The Legacy of the Apple Lisa Personal Computer: An Outsider's View

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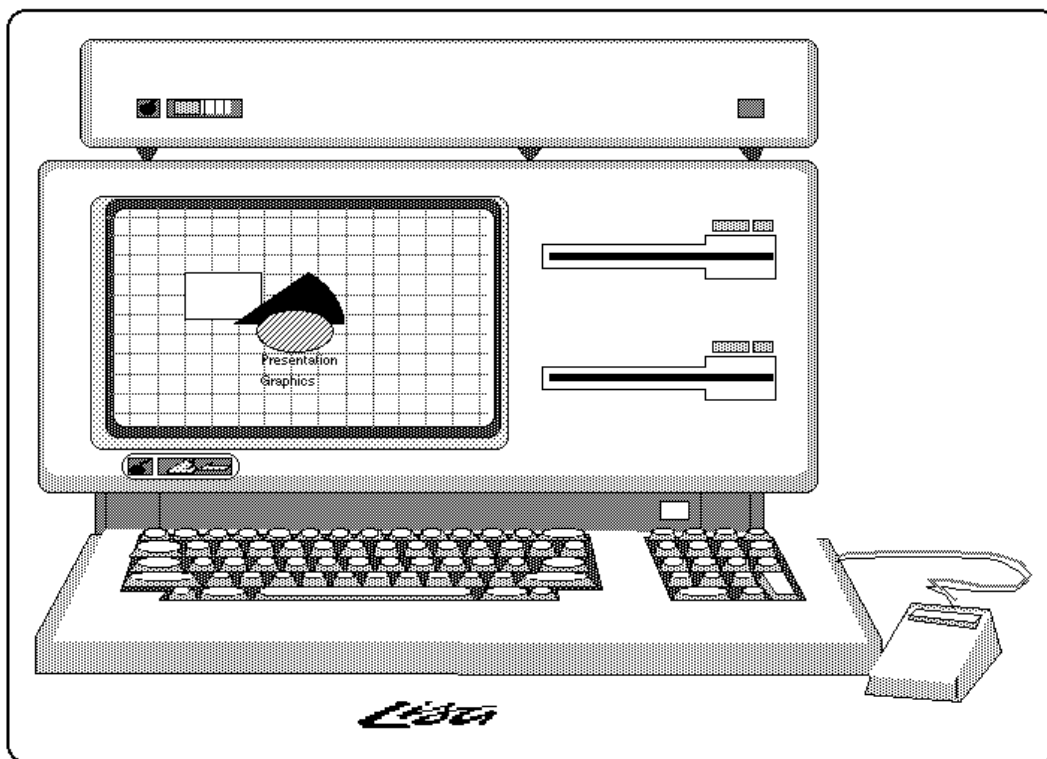
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• INTRODUCTION •

This paper is an attempt by a long time Lisa user to clarify the significance of the Apple Lisa personal computer for the computing industry. The audience of this paper is anyone who has an interest in innovative computing technology and wants to learn a little about Apple Computer's brief foray into this area via the Lisa computer.

This paper hopes to show why the Lisa was significant in its time and how some of what was called "Lisa Technology" is slowly migrating to other computer systems, mainly the Apple Macintosh computer series.

The author has never worked for Apple and as such is not privy to any insider secrets about this machine. All facts contained herein were obtained from Apple's cornucopia of Lisa literature, Apple's Macintosh literature, discussions with other Lisa owners, and my personal involvement with and close observations of both machines since 1984.

This paper is loosely based upon the excellent article "The Legacy of the Lisa" (MacWorld magazine, Sep. 1985) as written by Mr. Larry Tesler, one of the Lisa's main designers and currently a key technologist at Apple Computer.

• A LITTLE BIT OF HISTORY •

Apple began developing the Lisa computer in 1979. The Lisa charter was to build a revolutionary computer that was truly easy to use and thereby mitigate the limitations of existing computers. Developing a computer which was an order of magnitude easier to use than traditional computers required several major departures.

The name "Lisa" has always been rather enigmatic for most computer users, including Lisa owners. To set the story straight (as far as I know) here are the facts behind the name "Lisa". Officially, Apple states that "Lisa" stood for Local Integrated Software Architecture. Unofficially, "Lisa" has been associated with the name of a child fathered by one of the Lisa designers (this may be the same person who is now head of Next Computer, Inc., Mr. Steve Jobs).

The Lisa had several design goals:

> o   Be intuitive,
> o   be consistent,
> o   conform to the ways people actually work,
> o   have enough performance to do the jobs that need doing,
> o   provide an open software and hardware architecture,
> o   be reliable,
> o   be pleasing and fit into an everyday work environment.

The Lisa was built upon sophisticated hardware technology. This included a compact desktop unit containing a 12 inch black-and-white screen, and two revolutionary floppy disk drives called Twiggy. The Lisa internally contained a 68000 processor and 1 megabyte of memory (expandable to 2 megabytes). External to the Lisa's case was a keyboard and a rather rare (at the time) computer peripheral called a "mouse". The mouse was a key element of the Lisa's design. The title page of this paper contains a figure of the Lisa (this was drawn with LisaDraw by Business and Professional Software for its Lisa Art Department clipart collection).

Apple introduced the Lisa to the general public in January 1983 at a price of $9,995. In April 1985, after a life of one and a half years, Apple discontinued the Lisa in favor of its sibling, the Macintosh computer.

The development of the Lisa was a tremendous undertaking for Apple and basically required most of the company's resources, both financial and personnel. Apple reports that Lisa cost $50 million to develop and required 200 man-years of development effort. The story behind the development is a fascinating story in itself which should be more fully recorded. This paper will provide only a Reader's Digest version of the Lisa development history (a complete development history can only be written by the Lisa developers themselves, a history which this author does not think will ever see the light of day, alas!).

The Lisa may be considered a computer system that sprang from the loins of a host of successor systems. As such, many of the Lisa's "revolutionary" ideas were not really new (you may ignore the cries of the Apple marketers who think everything Apple does is new). The work by many computer companies over the decades (yes, decades) was used by Apple to design the Lisa. For example, Apple borrowed several key ideas from Xerox and its early Alto system.

In 1979 Mr. John Couch, Apple's head of software, was put in charge of a new Apple division called POS, Personal Office Systems. Mr. Couch's charter, as POS General Manager, was to develop and market the Lisa for the office system market (and provide a return on Apple's rather substantial Lisa investment).

From meager beginnings POS blossomed into a 300 person division with around 100 people devoted to the software and hardware development effort. Finally in charge of a division Mr. Couch was able to put together a team of very talented people from within Apple and from other Silicon Valley computer companies. The Lisa began life as a rather humdrum text based system, not a good sign for a "revolutionary" computer. After some field trips to a neighboring Silicon Valley computing center, Xerox PARC (Palo Alto Research Center), the Lisa developers (and some ex-PARC people who became Apple employees) embarked upon what became the Lisa computer as known to the public. One of the key changes at this point in the Lisa development history was the change from a text based system to a window based system (Xerox's Smalltalk development environment provided the inspiration for the Lisa's windows).

