

User Interface

USER INTERFACES

COURSE 2020/2021

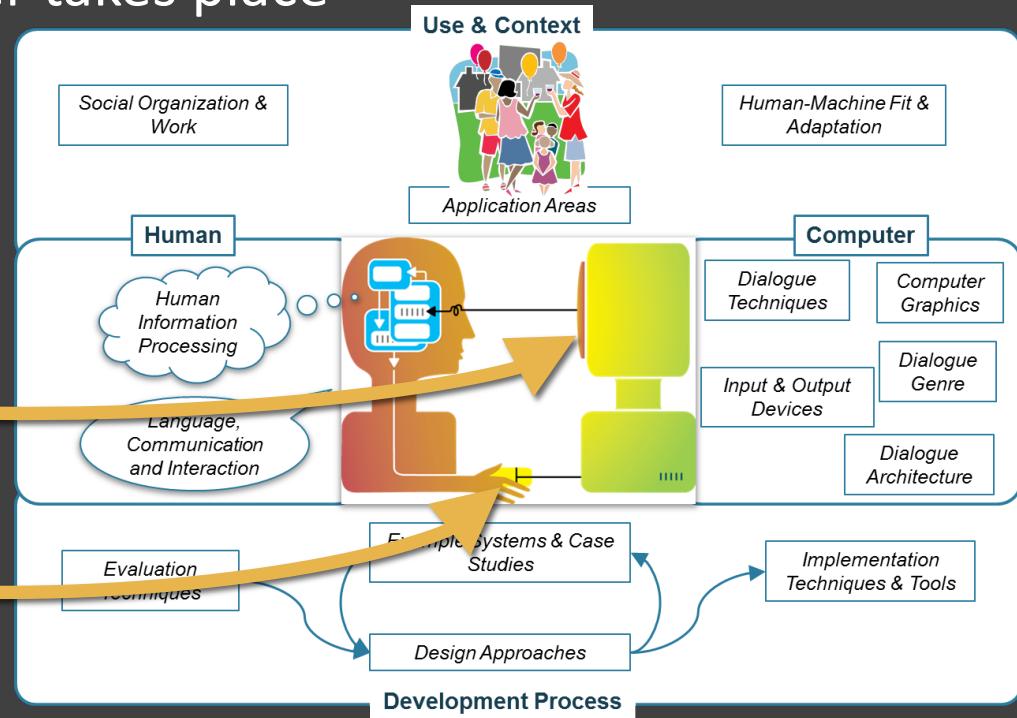
WHAT IS A USER INTERFACE?

The user interface is where the communication between the user and the computer takes place

The user interface is:

- ❖ Logic **Usefulness and usability**
- ❖ Physic

Ergonomics



WHAT IS A USER INTERFACE?

The interaction is a **dialogue** to carry out a **task**

- ❖ The user interface should be designed to help the user to conduct this task in an efficient and satisfactory way.
- ❖ Most of the technological innovations depend on good user interfaces (transform the complexity of a product into something useful, easy to use and attractive to people).

Types of User Interfaces

- 1. Command-based
- 2. WIMP and GUI
- 3. Multimedia
- 4. Virtual Reality
- 5. Dashboards
- 6. Mobile
- 7. Speech
- 8. Shareable
- 9. Brain-computer



1. Command-based

- ❖ Commands such as abbreviations (e.g. ls) typed in at the prompt to which the system responds (e.g. listing current files)
- ❖ Some are hard wired at keyboard, others can be assigned to keys
- ❖ Efficient, precise, and fast, but large overhead to learning set of commands
- ❖ Especially useful for visual-impaired people

