

Computer memories: the history of computer form

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Computer Memories: The History Of Computer Form

Paul Atkinson 1998

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Abstract

This paper looks at the computer as a truly global form. The similar beige boxes found in offices across the world are analysed from the perspective of design history rather than that of the history of science and technology. Through the exploration of an archive of computer manufacturer's catalogues and concurrent design texts, this paper examines the changes that have occurred in the production and consumption of the computer in the context of the workplace, from its inception as a room-sized mainframe operated through a console of flashing lights, to the personal computer as a 'universal' form, reproduced by many manufacturers. It shows how the computer in the past has been as diverse as any other product, and asks how and why it now appears as a standardised, sanitised object. In doing so our relationship with the office computer, past and present is explored, revealing a complex history of vicissitude.

Form as history

This paper addresses various criticisms of the history of computing. William Aspray noted that three professions had written about the history of computers: computer professionals; historians of technology and science; and journalists. Computer professionals had constructed a one-dimensional account of technical history. Technology and science historians had employed the methodology of the social shaping of technology to computing, but had less technical knowledge than computer professionals. The analysis of journalists had added little to scholarship, but the personal dimension of computing evident in their work had at least been popularly disseminated. "After all, as historians we are ultimately interested in computing as human enterprise."¹

This focus on the computer as a technological artefact has, as argued, limited its historical analysis to a narrow technical rather than social perspective. This paper is instead a study within the history of design - a piece of social and cultural history whose subject happens to be a technological artefact. It is not the technology *per se* which is the primary source of interest, but the presentation of that technology to its end user in a designed form.

The history of design explores cultural aspects of design meaning - design produced and consumed as a social process. The social world provides the conditions within which design operates and which design reflects. "If circumstances do not *coerce* form, they are certainly often *manifest* in form."² The position here is that through form, objects themselves convey meaning. Their study is a study of *representations* - the semiotic analysis of culture, in which objects or images are interpreted as cultural icons. Designed artefacts, then are a valid source of evidence for the writing of history. Their value lies in the status of meaning transferred to them by their consumers - an 'anthropology of consumption'³.

"Computers all look the same"

At the present time there is a clear perception of the appearance of all computers as identical and consequently boring. Discussions with users of computers entails repetitive rhetoric. "They all look the same", "They're so boring to look at", "They're just grey boxes". But what exactly is it that these people are referring to, the signified of the word 'computer' as signifier?⁴

I believe they are usually referring to the computer as it appears in the office - a series of beige boxes. A processor with a slot for a floppy disc in the front; a monitor; a keyboard; and a mouse. This is the 'Universal Desktop Office Computer' - the 'clone' - an identical, characterless copy of a bland original.

These boxes are the work of designers. The role of designers, one imagines, is to be creative and imaginative. The level of imagination shown over the last decade would appear to be nil. Any manufacturer's latest computer looks remarkably like its last - extra ribs on the case moulding, oval rather than square power buttons, slightly larger or smaller radii along this or that edge.

Computers enable people to do remarkable things: layout and print pages of text and charts; manipulate raw data into meaningful statistics. Through the internet, people across the world exchange ideas and news. The computer bears the mark of an incredibly exciting machine. Why then is its design so nondescript? Instead of instilling awe in people as it promises the Earth, the design of the computer instils only boredom. In this respect, the computer is a missed opportunity, an unfilled possibility, an unfulfilled promise.

This paper will show that there is no reason for this situation to exist. The tracing of the development of the electronic computer as a cultural object will demonstrate that in the past, the computer took a multitude of forms.

The gathering of archival information for such an analysis is problematic. Much ephemera has been lost, and the past focus of computer history has not been their designed form. The National Archive for the History of Computing at the University of Manchester carries an extensive collection of trade catalogues, showing the forms of the computers themselves, and to some extent their context. It must be noted, however, that catalogues are *not* documentary evidence, but *representations*. The photographs show staged

sets and models, not real workers in offices. This does not affect the analysis of the form of the computer, as its design is accurately conveyed (although any image of a product is, in effect, a translation placing the form over the function⁵), yet where analysis is attempted of the context this fact becomes important. We are not shown images of reality in catalogues, but a construct of the manufacturer's imagination. Even so, catalogues are a form of advertisement, and their analysis remains valid. Although the information they held quickly dated, it is precisely this ephemerality which makes catalogues such a fascinating record of the computer's development.

This paper focuses on computers in the office rather than the home as there is a marked difference in their development. Haddon has stated "In contrast to its current main image as office equipment that can be used in the home, the early home micro was promoted for less tangible uses."⁶ The home computer developed from the hobbyist, as opposed to the office computer's origins in large electronics corporations. The two different trajectories collided with the introduction of the Apple II in 1977. Studying the computer as an object within the workplace deliberately distinguishes between the relationships people have with personal objects and those they use at work, and allows us to consider its position within the corporate hierarchy. This is important - as the authors of *The Meaning of Things* have said: "The tools of one's trade, perhaps more than any other set of objects, help to define who we are as individuals. Karl Marx was right: Humans create their existence primarily through productive efforts".⁷

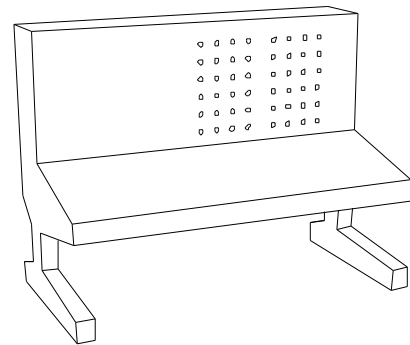
The number of manufacturers involved means that the range of images collated are representative rather than comprehensive. Consequently, findings from this archival research should be treated as indicative rather than conclusive. The dates associated with the images are a guideline, as the forms of computers presented may not contain the earliest or last example of their kind. Brochures for example may have appeared in advance of a product's launch. Others may have continued to be produced after the brochures ceased. This analysis, then, should be seen as diachronic - examining changes from one form of computer to another, and synchronic only in examining the number of different forms present at any particular time.