After repeated delays and two years beyond the initial Apple desired introduction date (January 1981), Apple unveiled the Lisa in late 1982 to selected outsiders. On 19 January 1983 Apple officially declared the Lisa a working system that would be deliverable in May 1983. Apple at this time hoped to mark the beginning of a new era in personal computers & establish the software technology standard of the 80's.

Apple's introduction of the Lisa hardware was also accompanied by a suite of revolutionary and sophisticated programs called the Lisa Office System (this program suite was later renamed "Lisa 7/7" by Apple). This suite consisted of 7 general application programs: LisaWrite, LisaDraw, LisaCalc, LisaGraph, LisaProject, LisaList, and LisaTerminal. Apple supported new Lisa owners with an extensive set of well-written documentation and an innovative interactive self-paced training course based upon the LisaGuide program (Apple called LisaGuide an "interactive manual"). For hardware diagnostic purposes Apple provided the LisaTest program, tho Apple appears to have discontinued the release of this program to Lisa owners in favor of sending the owners to the local friendly Apple dealer for Lisa servicing. For a user "operating system" Apple created the Desktop Manager. This program was a file organizer and a program manager. It created the illusion of a "desktop" on which users could place files, move files, rename files, delete files, and run programs.

On the printer front Apple provided Lisa with three different printers all capable of printing exactly what the user saw on the Lisa's screen. The dot-matrix printer could print both high-resolution text and graphics. The daisy-wheel printer was unique in that it could also print graphics, tho the ribbon was used up very quickly for this task. Later in the Lisa's life Canon provided a color inkjet printer for the Lisa. Apple appears to have had plans to support a laser

printer with the Lisa, but these plans were abandoned (Apple did have a $30,000 laser printer which Apple's Lisa developers used).

Apple's internal software development efforts centered around the Lisa Monitor development environment. This environment was text based and resembled the environments Apple provided for its Apple 2 and Apple 3 computer systems. The majority of Lisa programs were written in the Pascal language by Apple with a few programs written in 68000 assembly language. To give an idea of the size of this effort the Lisa operating system was written in around 90,000 lines of Pascal and each Lisa program (eg LisaWrite) contained somewhere around 50,000 lines each. The programmers used a wonderful window and mouse based editor called LisaEdit. Other languages included COBOL and BASIC.

For outside developers Apple provided a development environment for the Lisa called the Lisa Workshop. The Workshop was a decedent of the Lisa Monitor environment. With the Workshop a programmer could develop rather sophisticated programs using mainly the Pascal language.

A major software development effort by Apple focused on the Lisa Desktop Libraries. This collection of around 100 software modules provided the software foundation for Lisa Technology. These modules were used by all Lisa programs (eg LisaWrite) and were the main reason for the Lisa's consistent user interface. A key component of the Desktop Libraries was QuickDraw, a fast and versatile graphics module which formed the basis for Lisa Technology. QuickDraw was written in around 40,000 lines of 68000 assembly language. After Apple developed the major Lisa programs Apple permitted outside developers access to the Desktop Libraries via the Lisa ToolKit.

During the Lisa's rather short life very few programs were written for the Lisa by outsider developers that supported the Lisa's revolutionary user interface. The main reason for this was Apple's inability to provide outside developers with a fairly simple development environment that allowed the developers to write Lisa-like programs without having to know a tremendous amount of technical details for the computer. Apple attempted to develop a "framework" program called the Lisa ToolKit. Tho Apple basically finished the ToolKit development Apple decided to not support Lisa software development and instead focus its resources on Macintosh development. Apple had also not documented fully nor designed in an easily understandable fashion the underlying software modules which formed the basis for the software component of Lisa Technology. Outside software developers were also hesitant to develop for the Lisa given its high perceived price and its low sales numbers.

A major headache for Apple during the development effort was the Twiggy disk drive. Named after the British model (the drives, like the model, were thin) these drives proved to be a little too revolutionary for Apple. The Lisa contained two Twiggy drives. Consisting of a single 5.25 inch high density floppy (860K bytes) with software controlled automatic ejection mechanism, micro-stepping technology Twiggy proved detrimental to Apple and its Lisa schedule. After introducing Lisa Apple wisely abandoned Twiggy in favor of the new more reliable 3.5 inch 400K bytes Sony micro-floppy disks. Complimenting the floppy drives was a ProFile hard disk drive (built originally for the Apple 3) holding 5M bytes of data (a 10M byte ProFile was later developed by Apple for the Lisa).

Apple spent a lot of time during Lisa's development testing Lisa features with real users. From Apple's literature on this topic the Lisa developers were occasionally suprised by the user testing results. The end product of these tests was a better Lisa system. In the area of foreign languages Apple spent much time providing understandable foreign language translations for the Lisa software. Apple developed a very useful technical solution to the problem of "localization" via Phrase files. A phrase file contained all the phrases that a Lisa program could display to the user. These files simplified the translation problem by letting a language translator with minimal computer skills translate the phrases in the phrase file itself without having to delve into the highly

technical source code for the program. The Lisa at power-on also supported foreign language diagnostic messages which were keyed off of the attached keyboard.

Apple planned to sell around 10,000 Lisas in the last half of 1983 and 40,000 Lisa in 1984. In retrospect, Apple was able to sell around 80,000 Lisas during its 18 month life. On the average Apple sold 4,500 Lisas a month or 13,000 Lisa a quarter, figures which were very close to Apple's initial Lisa sales projections (I believe Apple's sales were less than expected in the first months after the Lisa's introduction, but sales picked up near the end of the Lisa's life).

Apple faced several significant risks with Lisa's introduction.

On the technical front the software development effort was immense and could easily delay Lisa's introduction. The Twiggy disk drive proved barely workable, but was fixed by the use of the more reliable Sony 3.5 inch disk drives. The Lisa's printing technology was a risk since Apple was trying to get a dot-matrix printer and a daisy-wheel printer to basically emulate a high-resolution laser printer. The Lisa fonts and printer problems were resolved.

On the business front Apple had several very high hurdles to jump. Apple was unable to devote as much time as needed to helping outside developers. The Lisa's seven software programs were basically all the programs Apple had for the Lisa's introduction. Apple was dangerously on the edge of confusing the Lisa and Macintosh product lines. Apple's data communication's strategy appeared to be rather primitive (Apple did develop for the Lisa a network called AppleBus [later called AppleTalk], but Lisa networking never seemed to catch on with users).

After a year with the Lisa product line Apple's management came to the conclusion that Apple could only support a single line of computer. The Lisa lost, Macintosh won. The Lisa's name was changed to Macintosh XL ("XL" has been quoted as meaning "Extra Large" or "X-Lisa"). The Lisa was discontinued in April 1985 and the Macintosh computer became Apple's top end system (the existence of the Apple 2 series at Apple at this time will not be discussed in this paper tho it was very important for Apple financially). After the Lisa discontinuation Apple supported the Lisa hardware with a 5 year program of spare parts and repair services.