Example

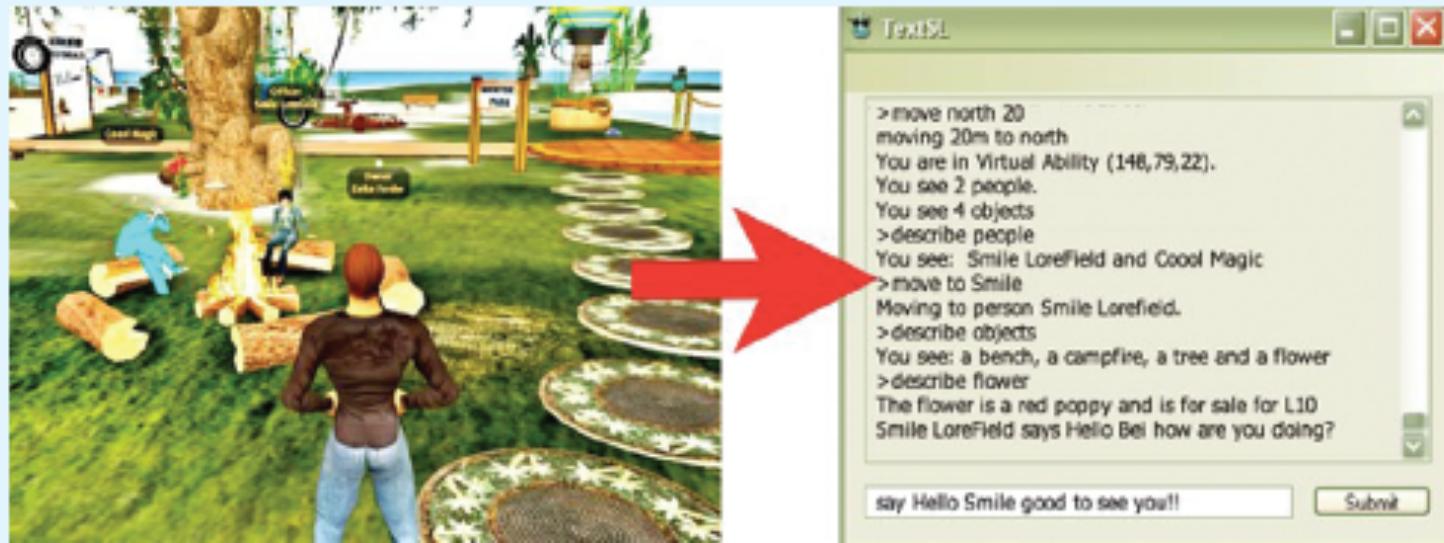


Figure 6.1 Second Life command-based interface for visually impaired users
Source: Reproduced with permission from <http://www.eelke.com/images/textsl.jpg>.