The development of the form of the office computer

In order to assess the variety of forms of past computers, a large number of images collated from the National Archive and other sources were arranged into groups, each having a distinct arrangement of the computer's main component parts. Each form is accompanied by a line drawing representing this arrangement, and a small table allowing direct comparison. The selected images shown are indicative of those in each group produced. This approach allows the focus to remain on the design of the computer, transcending the vagaries of less important stylistic influences. Where the input terminal was remote from the computer processor, it is the design of the terminal which has been considered. I would argue that from the operator's point of view, the input terminal *is* the computer itself.

Form A

Example	IBM Ramac 305, 1955
Earliest Appearance	1948
Latest Appearance	1974
Form Type	Remote Console
Keyboard/Controls	In Console
Monitor	n/a
Processor	Remote
Storage	Remote

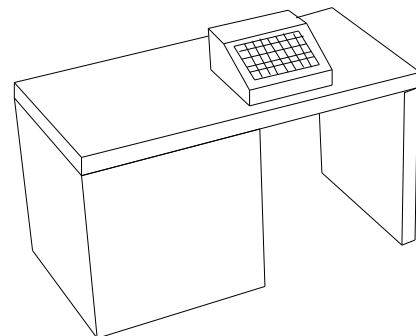


The earliest computer interfaces, appearing around 1945, were true consoles. Large desks within a room lined with the other components of the computer. The processing and storage units, power supplies and test equipment were housed in bespoke, yet anonymous, boxes. The function of these other components was esoteric, not necessarily understood by the operators. Banks of lights and dials displayed the machine's condition as instructions were given by flicking switches, pushing buttons, and by inserting punched cards, paper tape or typing commands.

The rhetoric used with this imagery of the console or 'control desk' is interesting. For example, the brochure for IBM's Ramac 305 (Fig. 1) stated that the console was for "interrogation and supervision". Words which suggest that the computer at this point was not seen as a fully willing servant or even as being under complete control, but rather as an alien intelligence to be probed and examined.

Form B

Example	Muldivo Digiputer, 1968
Earliest Appearance	1955
Latest Appearance	1974
Form Type	Self-Contained Desk
Keyboard/Controls	Separate
Monitor	n/a
Processor	In Desk
Storage	In Desk/Remote



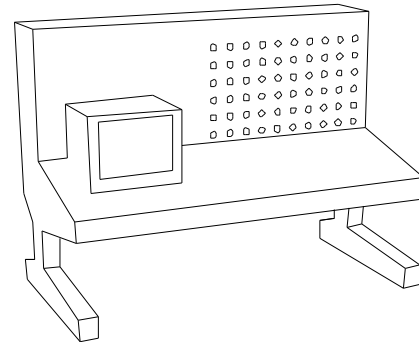
By the mid-1950s smaller computers appeared in which a less powerful processing unit formed part of the operator's desk itself. The pedestal unit contained the electronics, with input and output being through a specially arranged typewriter. The appropriation of the semiology of the office desk and prominent use of the typewriter form placed these computers firmly in the domain of female operatives.

The typewriter has been associated with women ever since they were first employed in offices specifically to operate them.⁸ Women were computer operators and programmers "at a time when those activities were considered

mundane,tedious and repetitive”⁹. This relationship between typewriter and computer perpetuated the undervaluation of women’s skills as non-technical, as technical competence confers “potential or actual power...central to the sexual and class politics of technological work”.¹⁰

Form C

Example	ICL 2900, 1974
Earliest Appearance	1964
Latest Appearance	1979
Form Type	Console with Monitor
Keyboard/Controls	In Console
Monitor	In Console
Processor	Remote
Storage	Remote

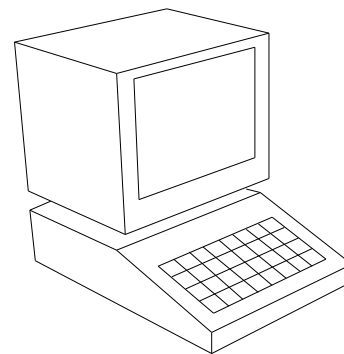


The commercialisation of the monitor in the mid 1960s meant computers could realistically have visual displays. Monitors in the operating consoles of larger computers gave vastly improved feedback. Instructions in written form rather than in punched tape may have made computers less esoteric, enhancing the feeling of mastery over the machine.

Specially-built consoles denoted expense and dedicated function, and connoted high technology and control. From power station control rooms, to space flight’s mission control, and the bunkers of master criminals in James Bond films, consoles with monitors appeared as the epitome of the remote regulation of distant, large and complex processes.

Form D

Example	Sanders 720, 1968
Earliest Appearance	1968
Latest Appearance	1979
Form Type	Remote Desktop
Keyboard/Controls	In Processor
Monitor	Separate
Processor	In Keyboard/Remote
Storage	Remote/In Processor

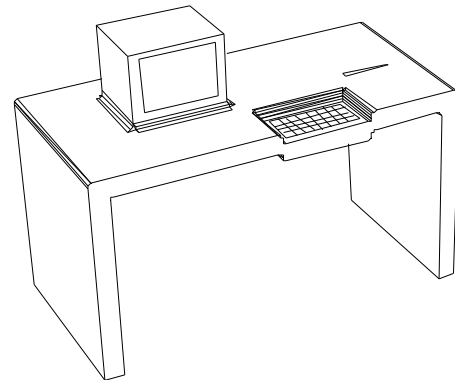


Miniaturisation removed the need for a full console, and by the late 1960s a monitor on top of a keyboard plinth formed a remote computer access terminal. These were still concerned with control: the ‘Telefile 40/3’ was “designed for ... inventory and production control reports, order processing, time-sharing, data collection and distribution”. The same format of components continued until the late 1970s, but by 1977 became an intelligent terminal. The plinth contained its own memory, tape storage, and in some cases a printer.

