Editorial backgrounder **November 2011**

The start of business computing:

FROM TEA SHOPS TO COMPUTER COMPANY: THE IMPROBABLE STORY OF LEO (Lyons Electronic Office)

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In the years before the Second World War, J.Lyons & Co, a family-run catering firm known for its tea shops and corner houses and the "nippies," the smartly dressed waitresses who served in them, had built a reputation as a go-ahead organisation in office management and procedures. Notwithstanding an Edwardian public face, with, behind the scenes, clerks as late as the 1920s standing, like Bob Cratchit, to work at large mahogany desks, the company was early into the new world of Organisation and Methods. It had, for example, developed a system whereby customer orders were photographed for record purposes and then returned to the customers as invoices in an early attack on the mountain of paperwork that had threatened to engulf its various businesses.

Each of these many businesses – tea, teashops, ice cream, bakeries, kitchens and the like – had its own groups of clerks and managers, but all working to the same management processes that moved information from operations – manufacturing, selling, distribution and so on – to decision-making senior management. The vast mass of transaction data from these operations was summarised and compared with pre-set standards, forecasts and budgets, providing management with a detailed picture of the week's trading on the Monday of the week following. It was as close to a real time management information and decision support system as you could get in the days before computers.

What really distinguished Lyons, however, was its culture of utter self-reliance. It built its own factory equipment, including the ovens for its well-known Swiss rolls; it built its own trucks; it grew its own tea and so on. Coming from this background, the company somehow sensed that it needed something like a computer to make further progress. So when, after the war, news began filtering in about the development of "electronic brains" used in solving complicated mathematical calculations of the kind required to direct artillery and missile trajectories, there were those in the Lyons company, like JRM Simmons, a top-flight mathematics graduate from Cambridge who had set up the Lyons' O&M department, or Systems Research Office, who could sit up and take notice.

As a result, in May/June 1947 OW Standingford and TR Thompson, assistant comptroller and chief assistant comptroller, crossed the Atlantic on an expedition to research what was going on in the States and in the course of it to find out whether computers, which had so far been used exclusively for mathematical calculations, "were capable of being put to use in commercial offices."

The report they produced for the Lyons' board reported on visits to universities, including Pennsylvania, the home of the ENIAC computer, and companies, including

the ENIAC designer's - J.C. Eckert's - newly formed Electronic Control Company, which he had set up to build computers for sale when the Moore school at the university had rejected the idea. Visits to NCR and Burroughs proved fruitless and the report of a visit to IBM was interesting in view of later developments: "as far as we were able to see, the aim of this company is to use electronic calculation purely as an adjunct to punched cards."

However, they received encouragement from Dr HH Goldstine of Princeton, who had promoted the original research resulting in ENIAC, and Professor Howard Aiken of Harvard where they saw the electro-mechanical Harvard Mark I, II and III computers, the first two in operation and the third in construction. A particular stimulus was provided by a visit to Prudential Insurance where they were told of a project to build an electronic machine to carry out the premium billing of millions of policyholders and automatically write insurance contracts.

Herman Goldstine encouraged them to make contact with Cambridge University in England where EDSAC was in development and the Thompson/Standingford report also includes a visit to the Mathematical Laboratory at Cambridge where they met with Professor Douglas Hartree and Dr Maurice Wilkes. We "found them both keenly interested in our proposals for a commercial machine and prepared to make their knowledge and advice available," the report records.

The report identified sales invoicing, letter-writing and payroll as potential applications for a commercial computer and concluded with the assumption that Lyons "will want to take full advantage of these machines for their own offices." They also saw wider horizons for business computers: these machines could "well be a prime factor in relieving the present economic distress of the country."

Finally, the report put various options to the Lyons' board:

- fund and work to influence the Cambridge project;
- put their ideas in the hands of a large electrical concern, such as EMI or GEC;
- work with Eckert's company, Electronic Controls;
- approach the UK Government; or
- "build a machine in our own workshops."