Besides the name change to Macintosh XL Apple also developed a software program called MacWorks that allowed the Lisa to run most types of Macintosh programs. MacWorks was basically Apple's gamble to sell its remaining inventory of Lisas to the Macintosh public which desired a higher powered Macintosh than the original low-end Macintosh 128K and 512K models.

The balance of Apple's Lisa inventory was sold to a Logan, Utah company called Sun Remarketing (1-800-821-3221). Sun continues to sell the Lisa today as a Macintosh. Apple's final Lisa collection was placed in a landfill by Apple several years ago (I'm not certain of the reason for this but believe it may have been a result of a lawsuit by several Apple stockholders concerning the Lisa).

The Lisa legacy at Apple, at least in a physical sense, is still somewhat alive. The Apple Corporate Museum houses a few functioning Lisas for display purposes (I've never seen this collection [the museum was closed for repairs the last time I was in Cupertino], but believe the Lisas may be running Macintosh software, not Lisa software).

• LISA TECHNOLOGY •

The Lisa computer has proven to be one of the computer industry's most underrated personal computer systems of the last decade. When Apple released the Lisa in 1983 very few people seemed to understand the revolutionary concepts introduced by the Lisa. This misunderstanding, in retrospect, was also present at Apple.

Apple's philosophy behind the Lisa can be summed up in two words: Lisa Technology. This technology is a combination of hardware and software technology. What made the Lisa a revolutionary computer was the integration of its hardware and software and the desire by its designers to make the computer as easy to use as possible without sacrificing the user's ability to accomplish significant computing tasks. In Apple's words, Lisa Technology was based upon "the extensive use of graphics, consistent user interface, and pointing device (the 'mouse') which together emulate the way an individual works in the office".

Lisa is a system that has to be used extensively before it can be appreciated. In the words of one of Apple's Lisa documents the Lisa hardware and software combination "must be seen to be believed". Telling people about Lisa's important differences will only cause your credibility to drop because they will not believe you. Lisa is really different. Demonstrating the system is some help, but not a lot. There is always the nagging question, "Can something that looks so gimmicky really do any serious work?" While there are people who have tried Lisa and really don't like it, I think that most people who spend several hours with a Lisa doing real work will come away with positive conclusions about the Lisa's value (or at least the value of its technology).
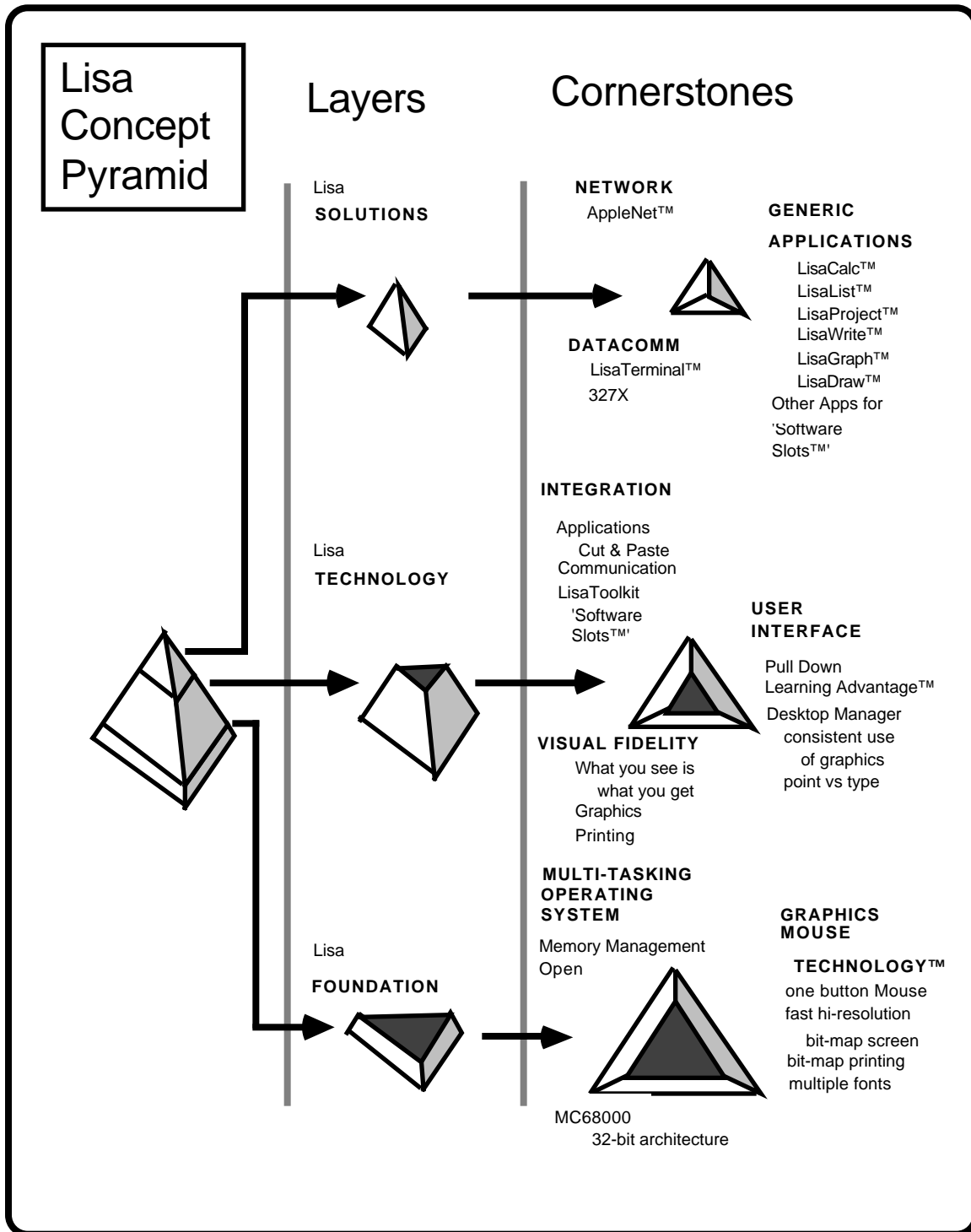
One effective presentation tool used by Apple for Lisa customers was the Lisa Concept Pyramid. The next figure is a diagram showing this pyramid.

The top part of the pyramid represents the solutions required by the target customer, the information professional (also called "knowledge workers" by Apple). The generic applications are all tools which can be used by almost anyone.

The middle layer of the pyramid represents the technology that had to be created in order to produce a truly "easy to use" system. The original prototype of this kind of technology was created within Xerox PARC. This is where the bulk of Lisa's 200 man-year effort went in developing Lisa. Many of the refinements and contributions of Apple are in the areas of Integration and a User Interface that is easy to learn and use. The one button mouse and the software to allow that was key to that accomplishment. The third cornerstone is Visual Fidelity, or what you see on the screen is exactly what you get when printed.