This form of the computer was also taken by one of the earliest home computers which found a place in business - the Apple II. This particular computer is seen as important by many historians due to the highly influential spreadsheet programme 'VisiCalc' which was instrumental in its move into the manager's office.¹¹ The partnership of VisiCalc and the Apple II was not only a "breakthrough as a financial tool but its users experienced for the first time the psychological freedom of having a machine of one's own, on one's desk".¹²

Form E

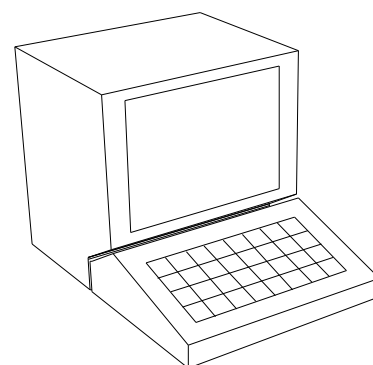
Example	NCR Criterion, 1976
Earliest Appearance	1969
Latest Appearance	1978
Form Type	Remote Console
Keyboard/Controls	In Desk
Monitor	In Desk
Processor	Remote
Storage	Remote/In Desk



The console, meanwhile, developed into a smaller, integrated desk. By 1969 these consisted of a monitor, keyboard and tape or 'discette' storage moulded into one piece of furniture. Combination into a single form seems to have given the computer interface a sense of expense and permanence compared to an arrangement of individual components. NCR's Criterion brochure (Fig. 5) stated that it can "change characteristics to fit each job", had "great flexibility" and "a degree of compatibility not only from model to model, but from generation to generation". This shows a lack of foresight of the speed with which computers would change, or else it is a statement of longevity hoping to counteract the design obsolescence seen by the manufacturer in its own product.

Form F

Example	Lear Seigler ADM-2, 1975
Earliest Appearance	1972
Latest Appearance	1982
Form Type	Remote Desktop
Keyboard/Controls	Visually with Monitor
Monitor	Visually with Keyboard
Processor	Remote
Storage	Remote



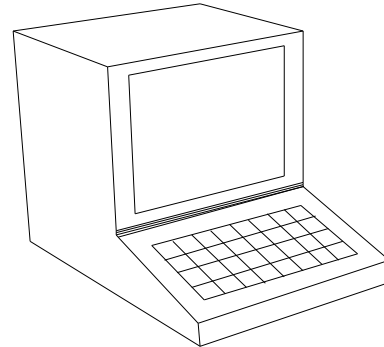
Around 1972 the monitor and plinth developed into a unit in which the keyboard appeared to visually 'dock' into the monitor. This two-part form was possibly inspired by 'space race' images of modules docking to rockets, although apart from the 'space age' styling of early examples (e.g. Fig. 6, Lear

Siegler's 'ADM-2' - "the second generation of the American Dream Machine"! there is no clear evidence for this.

These units were identified in their brochures as 'display stations', 'display consoles', 'data display terminals', 'data screens' or 'visual display systems'. By taking the role of the 'mother ship' into which the keyboard docked, the monitor gained higher status, displaying clearly the level of control held by its user.

Form G

Example	ICL Key-Edit 1000, 1973
Earliest Appearance	1972
Latest Appearance	1980
Form Type	Remote Desktop
Keyboard/Controls	In Monitor
Monitor	In Keyboard
Processor	Remote
Storage	Remote



Also around 1972 the monitor and keyboard appeared as a single unit. As a remote terminal, this form was the complete integration of typewriter input and monitor display. The increased importance of the keyboard resulting from this amalgamation is reflected in the names given to many of the terminals: 'data system', 'Data Entry', 'Datapoint', 'Key Edit' and 'Key Entry System'. Here, the computer is clearly presented in its own literature as being for the production of work.

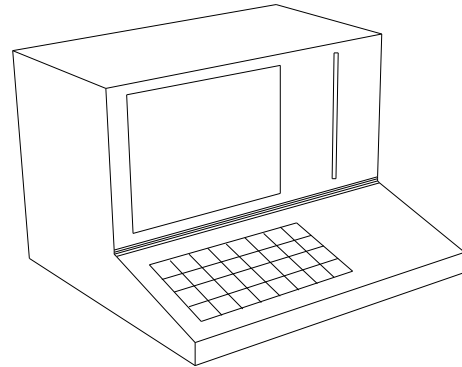
Between 1973 and 1977, the combined monitor and keyboard appeared in many brochures as little more than a futuristic typewriter. Consequently, the association with female operatives is once again evident. A 1977 'Keyboard Training' brochure from Kenrick and Jefferson showed rooms full of such computers and their operators, stating: "Consider the data preparation area of a computer project. This is almost certainly staffed by young, and frequently inexperienced girls". This is a reoccurring image - the female operator (there are no images of a number of men using office computers together), made insignificant by identical repetition - a mere cog in the machine, slavishly inputting data for analysis by the computer.

The computer as a method of control, however, was still in evidence at this time, and with the same combined form. The brochure for Racal's 'Redac Executive' stated the computer's functions as including forecasting of costs and sales, providing current financial status, true costs of overheads per department and evaluating cash flow to enable confident investment decisions: "Individual video display units are provided for the managing director, production director/manager, financial director/chief accountant, and marketing director/manager. These units are located in the individual's own office, and are always ready for immediate use".

It would appear that when combined as one unit, the keyboard element was associated with manual input and production, where the visual display of information remained associated with control.

Form H

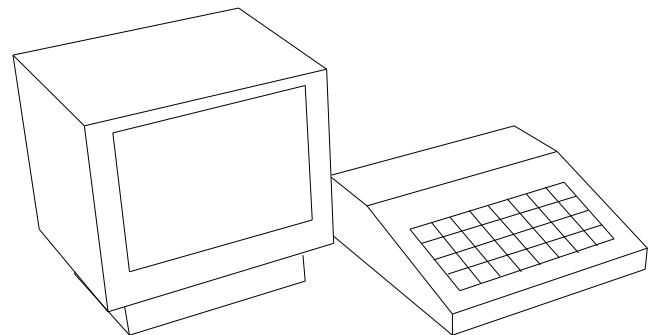
Example	ICL Datacapture, 1977
Earliest Appearance	1974
Latest Appearance	1977
Form Type	Remote Desktop
Keyboard/Controls	In Monitor
Monitor	In Keyboard
Processor	Remote
Storage	In Monitor



1974 saw an increase in the variety of computer forms available from 7 to 12 distinctly different types. The combined monitor and keyboard gained storage capability. Tape recorders were built into the top of the unit and later, diskette drives were placed next to the monitor screen. The addition of storage meant easier archival abilities, which may be why this form tends to be depicted as an efficient secretarial aid, rather than a managerial tool or a general workforce object.