"It is possible for us to play a passive role by merely keeping in touch with developments and in due course buying machines as they become available, probably from American sources. But such a role would not enable us to have any influence on the kind of machine built and without commercial influence they may well be built in a form more suited to handling mathematical and census calculations…"

Build it ourselves

This proved to be the crucial consideration. Years later, in an interview with the Science Museum, JRM Simmons declared there was a feeling that "unless the user (ie Lyons) was prepared to take a hand in building the (business) machine, the machine would never get built." The view that Simmons and Lyons took at the time was that the mathematical computers in development would not be of the "slightest use to us because we were dealing with a mass of information, not a complication of calculation."

The Lyons board took the "build it ourselves" decision, but based on the Cambridge EDSAC design and with one proviso: that before this decision was implemented the Cambridge team would have to prove that EDSAC was capable of doing a mathematical job. One Thursday in May, 1949, the call came through from Cambridge that EDSAC had compiled a table of prime numbers and, as it happened, the Lyons' board was in session. A message was passed into the boardroom from Simmons advising the board of this and asking for a go-ahead, and, he recalled, the answer came back five or ten minutes later: yes!

Simmons called the decision "extraordinary" and "courageous:" others, he suggested, would have said "foolhardy." But, he went on to say, "we had this big office organisation, which by definition was a gross extravagance on the back of the company, and the only way in which economies could be made on the scale we thought could be made was if we did go ahead and build the computer."

In the two years that had elapsed since the Thompson/Standingford visit to the US, a great deal of thought had been going on behind the scenes at Lyons and Dr John Pinkerton had been appointed as electronic engineer. Pinkerton, a Cambridge graduate recommended by Wilkes, was destined to take over and lead the technical development of LEO, the Lyons Electronic Office, drawing on the EDSAC experience.

Things, thereafter, moved quickly. David Caminer, who headed up the Lyons Systems Research Office, was put in charge of all the systems and programming development. In effect, starting from scratch, he had to invent the software disciplines of commercial systems and programming

Extraordinary team

Between them, Pinkerton and Caminer assembled an altogether extraordinary group of talented individuals, all drawn to Lyons by the singular challenge presented by the LEO project. Young people were given their head and did not disappoint.

Someone who was not involved, but might have been had she stayed, was a young chemistry graduate, Margaret Roberts, later Mrs Thatcher, who worked for a time in the Lyons Laboratories after coming down from Oxford. Among the ones who were offered computer jobs, but got away, was Jeremy Isaacs who went on to prominence within national television in the UK and, later, at the Royal Opera House.

Among those who grasped the opportunity and joined the LEO project along the way at the start of what were to be brilliant careers were

- Peter Hermon, best known for his work with British Airways where, having devised and implemented the airline's reservations system, he became a full board member;
- Mike Gifford whose career embraced many years as a prominent chief executive of the Rank Organisation;
- Tim Holley, who, as chief executive of Camelot, created the National Lottery;
- John Aris, who after running IT at the Imperial Group, became a distinguished director of the National Computing Centre;

and many others who, though less in the public eye, ran ground-breaking computing projects, or who, like Frank Land, LEO's chief consultant up until the merger with English Electric, pursued a distinguished academic career, becoming a professor at, first, the LSE and then the London Business School.

Among the former were Mike Jackson, who computerised Freeman's mail order, turning a large business with 4,500 people around completely within a space of five years; George Hayter, who developed the first market-wide online systems for the London Stock Exchange; and Alan Jacobs, who was with Hermon at BA and then went on to become head of computing for Sainsbury's. Others, like Ninian Eadie, who was the LEO consultant through all the early Post Office computerisation projects, stayed throughout the various mergers that characterised the British computer industry and made it to the ICL board.

Then there were those who pushed the boundaries of LEO computing out into the wider world, creating subsidiaries in South Africa, Australia and Eastern Europe: respectively, Leo Fantl, Peter Gyngell and Ralph Land, the brother of Frank, who achieved some spectacular sales successes in countries such as Czechoslovakia, Poland and Russia and subsequently joined Rolls-Royce plc, becoming a member of its international board as director responsible for East and Central Europe.