The bottom layer is the foundation for the layers above. The major design issues were all dictated by the needs of the software rather than the traditional way in which the hardware dominated the design. The Lisa operating system needed to be multi-tasking to allow multiple programs to co-exist at once on the screen. The Graphics Mouse Technology is the key to making the Lisa's user interface possible.

Note: Apple Computer created this figure as a LisaDraw example.

Lisa Concept Pyramid

Layers

Cornerstones

Lisa **SOLUTIONS**

NETWORK
AppleNet™

DATACOMM
LisaTerminal™
327X

GENERIC APPLICATIONS
LisaCalc™
LisaList™
LisaProject™
LisaWrite™
LisaGraph™
LisaDraw™
Other Apps for 'Software Slots™'

Lisa **TECHNOLOGY**

INTEGRATION
Applications
 Cut & Paste
Communication
LisaToolkit
 'Software Slots™'

VISUAL FIDELITY
 What you see is
  what you get
 Graphics
 Printing

USER INTERFACE
 Pull Down
 Learning Advantage™
 Desktop Manager
  consistent use
   of graphics
 point vs type

Lisa **FOUNDATION**

MULTI-TASKING OPERATING SYSTEM
Memory Management
Open
MC68000
 32-bit architecture

GRAPHICS MOUSE TECHNOLOGY™
 one button Mouse
 fast hi-resolution
  bit-map screen
 bit-map printing
 multiple fonts

A graphical overview of a typical Lisa screen should help the reader better understand the Lisa's features that made it unique in 1983. For those readers with a knowledge of the Macintosh or other object-oriented systems (eg Microsoft Windows for the IBM PC), the following will be rather boring. The next figure contains a screen image of the Lisa showing several key components of the Lisa's user interface, one of its major distinctive features.

The Lisa screen contained a menubar at the top that allowed the user to select commands using the mouse. The screen shows the Edit menu selected with the mouse pointer preparing to activate the Copy command. Arranged on the Desktop are several windows and icons. Windows display file data or file directory information to the user. Several windows are visible with some overlapping others. The front-most window is a LisaDraw window showing a freehand drawing of a rose. The menubar is owned by the font-most window so in this case shows the various major command groups available for LisaDraw.

All Lisa user actions were centered around the one-button mouse. The user moved the mouse pointer (usually a small arrow-shaped pointer) to the screen object of interest. For example, to activate a menubar command the user moved the mouse pointer to the appropriate command group label, eg Edit, and pressed the mouse button. The selected menu would then "pull down" showing a list of the specific commands the user could work with. Still holding the mouse button down the user dragged the mouse pointer to the desired command, eg Copy, and released the mouse button when the mouse arrow touched the Copy command and the command name in the menu was hilighted. At this point the selected menu command was activated and performed its function on the selected window object. For example, if you were using LisaWrite, the Lisa's word processor, you could copy data from a LisaWrite document by first selecting with the mouse pointer the text to copy, and then activating the Edit menu Copy command.
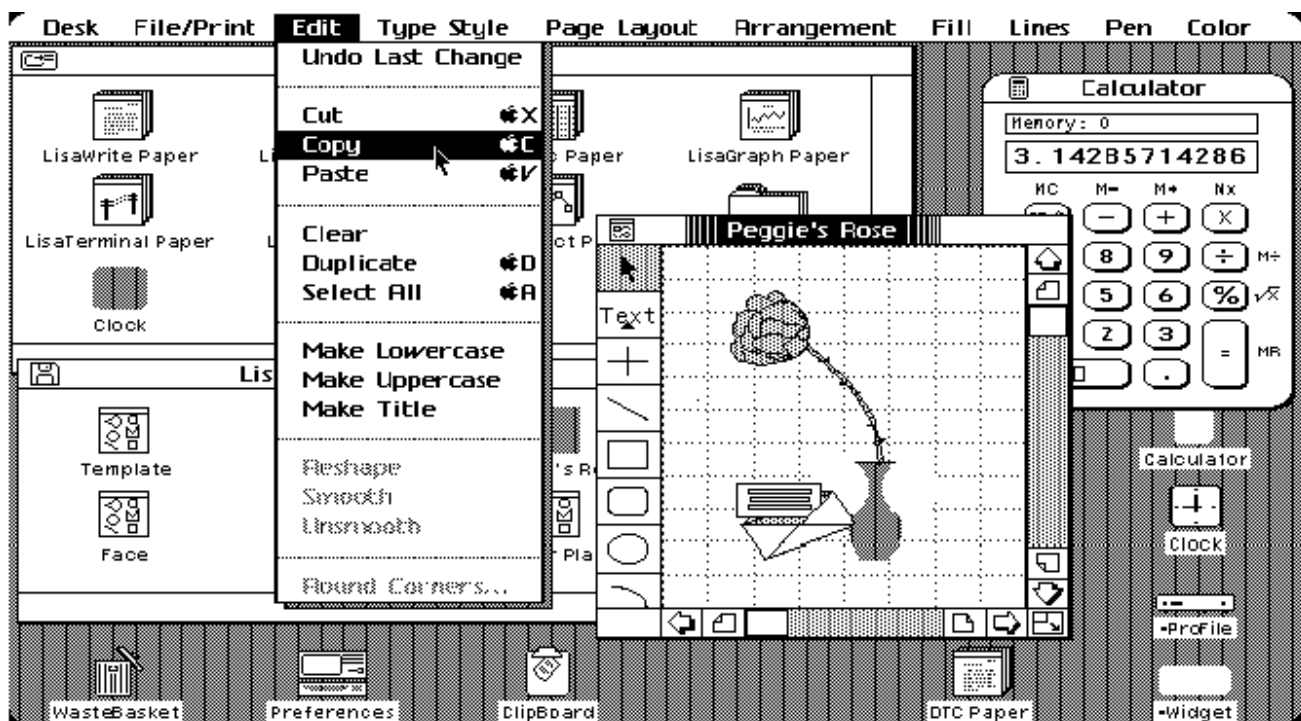
The Lisa's technology for the most part has been copied by other systems both in Apple and elsewhere. But in my opinion several aspects of the Lisa's design made the Lisa unique. These aspects to date have not been adopted by other microcomputer systems to any significant degree.

SOFT POWER-ON AND POWER-OFF
The Lisa was powered on by a button on the front plate of the computer case. This same button also powered off the Lisa. The difference tho here was that the Lisa's power button was not a true power button. The Lisa was never turned off, it was always running. When the Lisa was "off" it was really in a low-power mode that only waited for the user to press the power button. If powered-on and the user pressed the power button to turn the Lisa "off" the Lisa told the

operating system of this fact. The operating system (really the Lisa Desktop Manager) then commanded all executing programs to save their document's data. When all programs indicated that they had saved their documents the Lisa then powered-off to its low power mode.

SELF-ORGANIZING DESKTOP
In conjunction with the Lisa's soft power-on/off button the Lisa maintained an orderly desktop for the user. When the user power-off the computer the Lisa's Desktop Manager would save all open document data to disk AND save the state of the desktop too. When the user powered-on the Lisa the Desktop Manager restored the desktop state as it was when the user powered-off.