Form I

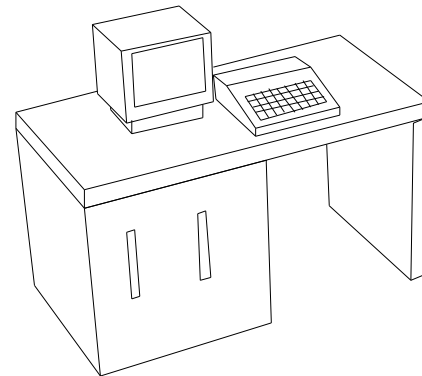
Example	Data General Eclipse, 1978
Earliest Appearance	1974
Latest Appearance	1986
Form Type	Remote Desktop
Keyboard/Controls	Separate
Monitor	Separate
Processor	Remote
Storage	Remote



The remote monitor and keyboard also appeared at this point to separate into two distinct components, bringing the ambiguity of the computer to light again. The 'Harris 1675' was described as a 'key entry station' and a 'data terminal'. The Data General's 'Eclipse S/130' literature presented a room filled with terminals for 'remote job entry'. Others were described as an 'information display system', a 'display station' or for 'processing information'. 'Informer' terminals were available in walnut finish for management "Data inquiry" and white plastic for workforce "Data entry". Generally, units seen in multiples tended to be aimed at use by a workforce, where single or isolated versions were aimed at management of one level or another.

Form J

Example	ICL DRS20, 1981
Earliest Appearance	1974
Latest Appearance	1983
Form Type	Self-Contained Desk
Keyboard/Controls	Separate
Monitor	Separate
Processor	In Desk/Remote
Storage	In Desk

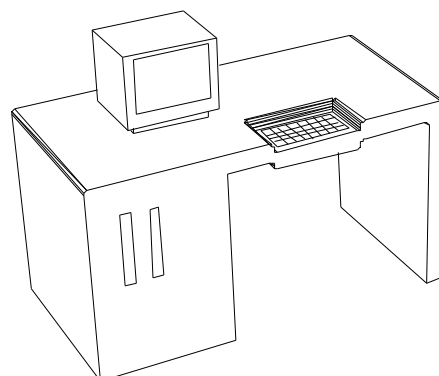


The separate remote keyboard and monitor format also appeared on an office desk containing a storage device - originally magnetic tape reels, then cassettes and finally diskettes. The semiology of a functional desk closely associated this form with the production of work. One brochure stated “DataVet keystations are designed to reduce the keying workload and motivate the operators, the tangible end product - a cassette - helps each operator to feel involved and of value”.

Later versions of this form contained a mini-computer in the pedestal of the desk. These were sold on their smaller size being friendlier than a mainframe. The ‘AddoSystem M10’ brochure declared “Enter the Mini...Exit the Expert” and stated “Datasaab systems don’t need the special air-conditioned environments that big brother demanded”. ICL’s ‘DRS20’ (Fig. 9) was part of its ‘Distributed Resource Systems’ - “a pioneer of networked computing.... providing appropriate computing at every level of an organisation in a controlled way”. While these systems provided computing throughout the workforce, the level of access was still decided elsewhere.

Form K

Example	IBM 6/440, 1977
Earliest Appearance	1974
Latest Appearance	1978
Form Type	Self-Contained Desk
Keyboard/Controls	In Desk
Monitor	Separate/In Desk
Processor	In Desk/Remote
Storage	In Desk

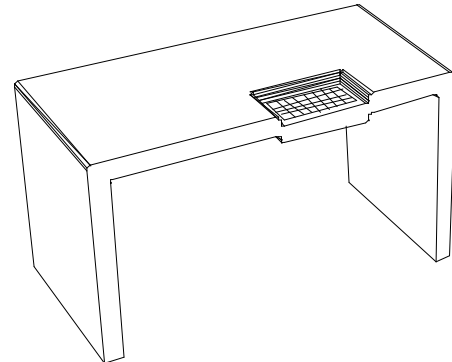


In an almost identical form, the keyboard was integrated into the surface of the desk itself. The ideology was of ‘intelligent’ or ‘networked’ terminals as a helpful resource. Nixdorf’s ‘Intelligent Data Entry and Terminal System 8820’ targeted medium sized companies: “As a company grows, so does its problem of collecting data and communicating it....every new person added to the staff makes an impact on the amount of information that must be recorded and communicated”. The separation of the keyboard from the

monitor and its integration into the desk maintained the importance of manual input - IBM's 'System/32' was described as "a compact operator-oriented unit with keyboard data entry, plus internal disk storage and processing capacity".

Form L

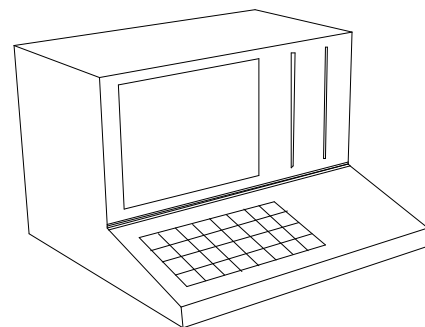
Example	Kienzle 2000, 1975
Earliest Appearance	1974
Latest Appearance	1977
Form Type	Remote Desk
Keyboard/Controls	In Desk
Monitor	n/a
Processor	Remote
Storage	Remote



A remote terminal forming a desk with a built in keyboard also appeared in 1974 without a monitor. As might be expected with no instant visual feedback, the manual inputting of data was the *raison d'être* of these machines - the input of accounting data for later processing as in Kienzle's '2000 Invoicing/Accounting Computer' (Fig. 10) or NCR's 'Distributive Document Processing System'.

Form M

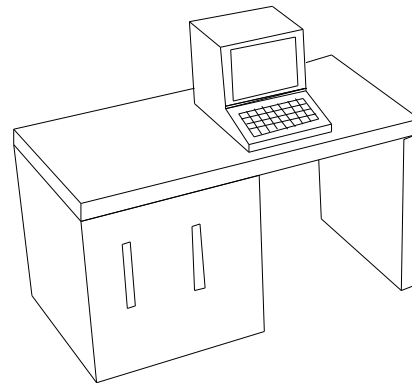
Example	IBM 5100 Portable, 1976
Earliest Appearance	1975
Latest Appearance	1981
Form Type	Self-Contained Desktop
Keyboard/Controls	In Monitor
Monitor	In Keyboard
Processor	In Monitor/Remote
Storage	In Monitor



Around 1975 a major change began to take place. The computer processor became small enough to fit inside a combined monitor/keyboard/storage unit. The high cost of computing power at this stage restricted its use to specialist applications in engineering or scientific research. IBM's 5100 portable computer heralded "portable power for specialists everywhere" (Fig. 11). Later, self-contained desktop computers appeared for management use, especially in accounts. Hewlett-Packard's 'Graphics Terminal' and IBM's 'Datamaster small business system' presented the ability to draw charts on screen as a major selling point.