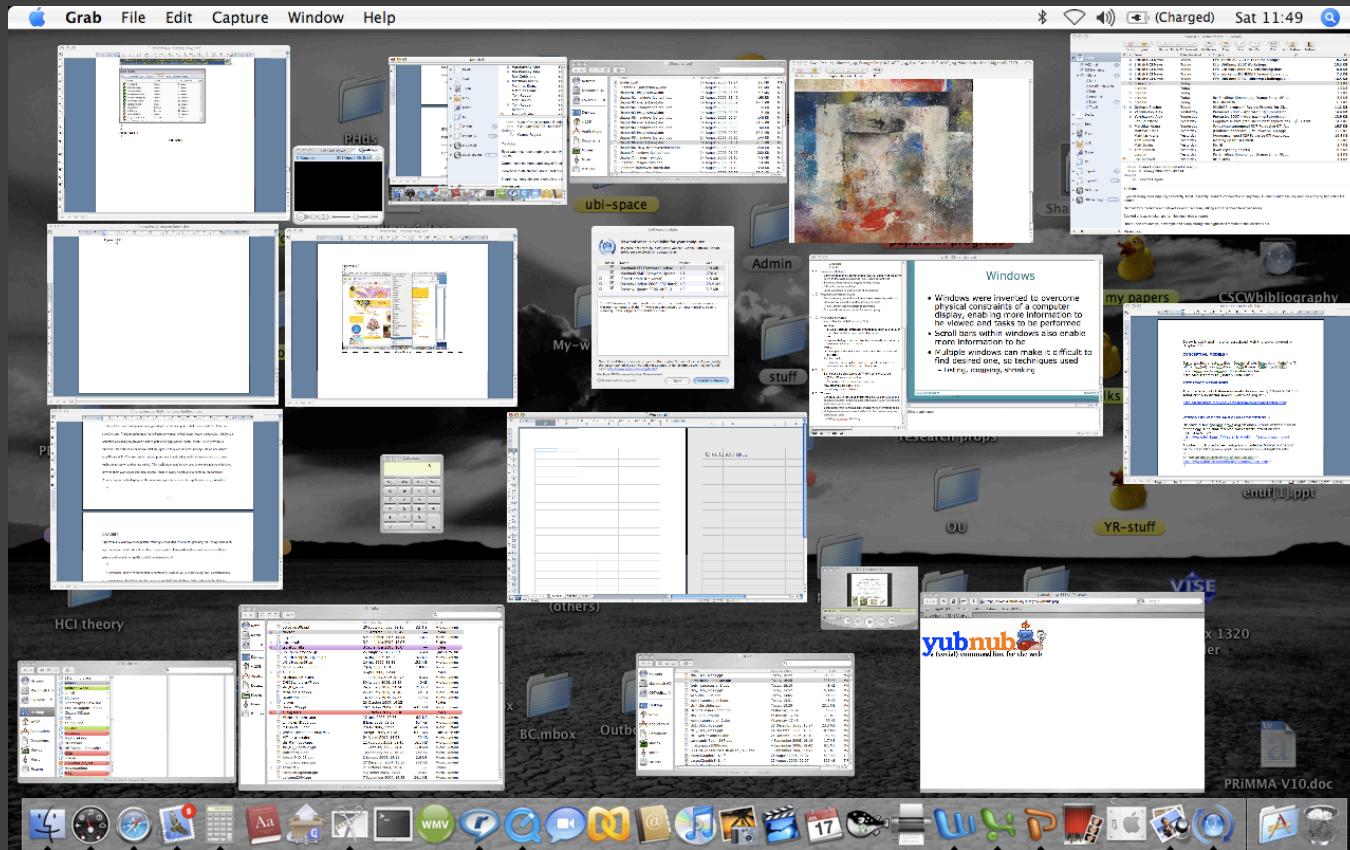
2. WIMP and GUI

- ❖ Xerox Star first WIMP -> rise to GUIs https://en.wikipedia.org/wiki/Xerox_Star
- ❖ Windows, could be scrolled, stretched, overlapped, opened, closed, and moved around the screen using the mouse.
- ❖ Icons, represented applications, objects, commands, and tools that were opened when clicked on.
- ❖ Menus, offering lists of options that could be scrolled through and selected.
- ❖ Pointing device, a mouse controlling the cursor as a point of entry to the windows, menus, and icons on the screen.

Windows

- ❖ Windows were invented to overcome physical constraints of a computer display for enabling more information to be viewed and tasks to be performed.
- ❖ Scroll bars within windows also enable more information to be viewed.
- ❖ Make sure the components of a window are related to each other.
- ❖ Multiple windows can make it difficult to find desired one.
 - ❖ listing, iconising, shrinking are techniques that help.
 - ❖ It's important to maintain the same focus of attention moving from one window to another.

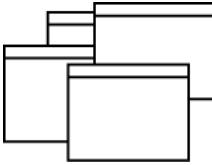
Apple's shrinking windows



Safari panorama window view



Types of Windows

Tiled windows	 <p>Screen divided into mutually non-overlapping frames Allow drag-and-drop</p>
Overlapping windows	 <p>Efficient use of the screen real state Difficult to handle</p>
Cascading windows	 <p>Efficient use of the screen real state Easy to organise</p>