DOCUMENT-CENTERED VIEW
The Lisa supported a document-centered view. In this view documents were important, not programs. To start a new document the Lisa user tore off a sheet of "stationery" from a stationery pad icon that resided on the screen. Each Lisa program came with a stationery pad. When "opened" by the user a stationery pad automatically duplicated itself, set its name to the current date, and created a window on the screen for the user. The Macintosh in System 7 supports stationery pads, but the Macintosh does not use a document-based view. Program icons were really not important on the Lisa except to move the program file to another disk. Generally, Lisa user's kept their document stationery pads in an easily accessible location on the screen and kept the program icons in a folder which they generally never opened except to add new programs or delete old programs.

RELIABLE FILE DATA STORAGE
The Lisa's file system was designed to be reliable. To reduce the impact of a system crash, the file system maintains distributed redundant information about the files on the disk storage. Duplicate copies of critical information were stored in different forms and in different places on the disk media. For example, the information in the central disk catalog about a file was also stored in a special disk block at the head of that file. Also each block on the disk specified the part of the file to which it belonged (this information was called a block "tag"). Since all the files and blocks on a disk were able to identify and describe themselves, there were several ways to recover lost information. A utility called the Scavenger was able to reconstruct damaged disk catalogs from the redundant information stored about each file.

In my experiences with the Lisa I've only had one Lisa disk that the Lisa scavenger could not fix. The scavenger is activated by the Lisa whenever the Lisa determines that a disk has problems. At this point the Lisa's low-level operating system informs the Desktop Manager which displays a dialog for the user. The user may then select to either have the Lisa repair the disk or eject it.

The Lisa's ProFile hard disk and Twiggy floppy drives also supported an extensive set of reliability features. Once such feature was disk block sparing. When a disk block (a unit of 512 bytes on the disk) was detected by the Lisa as beginning to fail, the Lisa's disk drive (either the ProFile or Twiggy) moved the data to a spare area of the disk media. The failing disk block was marked as "bad". Whenever a program attempted to access a bad block the disk drive automatically used a "spared" data block instead.

The original Macintosh used to support block tags at the hardware level, but Apple never provided a Scavenger program at the software level to use these tags. Neither did Apple's Finder program (the Desktop Manager equivalent) support any checks for failing disk blocks. After several years Apple abandoned disk block tag use, tho Apple has now introduced the use of block sparing for high density floppies and hard drives.

UNIQUE SYSTEM SERIAL NUMBERS

Each Lisa contained a unique serial number which the Lisa Desktop Manager could read (the serial number was stored in a special electronic chip). The Lisa used the serial number for program protection and for establishing unique communication nodes for the Lisa data network.

SIMPLE BUT EFFECTIVE PROGRAM ANTI-PIRACY AND DATA PROTECTION
All Lisa's provided a simple and effective method of protecting user programs from piracy and data files from snooping eyes of co-workers.

When the user installed a new program the Lisa "serialized" the disk copy of the program. This serialization process wrote the Lisa's serial number to the program floppy disk. The user of this floppy disk would then be unable to copy this "protected master" program file to another Lisa. But the user could execute the protected program from the floppy disk, a rather tedious task given that the Lisa programs tended to be rather large and floppy disk based program execution would try the patience of most users.

Document protection was provided by a password scheme. The user could select a document icon with the mouse and thru a menu command obtain general information about the document via a dialog. This information included the document's size and the protection password. If the user typed a password into this informational dialog the document was protected. When a user attempted to open a protected document the Lisa displayed a dialog asking for the password.

NON-PHYSICAL FILE NAMES
The Lisa Desktop Manager did not display physical document names to the user. Instead the Lisa presented the user with a document name "view" which made the user think that the Lisa stored document names with up the 63 characters. The underlying Lisa file system allowed file names to be up to 31 characters in length and the file names could not contain the directory separator characters, "-". The Lisa Desktop Manager maintained for each document a user document name (eg "Vacation Plans - 1983") and a physical low-level file name (eg "{T3D456}").

This non-physical file name scheme also supported the use of multiple documents with the same name, tho the underlying physical file names were different. In this regard the Lisa mimicked the physical working desktop where a worker could have 5 photocopies of the same document on his desktop at the same time.

To the best of my knowledge no other microcomputer currently supports non-physical document names.

PULL-OUT HELP CARD IN THE KEYBOARD
The Lisa keyboard contained small pull-out cards. These cards consisted of several firm plastic sheets containing helpful information. The first sheet showed the Lisa keyboard and a layout of all the special keys that the user could type with the Lisa keyboard's Option key. Other cards contained concise information about Lisa operating features such as how to copy documents. Another card was blank and allowed users to write down important information pertaining to the Lisa (eg phone number of the local Apple service center or representative).

HARDWARE BASED MEMORY MANAGEMENT
The Lisa supported a sophisticated hardware based memory management strategy. This strategy allowed Lisa programs to believe they could access more memory than there really was in the Lisa (note: Lisa contained 1 megabyte of physical memory with about half of it used for the Lisa Desktop Manager and the Desktop Libraries). This strategy also allowed the Lisa to segregate executing programs so that they could not interfere with other programs in the event a program tried to access another program's data when it should not have tried this. In this case the Lisa would stop the errant program and alert the user that the program has been stopped.

ENVIRONMENT WINDOW
Lisa provided a simple method for the computer to run radically different operating environments. This method was implemented with the Environments Window. When the Lisa started up it first ran a special low-level program called the environment selector. This program ran a default operating environment if one was present. Otherwise, this program displayed a window for the user allowing the user to select the environment to use. Apple supplied two different environments, the Office System environment (for non-technical end users) and the Workshop environment (for programmers). Other companies supplied additional environments (eg the UNIX environment).

ADJUSTABLE SCREEN CONTRAST AND DIM DURATION CONTROL
The Lisa screen contrast could be adjusted by the user with a special program called Preferences. This program also allowed the user to define a duration of inactivity for which the screen would automatically dim and the dim contrast. This feature prevented screen "burn in" which happens when a screen is set to a high contrast and images on the screen burn into the screen's phosphorus.

When automatically dimming the screen the Lisa did not suddenly dim the screen. Instead it gradually dimmed the screen in pleasing dim increments. This was a nice touch on Apple's part which saved the user from suddenly encountering a jarring screen change contrast change from a bright level to a dark level.

PRIVACY FEATURE FOR THE SCREEN
For Lisa users who dealt with sensitive data on their Lisa screen and could not allow people to see this data, the Lisa provided a simple screen privacy feature. The user could at any time press some special keyboard keys and the screen would automatically dim (Option-Shift-0 [zero] with 0 on the numeric keypad).

SELF-TEST AND FOREIGN LANGUAGE USAGE VIA THE ATTACHED KEYBOARD
The Lisa when powered on ran a special program which tested the Lisa's hardware components. This testing made certain that the Lisa was in well enough shape to run user programs and manipulate user data. Hardware failures caused the Lisa to alert the user with a specific failure error number which could be used by an Apple service center to replace the defective part.