Form N

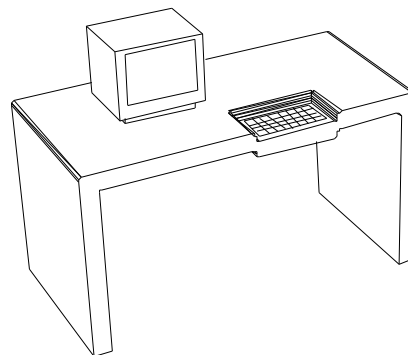
Example	Mael 4000, 1977
Earliest Appearance	1976
Latest Appearance	1977
Form Type	Self-Contained Desk
Keyboard/Controls	In Monitor
Monitor	In Keyboard
Processor	In Desk/Remote
Storage	In Desk



For general applications, the processor remained part of the desk, and the keyboard and monitor again fused into a single component. Labelled a 'data entry terminal' or 'video data terminal', these were aimed clearly at less experienced business users. General Automation Inc.'s 'DM130/2 Business System' "fulfills the information handling requirements of the small to medium sized business". Mael's '4000 Business Computer System' gave "accurate, instant management information without the need for experts" (Fig. 12).

Form O

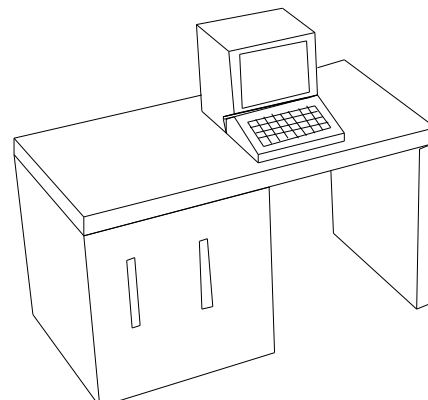
Example	Burroughs B3831, 1976
Earliest Appearance	1976
Latest Appearance	1976
Form Type	Remote Desk
Keyboard/Controls	In Desk
Monitor	Separate
Processor	Remote
Storage	Remote



Desks with keyboards moulded into the surface continued as remote terminals for mainframes, bearing separate monitors. Described as 'keyboard-display terminals' or a 'console display/keyboard', it was a short-lived, ambiguous form of computer, sold as suitable for "both business and engineering/scientific computations".

Form P

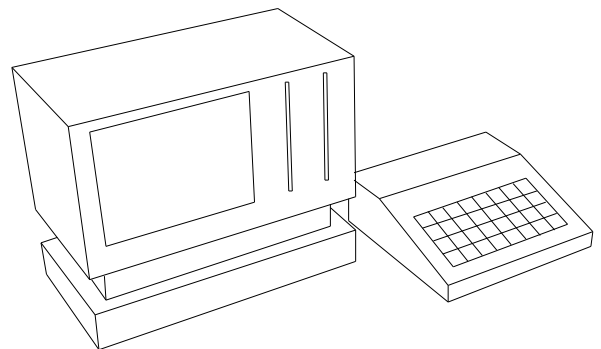
Example	Honeywell 6/36, 1977
Earliest Appearance	1977
Latest Appearance	1977
Form Type	Self-Contained Desk
Keyboard/Controls	Visually with Monitor
Monitor	Visually with Keyboard
Processor	In Desk/Remote
Storage	In Desk



One of the final forms of the computer as a self-contained desk saw the monitor and keyboard unit visually ‘docking’ together. These appear to have been presented as both a workforce tool of production and a management tool of control. The stand alone Hewlett-Packard ‘HP1000’ was capable of dedicated computation tasks, controlling automation, and data base management all “in an attractive deskcomputer work center”. When networked and appearing in multiples, the form is presented by Honeywell as the latest in efficient production : “Level 6 Office Packaging incorporates attractive desk-styled cabinetry for optimum operator interface between documents, keyboard and CRT” - described as “work-enhancing physical characteristics”.

Form Q

Example	ICL DRS20 /20, 1982
Earliest Appearance	1982
Latest Appearance	1983
Form Type	Self-Contained Desktop
Keyboard/Controls	Separate
Monitor	Separate
Processor	Separate/Remote
Storage	In Monitor

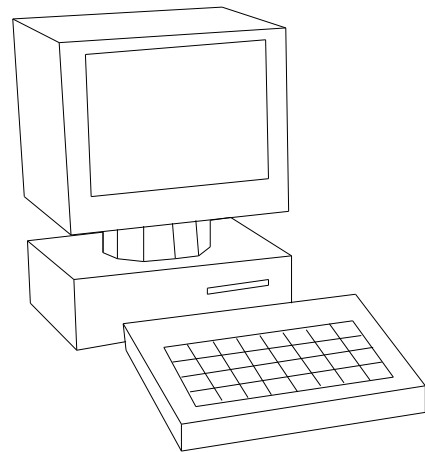


The stand alone desktop computer also began to separate into individual components. The ICL ‘DRS20 Model 20’ placed monitor and disc drive into one unit on top of a cast plinth and used a separate keyboard (Fig. 13). This move from workstations and combined units to individual components was a matter of flexibility for the manufacturer rather than the user. The industrial designer responsible for this product, Richard Satherley, stated “The vision of the computer being a desk of course evaporated - manufacturers had to make the decision whether they were making desks and furniture, or supplying computers.....no one wants to spend all their money putting them into big boxes that are purpose designed”.¹³

Design magazine discussed the status of these computers: “There was a clear mandate to establish the 2200 as an executive model. Nexos appreciated that word processors should not be considered as simply up-market electronic typewriters, but as the first step, from the customer’s point of view, towards an integrated office system....So, Satherley was instructed, make the product distinctive in its own right, and attractive to the executive as well as to the executive secretary”.¹⁴ Satherley denied this distinction between the end users had affected his design for this computer. Although the manufacturer targeted the executive closely, his view was “Executives don’t use them”.¹⁵ The intentions of marketing departments and the aspirations of designers do not always go hand in hand.