Yet others took their LEO experience with them to high-profile careers in IT in other countries, including John Gosden, who headed computing for Equitable Life in New York, and Paul Dixon, who became head of worldwide computing for Massey Ferguson in Toronto. Both Gosden and Dixon were prominent and widely known figures within the industry association, the Association for Computing Machinery (ACM), in North America.

Peter Hermon, reminiscing in the book on the LEO story published by McGraw Hill, spoke for the sentiment expressed by all of them at one time or another. "We were all doers and part of a concentration of talent that can rarely have been equalled in any programming office anywhere." Hermon also singled out the LEO training programme for particular praise: "As a model of clarity and professionalism, I have seen nothing since to rival it."

All-round consultants

What distinguished these early LEO consultants was their ability to take on all aspects of the job in hand. Unlike in other companies, there were no specialist salesmen who passed the buck to a systems operation that developed the application. At LEO, it was all one and at no time were LEO consultants on any bonus system linked to sales. Nor was there any industry specialisation. And bearing in mind that they were inventing on a daily basis, across different applications and different commercial and industrial environments, the pressures placed upon them were also extraordinary

Hermon, again, recounts how he wrote the functional specification for one of two statistics programs for Imperial Tobacco on the evening his eldest son, David, was born "in between rushing upstairs to assist the midwife with cups of tea."

Late night sessions in the office were routine and were rewarded by a perk remarked on by many a LEO consultant, namely the prized concession of late night meals in the executive dining suite which was barred to them during normal working hours.

LEO I - like a battleship

The LEO story is, above all, a people story. But the machine had to be built and, in itself, this was an epic event. Work on physically building the machine, LEO I, an electronic stored program system able to accommodate 2048 instructions in a mercury delay line acoustic store, went ahead briskly after the Lyons' board decision and followed closely the logic of EDSAC. Changes that were needed to meet the requirements of office work focused on the input/output mechanisms and, after a false start with magnetic tape experiments in conjunction with STC, a combination of punched cards and paper tape for input and line printer and card punch for output resulted.

The end result was a machine that, as Leo Fantl, an early LEO pioneer, remarked on first seeing it, resembled a battleship, occupying some 5000 sq.ft. of space and employing some 6000 thermionic valves in 21 tall racks. It was completed through the course of 1951 and the time came to run the first job.

Bakeries job a world first

The one chosen was a valuation of the bread, cakes and pies produced in a dozen Lyons' bakeries for their assembly and despatch to retail and wholesale channels. It integrated three different tasks that hitherto had been carried out separately: it valued output from each bakery at standard material, labour and indirect costs, as well as total factory costs; it valued issues to the different channels at standard factory cost, distribution cost, sales price and profit margin; and calculated and valued despatch stock balances for each item.

The job first ran on 17 November, 1951, and from 29 November ran weekly making LEO the first computer system in the world to run a live office application to a regular, time sensitive schedule.

It has been noted that, up to this time, no more than 20 people, including clerical assistants, had been involved in carrying out the whole LEO task in computer design, construction, application design and programming.

The bakeries job was followed, on 12 February, 1954, by a second world first when LEO's first large-scale job, the Lyons' payroll, produced pay cheques direct from the computer for 1670 staff of the bakeries without ever having to use the back-up system.

LEO II and the decision to enter the computer business

Over the years, a family of LEO computers evolved from this first machine. A design for LEO II was produced by Dr Pinkerton in May 1954 as soon as the payroll job was up and running successfully. The new design speeded up the computer by reducing the mercury delay line storage tubes to a quarter of their original size and featuring

faster registers in the arithmetic unit and increased word size. It also made provision for the connection of magnetic tape and magnetic drums anticipating the time when reliable equipment became available.