During these diagnostic tests (which took around 3 minutes to execute) the Lisa displayed icons and messages to the user. The messages could appear in either English, French, or German. The Lisa determined which language to use by which keyboard was attached to the Lisa. The Lisa keyboards were self-identifying and provided the Lisa with such information as the keyboard "language". For example, if the keyboard was a German keyboard, then all diagnostic messages appeared in German. Unfortunately, the Lisa's Office System and programs like LisaWrite did not use the appropriate language for its menus and messages based upon the keyboard type.

SPECIAL SERVICE MODE
The Lisa contained a special "service mode" which could be activated when the Lisa was powered on. This special feature allowed the knowledgeable user to run some special diagnostic tests on the Lisa. Also supported was a cross-hatch pattern for the screen which assisted the user in adjusting the screen contrast.

EASY SYSTEM DISASSEMBLY
Lisas were very easy to disassemble by the user without the use of any tools. Apple allowed the user to essentially disembowel a Lisa except for dangerous portions like the monitor screen. For example, users could remove and replace disk drives with ease by just popping the front off (finger grips are at the base of the front panel) and unscrewing a single screw which held the disk drive in place.

• MACINTOSH XL, MACWORKS, LISA-TO-MAC MIGRATION KIT

Apple developed the MacWorks program as a way for Macintosh owners to use the Lisa's bigger screen, bigger memory, and hard disk. When Apple planned to discontinue Lisa Apple was left without a high-end system. All Apple had to offer at the time was the Macintosh 128K or 512K models, or the Lisa which ran only Lisa software.

Apple's hardware and software engineers quickly developed a special program named MacWorks that allowed a Lisa owner to turn his Lisa into a big Macintosh. Apple produced three versions of MacWorks and later turned over all MacWorks development to Sun Remarketing (Logan, Utah) which went on to develop MacWorks Plus, an enhanced MacWorks that lets a Lisa emulate a Macintosh Plus computer.

With the development of MacWorks Apple changed the name of the Lisa to Macintosh XL. Apple then was able to sell a rather surprising number of Lisas (i.e. surprising to Apple). MacWorks is still a commercial product for Sun Remarketing, tho I wonder how many Lisas/Macintosh XLs Sun really sells now.

For the Macintosh XL Sun Remarketing has been quite prodigious in producing hardware peripherals. This includes larger hard disks and a SCSI board that allows SCSI devices to work with the XL.

The problem of transferring Lisa data to a Macintosh was solved by Apple via the Macintosh XL Migration Kit. This kit consisted of a special Lisa program called Lisa-to-Macintosh and a set of Macintosh data conversion programs. The Lisa program's main function was to place Lisa data files on a Macintosh disk. The Macintosh data conversion programs took the Lisa data files on the Macintosh disk and converted them to the appropriate Macintosh data file. For example, LisaWrite documents could be converted to either MacWrite or Microsoft Word data files for use by the Macintosh.

• MACINTOSH: BACK TO THE FUTURE •

Tho the Lisa is now a decade old, Lisa Technology still influences the Macintosh (and the Apple 2 computer series). The title of this section attempts to convey the idea that as the Macintosh product line matures it has in many ways approached the Lisa's technology of 1983.

When Apple introduced the Lisa in January 1983, the Macintosh was still under development. In January 1984 Apple introduced the Macintosh, a physically smaller version of the Lisa.

The Macintosh from a casual glance resembled the Lisa in many ways. But underneath, the Macintosh and the Lisa were totally different. The Lisa supported a multi-tasking operating system, the Macintosh supported single-tasking. The Lisa's extra memory (8 times larger than the Macintosh) and hard drive allowed larger more-sophisticated Lisa programs and larger data files.

The Lisa's Desktop Manager and its distinctive user interface were used by the Macintosh developers as a foundation for the Macintosh's Finder and its user interface.

A short list of Lisa legacy items from Mr. Larry Tesler's article "The Legacy of the Lisa" (MacWorld magazine, Sep. 1985) appear below (I've added the Software development list):

o   User interface
                - Menubar, pull-down menus, keyboard-activated menu commands
                - Printing dialog boxes

- Appearance, structure, and operation of windows and scroll bars
- Ability to move windows and icons by dragging with the mouse
- Windows that zoom to open and close
- Dialog and alert boxes with buttons and check boxes

o   Applications
- QuickDraw graphics package
- LisaDraw converted to MacDraw
- LisaProject converted to MacProject
- LisaWrite, LisaCalc, LisaTerminal influenced Macintosh applications
- Lisa Desktop Manager influenced the Macintosh Finder design
- Lisa printing architecture influenced Macintosh printing

o   Software development
- Lisa Pascal converted to MPW Pascal
- Lisa Clascal influenced MPW Object Pascal
- Lisa Workshop influenced design of Macintosh Programmer's Workshop
- Lisa Workshop editor (LisaEdit) influenced editor design
- Lisa ToolKit influenced heavily the Macintosh MacApp framework

o   Hardware
- Single-button Mouse design
- ImageWriter printer

The Lisa legacy may also be seen in its influence, thru the Macintosh at least, on the state of non-Apple microcomputers. This includes Microsoft Windows, Digital Research's GEM, and Commodore's Amiga DOS. If one looks at these systems closely one will see that they have a superficial resemblance to the Lisa (and Macintosh) environments. But many times below the surface one finds behavior that is reminiscent of the older PC-DOS and C/PM systems from long ago.

Other Macintosh technical areas were also influenced by the Lisa:

o   System 7 Stationery
o   System 7 Apple Events
o   Finder's Print Monitor

When I work with the Macintosh (eg a Macintosh II series machine) now (1993) I notice two prominent differences from the Lisa of 1984.

First, the Macintosh is much faster than the Lisa. Editing complicated images in LisaDraw is almost an exercise in futility. Apple has made excellent strides in enhancing the speed of its Macintosh series. If Apple had kept the Lisa product line one could only assume that hardware speed improvements would have emerged as technology advanced. I've heard that Apple even developed a prototype Lisa based upon the 68020 processor, but canceled this project when Apple canceled the Lisa. This may have made the Lisa a much faster machine.

Second, Macintosh seems incomplete in some areas. For example, the Macintosh Finder does not save the desktop and open application location and data states as did the Lisa's Desktop Manager. I miss being able on the Lisa to press the Lisa's power-off button and just walk away from the computer. I could do this because I knew the Lisa would save all my application data and turn off automatically. Later, when I wished to resume work with the Lisa I just pressed the power-on button and the Lisa showed me a screen matching the one I had left.

I don't mean to criticize the Macintosh unfairly since it has in its own right contributed much to the field of personal computing. But from an overall perspective the Lisa was a result of a total system approach that delivered integrated functions with a consistent and high quality user interface. I can only speculate how this "total approach" originated but think it may have something to do with the experience and age differences of the Lisa and Macintosh development teams. From my readings it appears that the Lisa developers were about a decade older than their Macintosh counterparts. The Lisa developers came mainly from large computer companies (eg Xerox, HP, DEC) which dealt mainly with mini-computer class systems, while the Macintosh developers came mainly from Apple itself and its Apple 2 and 3 computer divisions. The Lisa developers also appear to have had a different perspective on programming than the Macintosh developers. The Lisa's core software was mainly written in Pascal, a high-level language. Macintosh core software on the other hand was written in 68000 assembly language.

