened in 1997.

The new location chosen for the department, albeit on a short lease, was the basement of Mary Ward House in Tavistock Place, shown in Figure 15. The Annual Report notes that:

The Department of Computer Science moved – in a weekend, thanks to the efficiency and enthusiasm of our Attendants – to new quarters in Mary Ward House: the department’s accommodation is inadequate but the move was urgent to make way for the Woburn Place demolitions.

It provided accommodation for academic and support staff, research students as well as a large room with punched card and paper tape equipment and a lecture room. However, as the department grew, some staff were housed in Malet Street.



Figure 15 Mary Ward House 2008

In the summer vacation of 1973 the Department was on the move again this time to 10-12 Gower Street, see Figure 16. This was another temporary move as the Department’s contribution to the College Annual Report laments:

Unfortunately the move is again to temporary accommodation, ..., with the promised land of Senate House still very nebulously in the future.

The two Georgian houses were badly suited to the needs of a Computer Science Department with its regular movement of contemporary large and heavy equipment such as processors, disc drives and printers and were still too small to accommodate



Figure 16 10-12 Gower Street

all members of the Department.

However, the Department remained in Gower Street until the end of the 1970s when Birkbeck was able finally to acquire the 1st floor and basement of the North Block of Senate House, in Figure 17, when the Institute of Education moved into its new building. The Computer Science department was allocated the 1st floor and after some interior rebuilding it was ready for the start of the 1980/1 academic year. In addition to staff accommodation, it included two lecture theatres and a large air conditioned computer room which housed the Department's growing range of machines and subsequently the College's main computer and also some of the College computing staff.



Figure 17 Senate House North Block

As the department grew, it was able to acquire rooms from other departments in the Senate House basement. With the ending of the mainframe era, the College Computer

Unit moved out of North Block into the main building. The Department converted the former computer room into a workstation room as the Department's computers shrank in size to small modern servers and communications equipment.

In 2004 the London Knowledge Lab was created with HEFCE funding as a joint research laboratory of the School and the Institute of Education (IoE). A new building, shown in Figure 18, was acquired in Emerald Street, off Theobalds Road. This building has four floors and a basement. The ground floor, including a lecture room, is shared by all the occupants and the School occupies the 1st floor while the IoE occupies the two upper floors.



Figure 18 London Knowledge Lab

The School's latest venture is teaching the Foundation Degree in IT at Stratford. At present taught in the premises of the University of East London, the College hopes to have its own building by 2011 adjacent to Stratford station, shown in the artist's impression in Figure 19.



View 01

Nick Evans Architects
Birkbeck Stratford

Figure 19 Artist's Impression of Stratford Campus

Space remains a recurring theme and, as this account is being written, Senate House is subject to a massive rolling programme of rewiring. This is going to necessitate vacating North Block at least for an academic year and it is not finally confirmed that the School will return after the rewiring to this building - its home for the past almost 30 years.

6. Conclusion

This account has briefly traced the growth of the research and teaching of Computer Science at Birkbeck over the 50 years of the department's existence and the decade leading up to it. Looking back it is perhaps fair to say that the School was a precocious youngster. The departure of Andrew and Kathleen Booth undoubtedly left a gaping hole. With the appointment of Peter King in 1970 the department began to evolve steadily into today's School with its strong emphasis on data and knowledge management and web technologies combined also with the other large and newer research group in Computational Intelligence. These groups remain true to the tradition of School research which has stressed applicability in the real world.

Our students have always valued courses that reflect contemporary IT practice. The need every year to attract to our courses students who are paying their own fees challenges us to justify our course content to often well-informed enquirers.

The satisfaction of delivering high quality research led education is considerable. Working with mature students proves for many of us to be a very rewarding experience. Perhaps the unique combination of these two features at Birkbeck is what explains the number of colleagues who have devoted all or much of their careers to researching and teaching here.

As the School embarks on the second half century it is hard to foretell what our successors will be teaching in 50 years time. What I believe we can be sure of is that information technology will remain a key enabling technology for modern civilisation and like all technologies it will be require an educated professional workforce to build and maintain the new applications for which society seems to have an almost insatiable demand.

Acknowledgements



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Finally, I am grateful for colleagues who have pointed out corrections and omissions, nonetheless the final responsibility for any remaining mistakes are mine alone.

*Roger Johnson
April 2008*

Academic Staff

James	Bailey	1999	-	2000
Andrew	Booth	1946	-	1962
Kathleen	Booth (nee Britten)	1946	-	1962
Dick	Buckingham	1973	-	1978
Frank	Burgoyne	1963	-	1966
David	Cairns	1972	-	1985
Chris	Christodoulou	1999	-	2005
Andrew	Colin	1958	-	1960
Constantinos	Constantinides	2001	-	2004
Steve	Counsell	1999	-	2004
Linda	Crosthwaite	1970	-	1971
Abigail	Davidson	1968	-	1969
Ed	Dee	1971	-	1972
Giovanna	di Marzo Serugendo	2005	-	
Simon	Evans	1966	-	1968
Mick	Farmer	1969	-	
Trevor	Fenner	1966	-	
Guy	Fitzgerald	1993	-	1998
John	Florentin	1971	-	1987
Boris	Galitsky	2002	-	2005
Keith	Gibson	1988	-	2005
Sven	Helmer	2006	-	
Jim	Inglis	1970	-	1999
D	Jenkins	1972	-	1973
Roger	Johnson	1983	-	
Eleftheria	Katsiri	2007	-	
Peter	King	1970	-	1997
Clement	Leung	1986	-	1994
Mark	Levene	2001	-	
Mike	Levison	1960	-	1970
Xuelong	Li	2004	-	
Xiaohui	Liu	1989	-	2000
George	Loizou	1967	-	2003
George	Magoulas	2004	-	
Keith	Mannock	1986	-	
Nigel	Martin	1984	-	
Stephen	Maybank	2003	-	
Szabolcs	Mikulas	2001	-	
Boris	Mirkin	1999	-	
Roger	Mitton	1986	-	
Alex	Poulovassilis	1999	-	
Steve	Probert	1994	-	1998
George	Roussos	2002	-	
Alan	Sentance	1962	-	1968
Carol	Small	1988	-	1997
Ken	Thomas	1988	-	1999
Agathoniki	Trigoni	2004	-	2007
Tom	Westerdale	1969	-	2006
David	Wilson	1996	-	
Peter	Wood	2001	-	
Michael	Zacharyechev	2006	-	
Dell	Zhang	2005	-	

The School Today



Some members of the 2008 department:

Front row (l to r): Boris Mirkin, Gilda Andreani, Szabolcs Mikulas, Jane Lucas, Nimali Udukulage, Tara Orlanes-Angelopoulou, Phil Docking, Tony Griffith

Second row: Tom Westerdale, George Magoulas, Steve Maybank, David Wilson, Peter Wood, Jenny Pedler, Peter King, Michael Zakharyashev, Dell Zhang

Third row: Darren Pearce, Sergio Gutierrez, Nigel Martin, Mick Farmer, Sven Helmer

Back row: Gordon McIntyre, Trevor Fenner, Petar Konovski, Roger Mitton, Phil Gregg



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*Back cover left to Front cover right:
Andrew Booth's Drum,
HEC2 Card Reader/Printer,
HEC2 Function Mesh,
Andrew Booth,
LKL Students,
Dame Stephanie Shirley.*