Types of Windows

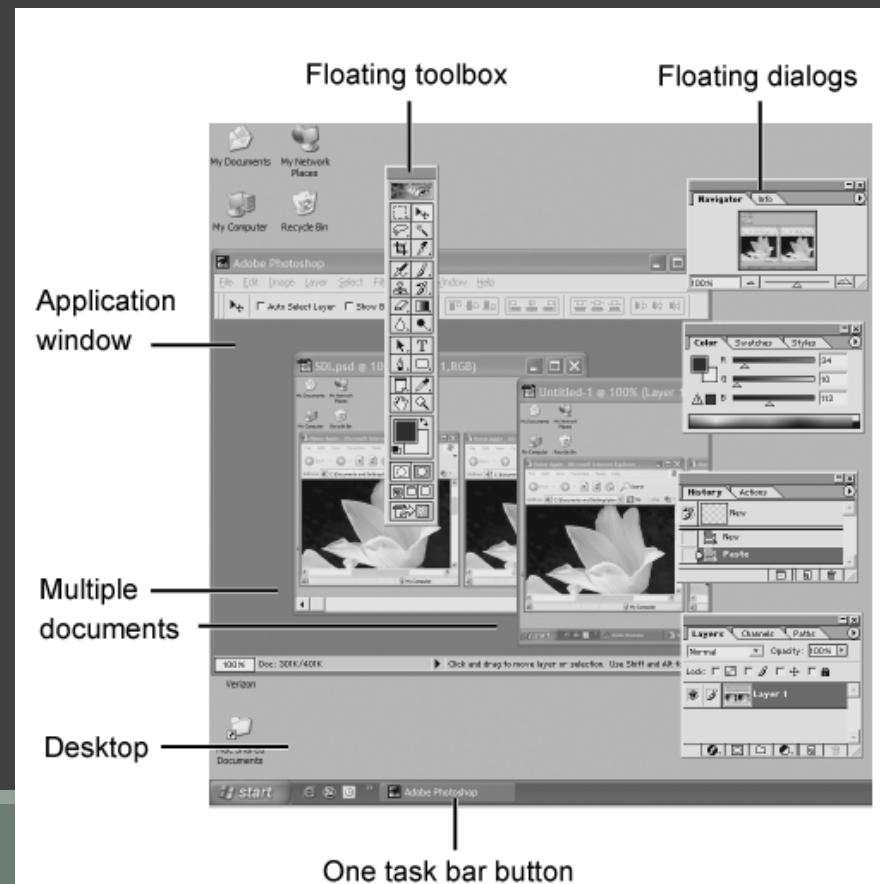
Three types of WIMP interfaces

- ❖ Multiple Document Interface (MDI)
- ❖ Single Document Interface (SDI)
- ❖ Tabbed Document Interface (TDI)

WIMP – WINDOWS MDI

- ❖ MDI is application-centric
- ❖ Windows reside under a single parent window (aka application window)
- ❖ This contrasts with SDI = all windows are independent of each other

Adobe PhotoShop® application.



WIMP – WINDOWS MDI

Advantages:

- ❖ Multiple documents to be simultaneously visible
- ❖ Coordinated work space
- ❖ Create minimal visual clutter – only one menu or toolkit is required for all documents
- ❖ Conserves system resources because only one instance of the application runs at a time

