

Usability Engineering

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Generations of User Interfaces

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Generation of User Interfaces

- In computer field **generation** is often used to refer to the changes in the underlying hardware component technology.
 - UI technology has also been through a series of generations that roughly parallels the generations of hardware.



Summary of the generations of computers and user interfaces

Generation	Hardware technology	Operating mode	Programming languages	Terminal technology	User types	Advertising image	User interface paradigm
0 –1945 Pre-history	Mechanical, electromechanical (Babbage, Zuse Z3)	Not really being “used” except for calculations	Moving cables around	Reading blinking lights and punch cards	The inventors themselves	None (computers had not left the lab yet)	None (direct hands-on access to the hardware only important thing)
1 1945–1955 Pioneer	Vacuum tubes, huge machines, short mean time between failures	One user at a time “owns” machine (but for a limited time only)	Machine language 001100111101	TTY, typewriter. Only used in the computer center	Experts, pioneers	Computer as calculator	Programming, Batch
2 1955–1965 Historical	Transistors; more reliable. Computers start seeing use outside the lab.	Batch (centralized “computer as temple,” not accessed directly)	Assembler ADD A,B	Line-oriented terminals (“glass-TTY”)	Technocrats, professional computerists	Computer as information processor	Command languages
3 1965–1980 Traditional	Integrated circuits. Businesses can cost-justify buying computers for many needs.	Time-sharing (online transaction processing systems)	High-level languages, Fortran, Pascal, C if expense > income then...	Full-screen terminals, alphanumeric characters only. Remote access common	Specialized groups without computer knowledge (e.g., bank tellers)	Mechanization of white-collar labor	Full-screen strictly hierarchical menus and form fill-in
4 1980–1995 Modern	VLSI. Individuals can buy their own personal computer	Single-user personal computers	Problem-oriented languages, spreadsheets	Graphical displays. Desktop workstations, heavy portables	Business professionals, hobbyists	Personal productivity (computer as tool)	WIMP (Windows, Icons, Menus, and a Pointing device)
5 1995–? Future	Wafer-scale integration. Individuals can buy <i>many</i> .	Networked single-user and embedded systems	Nonimperative, possibly graphical	“Dynabook,” multimedia I/O, easily portable, with cellular modem	Everybody	Computer as appliance	Noncommand-based interfaces



Batch Systems

- First generation interfaces was not even interactive
- Interaction between user and the system was restricted
- Submit a batch job as a single unit
- All the user's commands had to be specified before the result of any of them was made known to the user.
- Did have an advantage in being able to run without user supervision in cases where the same thing had to be done over and over again
 - Payroll processing
- Therefore, many modern computers have retained some forms of batch capability to supplement their interactive mode.
- Batch modes provide some opportunity for the user to continuously monitor the progress of the batch job.
 - Can interrupt and/or modify the job



Batch Systems



Line-Oriented Interfaces

- Time sharing systems were invented around 1960
 - Allow several users simultaneously interactive access to a single mainframe computer
- Major problem - the small number of computational resources are available to support the user interface for any given user.
 - So often used line-oriented interfaces
- Line-oriented interfaces - one dimensional interfaces
 - User could only interact with the computer on the single line that served as a command line
 - Once hit the enter input could not be modified
- Interaction Style is limited
 - Interface did not allow users to move about screens
 - Limited to question-and-answer dialogues
- Problems with Question answer system,
 - Users may want to change earlier answers
 - They need to answer the current question without knowing what the following questions will be



Full Screen Interfaces

- Started taking advantage of the modifiable nature of the entire screen, and full screen interfaces were introduced
- Change the space of interface design from one to two dimension
- Classic use of the full screen - form filling dialogues
 - Still exist in modern computers
- Many full-screen interfaces also use the function keys as a primary interaction style.
 - Function keys - use as accelerator
 - Few to learn