I can only hope that Apple will try to bring back some Lisa technology that is appropriate for its Macintosh (and newer) systems. For this hope to become reality Apple will need to preserve the Lisa development materials as best it can. Unfortunately, from my experiences with Apple in this area, Apple appears to have lost some of the Lisa materials already and does not seem too interested in spending time on what many at Apple may consider antiquated Lisa technology. I see the preservation of the Lisa design notes and the Lisa Office System source code files as very important for the continuance of the Lisa's legacy.

Hopefully Apple will remove the confidentiality status of its Lisa materials in the upcoming years so that outsiders like myself may have access to this body of knowledge.

• MACINTOSH SYSTEM 7 LISA DEDICATION •

Even tho the Lisa was considered by many at Apple to be a failed experiment there appear to be some Applers who still remember the Lisa and its legacy to the Macintosh. These people provided a short dedication to the Lisa Desktop Manager and its designers in Apple's latest operating system, System 7, which debuted in 1990, almost a decade after the Lisa's debut.

On a Macintosh running System 7 you may obtain a dialog showing a Lisa dedication. Hold down the Option key and select with the mouse the Apple menu item "About the Finder" (this item is called "About this Macintosh" if the Option key is not held down). You should see a pretty mountain scene with some people's names at the bottom of the scene. Wait about 15 seconds and the bottom names will scroll showing the names of the people at Apple who contributed to the various versions of the Macintosh Finder. Eventually you will see the following dialog describing the Lisa Desktop Manager:

Lisa Desktop Manager 1981-1983 by Dan Smith, Frank Ludolph, Bill Atkinson

• REFERENCES •

There exist many reference materials for the Lisa. Unfortunately, most of these references are rather difficult to obtain. Fortunately, the author of this paper appears to have most everything ever written about the Lisa both by the general press and by Apple Computer. All my Lisa materials are available to others if they pay for the copying (US$0.10 per page) and shipping.

Note that this discussion of Lisa references mainly covers those reference works which pertain to the original Lisa, not the Macintosh version which Apple called Macintosh XL. The original Lisa ran its own operating system (called the Lisa OS) while the Macintosh XL ran the Macintosh OS.

For general Lisa information I recommend the following books and articles:

o   The Complete Book of Lisa (Kurt Schmucker, 1984)
o   The Lisa Computer System (BYTE magazine, Feb. 1983)
o   The Lisa 2: Apple's Ablest Computer (BYTE magazine, 1984)
o   A First Look at Lisa (Personal Computing magazine, Mar. 1983)
o   Apple's Lisa (The Seybold Report on Professional Computing, Jan. 1983)
o   Lisa Makes the Scene (Apple Orchard magazine, Mar. 1983)
o   Background Information: How Lisa Works (Apple Computer, 1983)
o   Introducing Lisa: Apple's Personal Computer for the Office (Apple Computer, 1983)
o   Apple Introduces Lisa: A Revolutionary Personal Computer for the Office (Apple, 1983)
o   The Apple Lisa (Officemation Product Reports, Apr. 1983)
o   Lisa/Mac XL Handbook (Michael Posner, Lisa Lives User Group, 1992)
o   How Apple presents Lisa (Softalk magazine, Sep. 1983)
o   Personal Computer Series: Apple Lisa 2 (Electronic Design, Jul. 1984)
o   Lisa Owner's Manual (Apple Computer, 1984)

Many other general Lisa references exist, ranging from general magazine articles to press clippings. Three books were written for the Lisa, but only Schmucker's book may be considered worth reading. Michael Posner's 123 page handbook is worth reading if you want a decent overview of the Lisa's history and operational information. This handbook is also noteworthy because of its current publication date, 1992 (this may show to some the longevity of the Lisa). To join Michael Posner's Lisa Lives user group write to him at 5170 Woodruff Lane, Palm Beach Gardens, Florida 33418.

Several Lisa-specific magazines were also around for a while.

o   Semaphore Signal
o   ICON
o   The LisaTalk Report

Semaphore Signal was a very detailed Lisa newsletter which produced around 30 issues. ICON was also good. The LisaTalk Report was the newsletter for the Lisa NetWorkers, a group which tried to breath some life into the Lisa after Apple discontinued this machine.

For information about the Lisa's first operating system (aka the Lisa Office System or Lisa 7/7) see the following.

o   Reviewing Lisa's Office System (St. Mac magazine, Mar. 1984)
o   Venerable Lisa Software Improved (Personal Computing magazine, Mar. 1985)
o   The Lisa Office System (Apple Computer, 1984)
o   Lisa Product Data Sheets (Apple Computer, 1983-1984)

o   LisaGuide screen prints (David Craig, 1984)

The Product Data Sheets are worth reading if you desire some knowledge about the programs Apple created for the Lisa. These describe the Lisa itself, LisaWrite, LisaDraw, LisaCalc, LisaGraph, LisaProject, LisaList, and LisaTerminal. The LisaGuide screen prints are a collection of all the screens shown by Apple's interactive tutor for new Lisa users, LisaGuide. There exist 126 screen prints in this collection.

For historical information about the Lisa see the following.

o   The Legacy of the Lisa (MacWorld magazine, Sep. 1985)
o   The Apple 32 Line: Past, Present, and Future (A+ magazine, Jul. 1984)
o   Lisa Chronology (Orphan Support column, MACazine, 198?)
o   Fire in the Valley (book, 198?)
o   The Little Kingdom (book, 198?)

The Lisa Legacy article is well worth reading since it was written by one of the Lisa's main designers who provides a concise narrative of how the Lisa changed personal computing.

For those readers with a technical bent there exist a smorgasbord of technical Lisa materials that should satisfy the most hungry technologists.

o   The Architecture of the Lisa Personal Computer (Proceedings of the IEEE, Mar. 1984)
o   Lisa User Interface Guidelines (Apple Computer, Nov. 1983)
o   Lisa's Alternative Operating System (Computer Design, Aug. 1983)
o   Lisa: Up Close and Personal (Softalk magazine, Sep. 1983)
o   Network Introduction Package (Apple Computer, 1983)
o   The Lisa Applications Toolkit (Apple Computer, 1983)
o   Lisa Workshop User's Guide (Apple Computer, 1984)
o   Lisa Development System Internals Documentation (Feb. 1984)
o   Lisa Desktop Libraries Interface Listings (David Craig)
o   Lisa Hardware Manual (Apple Computer, May 1983)
o   Guide to the OS (Apple Computer, Oct. 1982)

The Lisa Architecture paper is a tremendous resource of Lisa technical design and implementation facts. The author of this extremely difficult to find paper was one of the Lisa's main designers. The Lisa User Interface Guidelines is a wonderful 100 page document that describes the design behind the Lisa's user interface. The Desktop Library interface listings describe the routines and data structures which Apple developed to implement Lisa Technology. The Lisa Hardware Manual is a rather lengthy tome describing Lisa's hardware in extreme detail. If you are a nut about computer electronics, this manual is for you. The author also has a 1981 version of the hardware manual which is rather short (80 pages versus 200 pages for the 1983 version). The "Guide to the OS" was an internal Apple development manual describing the Lisa Monitor development environment, the precursor to the public Lisa Workshop development environment. This document should be of interest to those people who have a yearning to learn about the Lisa's early development years and the tools which Apple's programmers used for the programming effort.