Within a week of the design being submitted, the Lyons' board had given approval to go ahead for two such systems. More than this, the board meeting on 30 June, 1954, produced the momentous declaration, "We should let it be known that we are prepared to build other Mark IIs for sale or hire." To give effect to this, the board also decided to form a company, LEO Computers Limited. There were no exaggerated expectations, not even an estimate of likely sales. But it was significant as a declaration of intent.

By the time LEO II was fully operational, in May 1957, LEO Computers had received its first orders for machines. WD & HO Wills was the first to sign up for a system to handle invoicing and distribution of products. Stewarts & Lloyds, a family steel firm, followed suit with a system for payroll. The Ford Motor Company's parts depot at Aveley came in with an order that was viewed as particularly significant in that capital expenditure for the project had to have approval from Detroit.

At this stage, however – partly because of the formidable bulk of the LEO machines - most companies interested in applying computers to their business problems took what became known as the bureau route. In other words, they paid for time on the Lyons machines on a service basis. Ever Ready, Kodak and Tate & Lyle were early LEO bureau users and, in most cases, the killer application was payroll. Other, less routine, bureau applications included the preparation of the Government's tax tables following budget announcements and the calculation of all station-to-station distances for the British Railways network.

It's hard to imagine now, but at this time LEO was out on its own in the application of electronic computers to commercial data processing. The population of electronic computers of any kind in the UK was still small and, following a visit to the US in March/April 1958 to check on progress there, Pinkerton and Caminer, whilst impressed at the enormous investment and vitality of the US scene with all sections of the community taking at least the first steps into electronic computing, reached the conclusion that there were not the results to justify the extent of the investment.

LEO III and transistors

They did, however, return with the conviction that LEO should push ahead as fast as possible with the design of an all-semiconductor LEO III, one of the very first transistor machines. LEO III, featuring microprogramming and multiprogramming and a high-level language, CLEO, was completed in 1961, fully three years ahead of the IBM 360 series.

Meanwhile LEO II installations and the workload of the LEO service bureau, which had moved into a new location above Whiteley's departmental store in Bayswater, had added to LEO Computers' reputation and brought in a string of well-known names across a wide spectrum of business: Standard Motors at Coventry; Durlachers in the City of London; Dunlop in Birmingham; a London boroughs consortium based on Greenwich. In addition, late in 1959, LEO had installed its first system for the

UK Government to handle a massive payroll job for the Ministry of Pensions in Newcastle. This had followed bureau work on PAYE tables for the Inland Revenue in the mid 1950s.

Government reticent with support

The UK Government, however, was noticeably reticent in supporting, either directly or with orders, the LEO thrust into commercial computing, albeit R&D funds were routinely ploughed into scientific and engineering projects. LEO suffered the disadvantage of being outside the accepted group of suppliers of electronic equipment for defence systems and scientific use such as Ferranti, Elliott and EMI.
As Murray Laver, a LEO user who became prominent in the industry both as head of the computer division of the UK's Ministry of Technology and chief of the Post Office's National Data Processing Service and its National Giro operation, put it, "In Britain generally we were slow to realise that the computer market for commercial work would greatly exceed the markets for science and engineering."

The UK Government, he added, was "especially sceptical that a machine produced by a catering company could meet their needs."

At the time when, all through the 1950s, LEO was making its own frugal way, R& D contracts worth over $400m were awarded to IBM by the US Armed Services, or some 60 per cent of IBM's total R&D expenditure. Similar contracts, if not quite on the same scale, went to other US companies producing considerable fall-out for commercial system development. In comparison, the UK's National Research Development Corporation had only some $15m to cover the whole of British industry.

Of all the early generation LEO installations, only one was marked down as a failure. This was a production control job for British Oxygen at Edmonton and here there was a major organisational change within the client company that destroyed the structural basis for the job.

LEO III was not announced with great fanfare. Instead, it was introduced quietly to companies who had expressed interest in acquiring systems. It received a warm reception. Orders came in rapidly and ten systems were marked down for delivery at the end of 1962 and through 1963 – almost as many systems as had been installed in the lifetime of LEO II. An order from Dunlop for a comprehensive system to cover all aspects of sales and distribution, won after a protracted battle with IBM, was seen as especially indicative of LEO III's superiority in the market at the time.