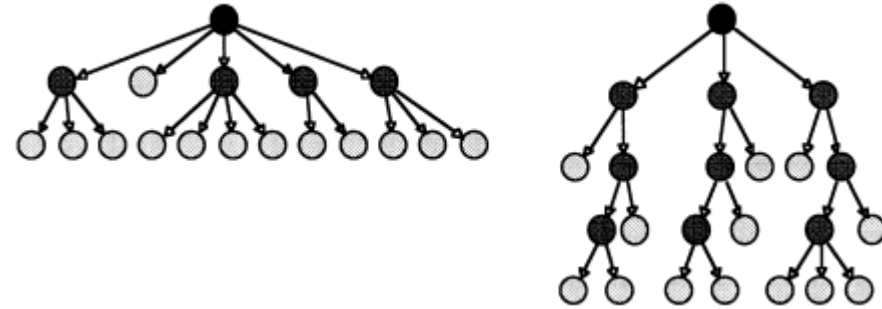
Menu Hierarchies

Full screen interfaces often depend heavily on hierarchically nested menu, with each menu taking up the full screen



Menu Hierarchies ctd.

- Menus can also be used in line-oriented interfaces
 - Possible user to choose from a menu by typing the desired menu option
- Best advice is to avoid hierarchical menus



- Trade off between depth and breath hierarchical menu design
 - Breath does not require the user to go through as many levels as a deep menu.
 - Reduce the need for user navigation
 - Breath becomes more complex making user choose between more options at each level



Graphical User Interfaces

- Most current user interfaces belongs to the category of graphical user interfaces
 - a.k.a WIMP systems
- Interaction Style - Direct Manipulation
 - Based on visual representation of the dialogue objects of interest to the user
 - Continuously updated representation allows the user to control the dialogue by moving objects around the screen and manipulating them
 - E.g. word processor margin selection
- ● Good for novice users
- ● Provide better possibilities for users to interact multiple applications and data
- objects at the same times



Graphical User Interfaces

- GUI can be more natural and compelling - especially if the actual system does not support user expectation.
 - Novice users of the systems where file manipulation is performed by dragging icons can sometimes be observed trying to perform text editing operations by dragging texts.
- Direct manipulation interfaces may be harder to use for some disabled users than the traditional



Next Generation Interfaces

- Dimensionality of user interfaces will increase from the current 2.5 to 3 or more.
 - Animation
 - Sound / voice
 - VR
- Traditional operating systems - use once application at a time
 - Forced user to “be” in one application at a time even though other application running in the background
- Some systems allow the construction of pipelines - connecting multiple applications
 - But applications acts sequentially on the data
- Application model
 - Constrain users who have integrated tasks that require multiple applications.
 - E.g cut and paste - have been available for several years