Shortly after Apple introduced the Lisa in 1983 an enterprising computer engineer from Seattle started a Lisa programming group called the ToolKit User's Group (TUG). This group centered around the software package called the Lisa ToolKit, which was based on the Pascal language derivative Clascal, as developed by Apple for long-term Lisa development. For those with an interest in the Toolkit the following resources may be beneficial.

o   Software Frameworks: The Lisa ToolKit (BYTE magazine, Dec. 1984)

o   Professor Overrider's Almanac (David Redhed, TUG's newsletter, 4 issues)
o   Save the ToolKit: A Call to Arms (Call A.P.P.L.E., Jun. 1984)
o   An Introduction to Clascal (Apple Computer, Jul. 1984)
o   The Lisa Applications ToolKit Reference Manual (Apple Computer, 1984)
o   Object-Oriented Programming for the Macintosh (Kurt Schmucker, 1986)
o   ToolKit source code (David Craig)

The Schmucker Macintosh book is recommended reading for those wanting a concise introduction to the Lisa ToolKit and the Clascal language. Tho devoted to the Macintosh and MacApp, Apple's Lisa ToolKit son, this book does provide an excellent chapter on the Lisa ToolKit and Clascal. The ToolKit source code is a wonderful collection of well-written modules which any programmer could benefit from reading.

The history and details behind the Lisa's development are documented in the following references.

o   The Past, Present, and Future of the Macintosh Desktop (Semaphore Signal, Mar. 1986)
o   An Interview with Wayne Rosing, Bruce Daniels, and Larry Tesler (BYTE, Feb. 1983)
o   The Birth of the Lisa (Personal Computing magazine, Feb. 1983)
o   Lisa's Design (Popular Computing, Mar. 1983)
o   Lisa: A Vision from the Couch at Apple (Softalk magazine, Jul. 1983)
o   Racing to a Draw: How Apple Gets its Software out the Door (St. Mac, Jun. 1984)
o   Apple's Second Try at UNIX (UnixWorld magazine, Mar. 1988)
o   A Death in the Family (ICON magazine, Vol. 2, No. 3)

The BYTE interview article is excellent since it contains an interview with the main Lisa designers. The "Racing to a Draw" article is worth reading since it provides a fairly detailed description of how Apple developed the LisaDraw and MacDraw programs. The "Couch" article is a good read since it discusses Mr. John Couch, the General Manager for Lisa, who may be considered Lisa's "father".

For those with inquiring minds about MacWorks, the software which allows a Lisa to run (most) Macintosh software, see the following.

o   MacWorks XL User's Manual (Apple Computer, 1984)
o   MacWorks Plus: Making a Lisa Speak Macintosh (MacTech Quarterly, Spring 1989)

There exist several articles and manuals that describe how to transfer Lisa data to a Macintosh. This transference is based upon the Apple program called the Macintosh XL Migration Kit.

o   Using the Macintosh XL Migration Kit (Apple Computer, 1985)

Several U.S. patents from Apple cover key Lisa technologies.

o   Lisa Twiggy disk drive front panel   (Patent # Des. 266,426, Oct. 1982)
o   ProFile hard disk case   (Patent # Des. 273,295, Apr. 1984)
o   Lisa case   (Patent # Des. 277,673, Feb. 1985)
o   Lisa mouse   (Patent # 4,464,652, Aug. 1984)
o   Twiggy disk drive   (Patent # 4,466,033, Aug. 1984)
o   Lisa QuickDraw "regions"   (Patent # 4,622,545, Nov. 1986)
o   Lisa Memory Management Unit   (Patent # 4,926,316, May 1990)

There exist several good Lisa hardware repair books which current Lisa (or Macintosh XL) owners should seriously consider purchasing.

o   Macintosh Repair & Upgrade Secrets (Larry Pina, 1990)
o   Lisa/Macintosh XL Do-it-Yourself Guide (Sun Remarketing, 1990)
o   Apple Service Technical Procedures: Lisa/Macintosh XL (Apple Computer, 1988)

The Apple Service Technical Procedures manual is a very detailed document describing how to fix errant Lisas (or Macintosh XLs). The original Lisa systems came with a wonderful disk called LisaTest that allowed a novice Lisa owner to diagnose the Lisa's maladies.

For an overview of the computing technology that Apple "borrowed" heavily upon for the Lisa's design see the various papers from Xerox and others (the entries marked "*" are contained in the Xerox publication "Xerox Office Systems Technology: A Look into the World of the Xerox 8000 Series Products" [OSD-R8203A, Jan. 1984]).

o   The Star User Interface: An Overview (*)
o   Designing the (Xerox) Star User Interface (* [also in BYTE, Apr. 1982])
o   Alto: A Personal Computer (Computer Structures, Principles, and Examples, 1982)
o   The Smalltalk Graphics Kernel (BYTE, Aug. 1981)

This paper's author has written several somewhat interesting Lisa papers which may attract the attention of a few people.

o   Apple Lisa Graphical Object-Oriented User Interface (Oct. 1987)
o   A Review of Apple's Lisa Pascal (Oct. 1988)
o   A Review of Apple's Lisa Workshop (Oct. 1988)
o   Apple Lisa 7/7 Tool Deserialization (1988)

• SUMMARY •

In retrospect the Lisa may be seen as an experiment that both succeeded and failed. The Lisa succeeded by introducing several concepts to the computing industry which in some cases revolutionized how computers were built and how users used them. The Lisa failed by not being able to convey what it was really trying to accomplish, that is, convincing people (both power users and normal users) that a computer system can be easy to use, powerful, and reliable.

Apple Computer is one of the few computer companies in the world that has the gumption to attack projects like Lisa. Apple's success in developing the Lisa, showing that a desktop system could be both powerful and easy to use, and attempting to migrate some of the Lisa's features to its other computers (eg Macintosh and Apple 2 series) should be considered a feather in the hat of all the people at Apple who participated in the Lisa adventure.

In a few short years a rather small group of very talented and dedicated people at Apple built a computer system designed to be used by ordinary people. What specific circumstances created this conjunction of technical talent is beyond my knowledge. However, it did happen and for a brief time there was an unparalleled flash of brilliance that is now a fading image. Hopefully this fading flash will be rekindled in the future.

Having the Lisa legacy without learning from it would be worse than not having a legacy at all.

<div align="center">That's all, folks !</div>