Against this background of increasing potential and market opportunity, which included the first steps to set up operations overseas, LEO Computers came face to face with a major organisational change that was to have a profound effect on the development of its product line and the overall direction of its business.

Merger with English Electric a bombshell

Out of the blue, in February 1963, a merger with the computer business of English Electric to form English Electric LEO Computers was announced to, David Caminer recalls, "the dismay and disbelief" of LEO staff at all levels. The interlinked families

who controlled Lyons had always kept control of business strategy, as against operational management, close to its chest and there had been no discussion with the LEO directors prior to the agreement.

In the event, most of the top jobs went to English Electric people and, according to Caminer, it soon became apparent that there was a conflict between the cultures of the two merging groups. In English Electric, computers were equipment and were sold by salesmen. Within LEO, by contrast, computers were part of a mission to bring efficiency to the office and the LEO consultant retained responsibility for the application well after the ink was dry on the contract.

The merger, paradoxically, was followed by years in which the sale and installation of LEO computers took off, particularly following the introduction of a faster version of the LEO III, the LEO 326 able to run individual programs at five times the speed and run more programs concurrently.

The 360 challenge and denouement

But around the corner, another challenge of supreme significance was lurking with the announcement, in April 1964, of IBM's Series 360 range. Just four months before, in December 1963, Honeywell had sprung its 200 series. The Americans were coming in force for a new assault on the business computer market.

The announcement of the IBM 360 coincided precisely with the installation of the first LEO III installations for the British Post Office in London and Lytham St Annes. Nor did the announcement stop the Post Office from ordering five LEO 326s, the largest order ever placed with any computer vendor up to that time in the UK.

Despite the avalanche of orders from central and local Government and many of the leading names in British business, such as Allied Suppliers and Shell Mex & BP, time was running out for LEO computers. They were to soldier on manfully for many years with the last of the line – the Post Office LEO 326s – remaining in service until 1981. The line had numbered 73 machines in total – LEO I, eleven LEO IIs and 61 LEO IIIs – and had given 30 years service.

The Lyons' interest in English Electric Leo Computers had ended in October 1964 with the English Electric purchase of the remaining 50 per cent Lyons' holding, at the same time merging Marconi's computer interest into the group to form English Electric Leo Marconi Computers. English Electric paid Lyons £1,856,250, which, according to the press statement announcing the deal, "approximately covered Lyons total expenditure in the Leo computer project." And then in March 1967, Elliott Automation was also merged into the group when the company became plain English Electric Computers Ltd., only to be followed by yet another merger, announced in July 1968, with International Computers and Tabulators (ICT) to form International Computers Limited (ICL).

This time the biter was bit and it was ICT, not English Electric, that was in the driving seat. English Electric's System 4 computer range, which had been announced in September 1965 as the follow-on range for LEO and other systems within the group, had slipped its early delivery dates by some six months and the sales of ICT's 1900

range had done well. Much of the LEO experience, including multiprogramming, had gone into the design of System 4, albeit the definition of the range had been based on the RCA Spectra hardware to save on both development time and cost.

The key feature of System 4, as with the Spectra range, was its compatibility with the IBM 360. The ICT 1900, by contrast, ploughed its own furrow, a different philosophy to the one that English Electric had espoused.

This leads to an intriguing question that can never be answered: what might have happened to the British computer industry had the line through LEO and System 4 prevailed? As it was, the influence of LEO and LEO people declined through the succession of mergers, though nothing can take away their place as frontrunners in the history of business computing.

"It was a pity," Murray Laver has said commenting on the first of the mergers, "that LEO's distinctive contribution to the development of computing in Britain was diminished when LEO Computers was absorbed into a larger conglomerate."

Like the J. Lyons company, swallowed by Allied Breweries in 1978, LEO is now a memory, but one to savour and conjure.

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