Form R

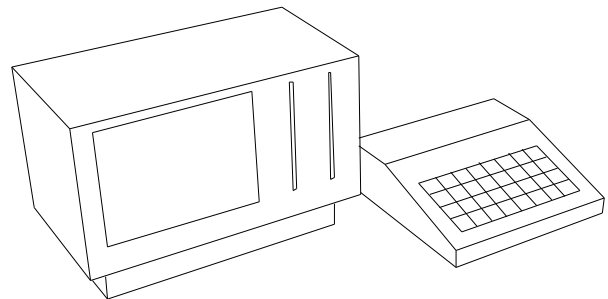
Example	ICL PC Model 30, 1982
Earliest Appearance	1982
Latest Appearance	1987
Form Type	Self-Contained Desktop
Keyboard/Controls	Separate
Monitor	Separate
Processor	Separate
Storage	In Processor



The computer became a desktop processing unit with built in disc drive, separate monitor and separate keyboard from late 1981, when it first became commonly known as a 'personal computer'. Initially, images showed these computers being used by individual (female) secretaries for the fast-growing application of word processing (as in ICL's 'DRS 8801 Wordskil'), and even IBM's 'System/36' terminals of the same format were described as 'team computers' as they could link into a larger network. It is not until the late 1980s that the 'personal computer' is portrayed on a desk belonging to a (male) manager.

Form S

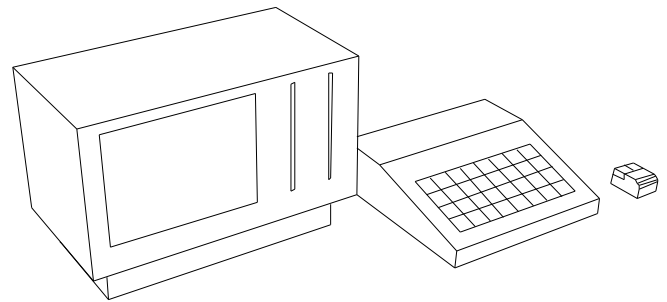
Example	Philips 3003, 1983
Earliest Appearance	1983
Latest Appearance	1984
Form Type	Self-Contained Desktop
Keyboard/Controls	Separate
Monitor	In Processor
Processor	In Monitor
Storage	In Processor



The concept of the computer remaining in a single horizontal desktop unit with only a separate keyboard appeared in 1983 with Philips' '3003 Electronic Word Processor' and Tandy's 'Model 4P'. The Philips computer was a close contender for the 1983 design award in *ID Magazine*, where placing the components in one shell was seen as "rational design"¹⁶, but the placing of the unit on a stalk was seen as aesthetically unsound.

Form T

Example	Apple Lisa, 1983
Earliest Appearance	1983
Latest Appearance	1984
Form Type	Self-Contained Desktop
Keyboard/Controls	Separate & Mouse
Monitor	In Processor
Processor	In Monitor
Storage	In Processor

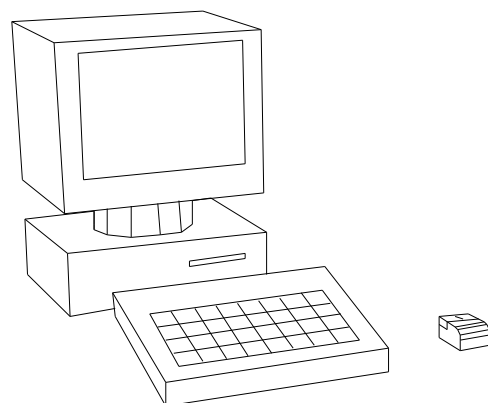


The same horizontal form, with the highly significant addition of the mouse, appeared with 1983s 'Apple Lisa'. As a method of interaction with the revolutionary Graphical User Interface (GUI) developed by Xerox, the mouse changed the way in which people related to the computer completely. The mouse and the GUI moved all the attention the computer received to the screen. This particular model was unsuccessful due to its high price and low performance. Its 1984 replacement - the 'Apple Macintosh' - turned the combined monitor, processor and drive vertically, reducing the desk space required and producing one of the most famous individual computers ever created.

If anything, the 'Apple Macintosh' was (and remains) an idiosyncratic vision of the computer. Small, friendly and loved by its owners (one developed such an attachment to his Mac "that he almost wanted to caress, hug and sleep with it"¹⁷) its greatest drawback was its lack of flexibility. The uniting of monitor, processor and disc drive removed the possibility of easy expansion, tying permanently the ever increasing power and shrinking cost of the processor to the comparatively static technology and high cost of the monitor.

Form U

Example	Torch XXX
Earliest Appearance	1985
Latest Appearance	Current
Form Type	Self-Contained Desktop
Keyboard/Controls	Separate & Mouse
Monitor	Separate
Processor	Separate
Storage	In Processor



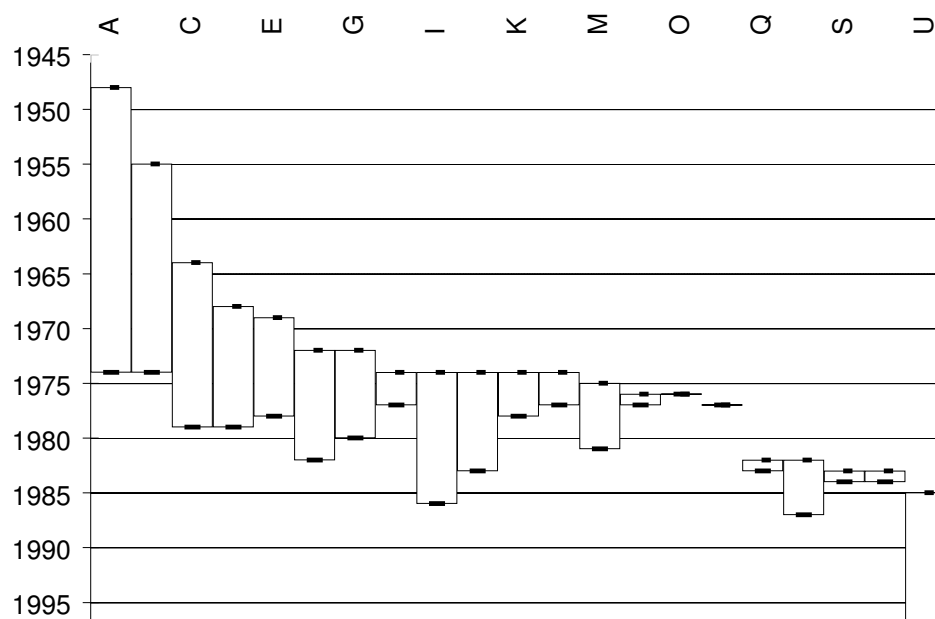
The vision of the computer as separate processor, monitor and keyboard remained the most versatile. This, with the addition of the mouse, became the accepted form from 1985 as company after company produced IBM clones. This to date marks the end point of the development of the office computer. Since this form's appearance thirteen years ago, there has been no change in the basic arrangement of parts, and an astonishing lack of stylistic development. It is no wonder that journalists make such statements as "Look