Next Generation Interfaces

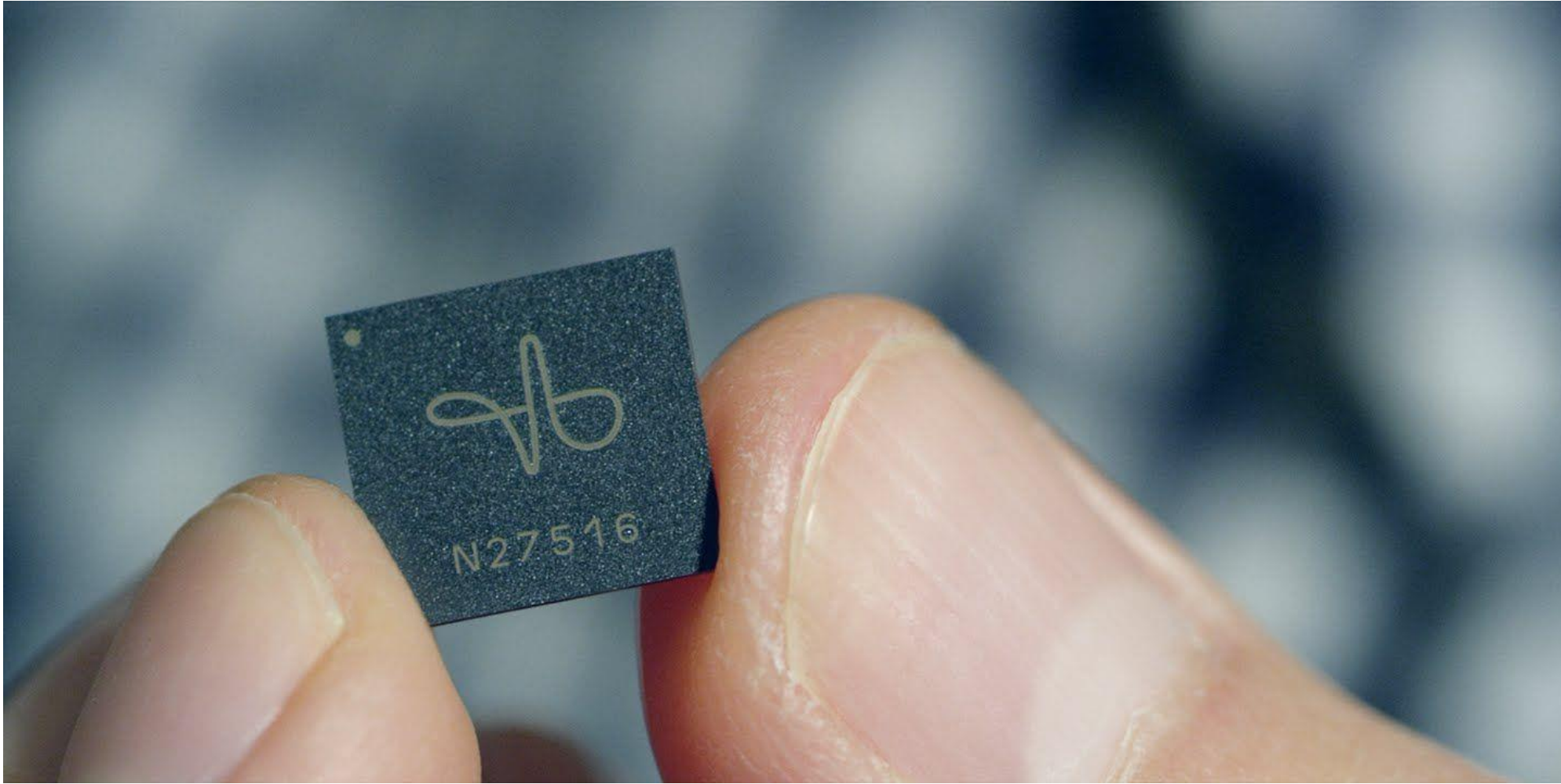
- Object oriented operating systems
- User no longer requires to running applications since data knows how to integrate available functionality in the system
 - Having different spell checker
 - Word processor, IDEs etc.
- Still have concept of commands
- Adapt natural setting
 - Items in cabinets - frequently used ones in front
- Allowed to change the user interfaces - it can adopt the interaction to the user's specific usage circumstances, and location
 - Mail notification
 - Ringing the phone based on the location



<i>Interaction Style</i>	<i>Mainly Used In</i>	<i>Main Characteristics</i>
Batch	Batch processing, email servers	Does not require user intervention, works even when user and computer are in different time or place.
Question–Answer	Line-oriented	Computer controls the user, so suited for casual use.
Command Language	Line-oriented	Easy to edit and reuse command history. A powerful language can support very complex operations.
Function Keys	Full-screen, WIMP	Fast entry of a few standard commands, but limited flexibility.
Form Fill-in	Full-screen, WIMP	Many fields can be seen and edited at once.
Menus	Full-screen, WIMP, Telephone-based interfaces	Frees the user from remembering options, at cost of potentially being slow or having confusing hierarchy.
Direct Manipulation	WIMP, Virtual reality	User in control. Enables metaphors from real world. Good for graphics.
Non-Command	Future systems, Virtual reality	The user is freed to concentrate on the domain and need not control the computer. Computer monitors users and interprets their actions, so suited for cases where misinterpretations are unlikely or without serious consequences.
Natural Language	Future systems	Ideally, allows unconstrained input to handle frequently changing problems.



*Project Soli is developing a **new interaction sensor using radar technology**. The sensor can track sub-millimeter motions at high speed and accuracy. It fits onto a chip, can be produced at scale and built into small devices and everyday objects.*



Q & A