around your workplace and you barely notice them. So ubiquitous are the white boxes that process data on our PCs that we rarely question how else they might look.”¹⁸ This is truly the face of the ‘Universal Desktop Office Computer’.

Analysis

It is clear that the uses and perceptions of the office computer have been as varied as the different forms the machine itself has taken: a new and frightening creation, a familiar piece of office equipment, an object for repetitive work, a marker of status. By placing the various forms presented above and the duration of their existence into a column chart a picture of the development of the form of the computer emerges (Fig. 16). Starting in the late 1940s as a single concept - a central console within a room of identical cabinets - a number of different forms gradually appear. This continues until 1976 and 1977 when a peak of thirteen different forms are in existence. This variety becomes eroded as various forms of computer disappear, eventually leaving only the ‘Universal Desktop Office Computer’.

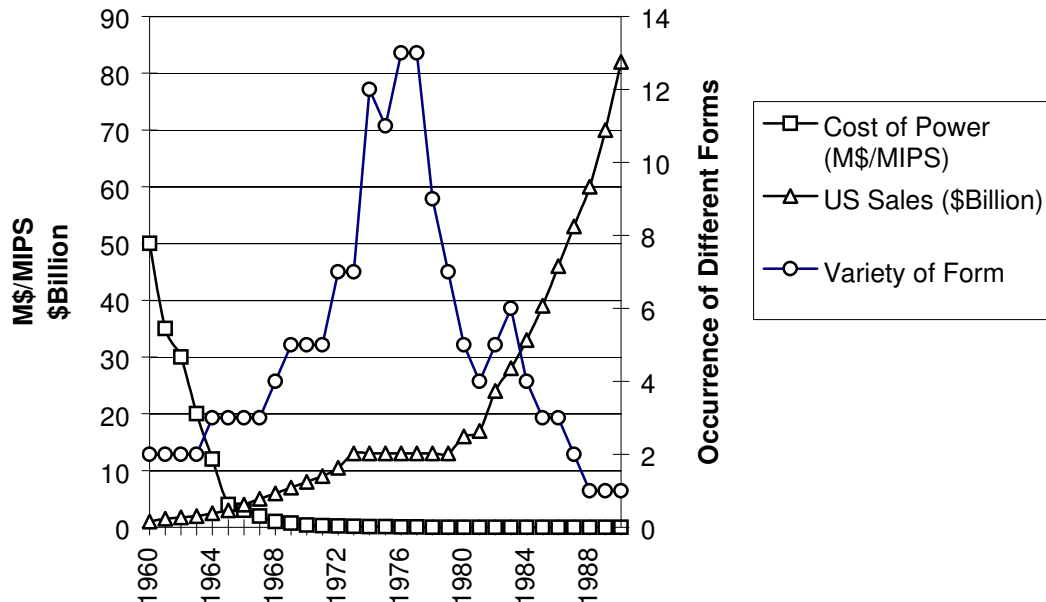
Fig. 16: Duration of Different Forms of Computers



The number of different forms in existence at one time is seen in Figure 17. The ‘variety of form’ line shows the speed at which this divergence and convergence of form occurred. It took the office computer over twenty years to diversify into thirteen different forms, yet only ten more before the final form appears. Figure 17 relates this variety to other factors. A number of analysts have presented charts of quantitative data on relevant aspects of technical and economic computer history.¹⁹ By combining data from a selection of these charts it has been possible to obtain a portrayal of the cost of

computing power and total sales of computers.²⁰ The cost of computing power is shown in Millions of Dollars/Millions of Instructions Per Second. The value of sales appears on the same axis measured in Billions of Dollars.

Fig. 17: Sales/ Cost of Power/ Variety



This chart may represent a 'natural' phenomenon in the product life cycle of technological products. To the left, the cost of technology is high and the amount of sales low, as a small number of companies satisfy an emerging market. To the right, the cost of the technology is negligible and the amount of sales high as the computer becomes a commodity item. Both of these are arguably circumstances where aesthetic design is given low priority. The central part of the chart depicts a situation where the cost of technology is relatively low and sales are increasing. A large number of competitors developing a growing market for new products is a situation likely to produce a wide variety of forms.

Conclusions

It is impossible to deny that technological developments were to some extent responsible for the growing diversity of form in the late 1960s and early 1970s. Radical changes in casing materials occurred as computers moved from being built to order to being mass produced. As a significant investment, the computer was originally sold as being flexible, adaptable, and upgradeable for future needs. This was reflected in its design as an impressive, dominating presence, and its construction in quality materials. Changes in the cost of producing electronic components, and vast increases in computing power have also been associated with changes in computer

usage as it moved from the role of a calculator to information processor. The high price of early circuitry negated the cost spent on its inclusion in a piece of office furniture. Through this design approach the computer attained an air of permanence and value at odds with its likely obsolescence.

In part, a greater variety of form resulted from the introduction of overt styling and design to deliberately encourage replacing rather than upgrading computers. Capitalism relies on the constant consumption of new products, and historically this has been enhanced by aesthetic developments in which the desire for the new is fuelled by advertising and brochures of the kind analysed in this paper. However, this occurred before the rate of technological change was fully realised. Manufacturers as well as purchasers now realise office computers are outdated some time before the end of their productive life. The inherent technical redundancy of the computer may have removed the perceived requirement for a visual, stylistic obsolescence.

The role of the office computer clearly affected its design. While it is true that the design of the computer as a typewriter or an office desk framed it as a tool of production, and that images of computers on executive desks framed them as bestowing authority, there was no linear development from one to the other. Computers have always been used for both repetitive work and managerial control. The change in design approach occurred between 1975 and 1985. The forms of computers used for distinct functions were often very different, and reflected the status of the user. Today, exactly the same form is used throughout the corporate hierarchy. The 'Universal Desktop Office Computer' has no obvious semantic it can claim as its own. Status is no longer defined by the form of the computer itself, only by the way in which the technology is employed.

The successful introduction of the IBM 'Personal Computer' in 1981 set a technical and semiotic precedent difficult for rival companies to overcome. Although there is no reason why technical compatibility should be carried over into stylistic similarity, it is understandable. Just as the introduction of a new format of software would threaten to isolate its users from the overwhelming majority of PC compatible equipment already available, a radically different form of computer would run the risk of being perceived as incompatible even if it were not. The similarity of form of today's office computers to many represents a stability they are not willing to upset - pointing to the concept of 'rhetorical closure':

Closure in technology involves the stabilization of an artifact and the 'disappearance' of problems. To close a technological 'controversy', one need not *solve* the problems in the common sense of that word. The key point is whether the relevant social groups *see* the problem as being solved.²¹

In the case of the office computer, the fear of constant change has been removed by stabilising its design into the position of a 'given'. Appearing as unchanging and predictable, beneath the surface progress continues. New technology is no longer accompanied by new forms. Instead, development is

focused on processing speed. More powerful software appears constantly, making the previous version and to an extent the hardware which ran it obsolete. The new, necessarily improved machine provides a continuity in that paradoxically, it is identical to its predecessor. The sense of closure created by this stability locates the office computer, fixing a transient object into one on which meaning can be conferred.

Notes

Images in published version:

- Fig. 1: IBM Ramac 305, 1955
- Fig. 2: Muldivo Digiputer, 1968
- Fig. 3: ICL 2900, 1974
- Fig. 4: Sanders 720 Display System, 1968
- Fig. 5: NCR Criterion, 1976
- Fig. 6: Lear Siegler ADM-2, 1975
- Fig. 7: ICL Key-Edit 1000, 1973
- Fig. 8: ICL Datacapture, 1977
- Fig. 9: ICL DRS20, 1981
- Fig. 10: Kienzle 2000 Invoicing/Accounting Computer, 1975
- Fig. 11: IBM 5100 Portable Computer, 1976
- Fig. 12: Mael 4000 Business Computer System, 1977
- Fig. 13: ICL DRS20 Model 20 Desktop Computer, 1982
- Fig. 14: ICL Personal Computer Model 30, 1982
- Fig. 15: Torch XXX, 1985

¹ W. Aspray, "The History of Computing within the History of Information Technology" History and Technology (1994), 11:7-19 on p. 10

² C. Dilnot, "The State of Design History. Part II: Problems and Possibilities" Design Issues (1984) 1, No. 2: 3-20 on p. 10

³ 'Towards an anthropology of consumption' is the subtitle of M. Douglas & B. Isherwood The World of Goods (Penguin, 1980)

⁴ F. Saussure, Course in General Linguistics (Collins, 1974), explains that "a linguistic sign unites, not a thing and a name, but a concept and a sound-image" - that is the sign 'computer' is a whole, consisting of the acoustic word 'computer' (the signifier) which when spoken invokes a mental perception of a computer (the signified).

⁵ R. Barthes, Mythologies (Paladin, 1973), pp. 95-97, reveals clearly in his analysis of the Citroën DS that the representation of an object even when shown as if in a real situation, is in fact presenting it as something precious, isolated from its natural environment.

⁶ L. Haddon, "The Home Computer: the making of a consumer electronic" Science as Culture (1988), 2: 7-51 on p. 7

⁷ M. Csikszentmihalyi & E. Rochberg-Halton, The Meaning of Things (Cambridge University Press, 1981), p. 92

⁸ V. Guiliano, "The Mechanization of Office Work" in T. Forester (Ed) The Information Technology Revolution (Basil Blackwell, 1985), p. 299

⁹ G. Kirkup, "The Social Construction of Computers: Hammers or Harpsichords?" in G. Kirkup & L. Keller (Ed.), Inventing Women: Science, Technology and Gender (Open University Polity Press, 1992), p. 269

¹⁰ J. Webster, "From the Word Processor to the Micro: Gender Issues in the Development of Information Technology in the Office" in E. Green, J. Owen & D. Pain (Ed), Gendered by Design? (Taylor & Francis Ltd., 1993), p. 118

¹¹ M. Campbell-Kelly & W. Aspray (1996), S. Levy (1994) and R. Cringely (1992) et. al.

¹² M. Campbell-Kelly & W. Aspray, Computer: a history of the information machine (Basic Books, 1996), p. 251

¹³ Richard Satherley, interviewed at his London office, July 1st 1997

¹⁴ J. Lott & M. Blakstad, "The Rock-and-Roll Word Processor" Design (1981), January: 36-39 on p. 36

¹⁵ R. Satherley, as above

¹⁶ R. Gersin, "Equipment & Instrumentation" ID Magazine (1983) Sept/Oct: 26-40 on p. 27

¹⁷ Takashi Ashitomi "Macintosh 128K" Axis (1997) July: 122-123 on p. 123

¹⁸ Not Credited, "Reinventing the box" Blueprint (1997) July/August, p. 20

¹⁹ See M. Phister Jr., Data processing technology and economics (Digital Press, 1979); T. Forester, The Microelectronics Revolution (Basil Blackwell, 1980) and The Information Technology Revolution (Basil Blackwell, 1985)

²⁰ It should be noted that both sets of data contain their own problems in terms of ratifying the changing value of money over time and the changing definition of the word computer, as described by the various authors of the data themselves.

²¹ T. Pinch & W. Bijker, "The Social Construction of Technology" in W. Bijker, T. Pinch & T. Hughes (Ed), The Social Structure of Technological Systems, (MIT Press, 1985), p. 44