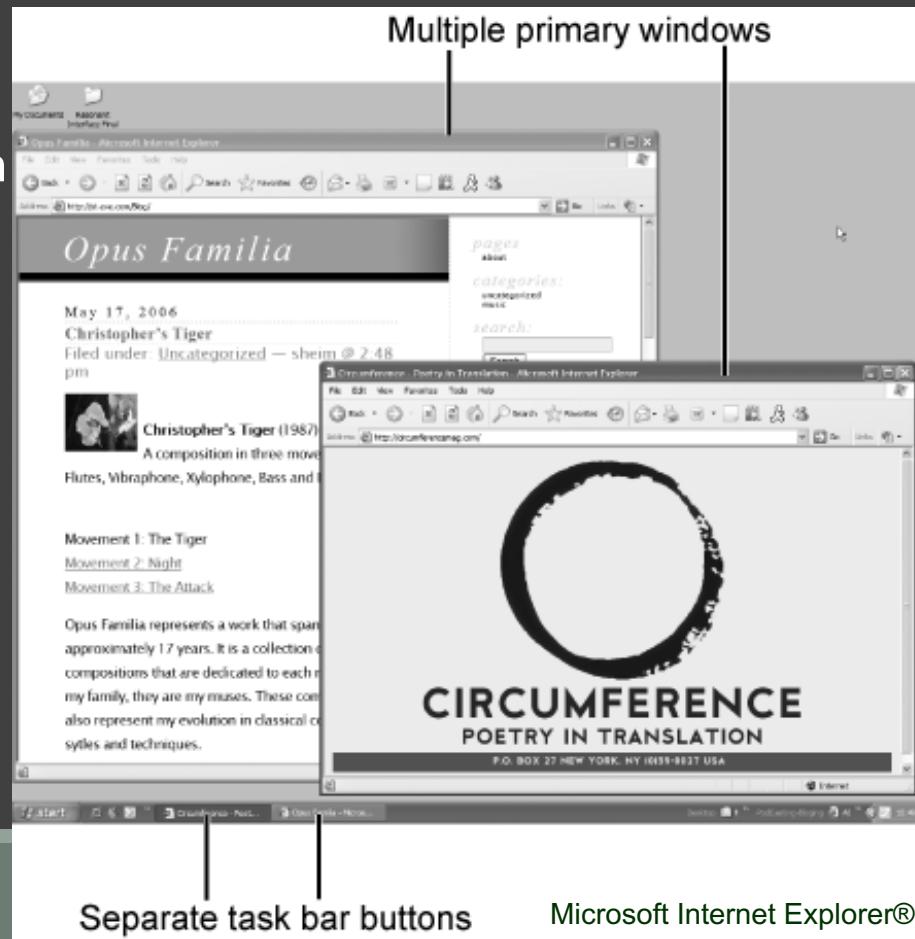
WIMP – WINDOWS MDI

Disadvantages:

- ❖ The menus change according to the state of the active document – this can increase the learning curve
- ❖ Document windows must remain within the MDI primary window – this eliminates the advantages of using multiple displays
- ❖ Child windows are minimized within the parent window - increasing visual complexity

WIMP - WINDOWS SDI

- ❖ SDI are document-centric
- ❖ They open new primary windows for each instance of an application document
- ❖ Each primary window contains all the program's menus and toolkits



WIMP - WINDOWS SDI

Advantages:

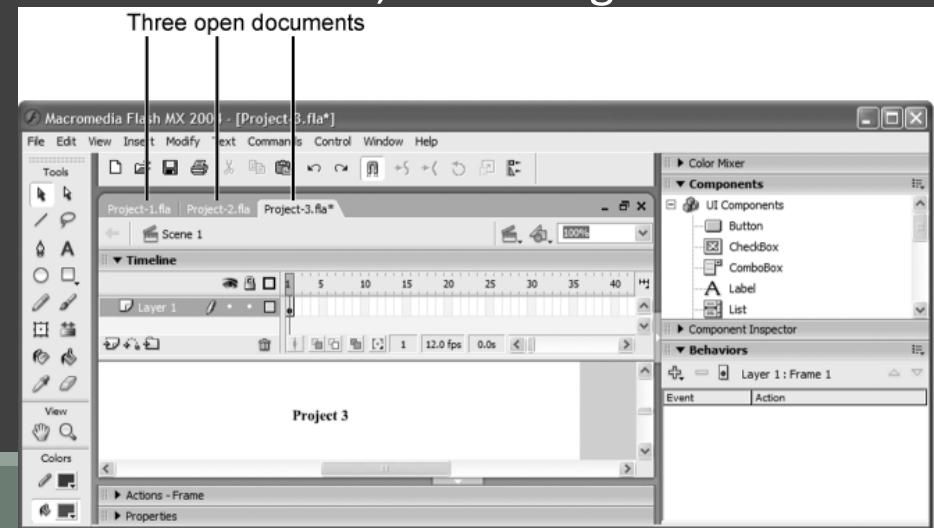
- ❖ User's view – all the applications are document-centric
- ❖ They are less visually complex – the primary window and the document window are connected

Disadvantages:

- ❖ They do not provide a way to group diverse but related document windows
- ❖ The task bar can become full when too many documents are open
- ❖ Moving from one window to another might be complex

WIMP - WINDOWS TDI

- ❖ A type of MDI (aka workbook)
- ❖ Tabs to move from one document to another
- ❖ Some applications limit the size of the window and neither “tiling” nor “cascading” is allowed
- ❖ Other application let us change the size of windows, becoming MDI applications

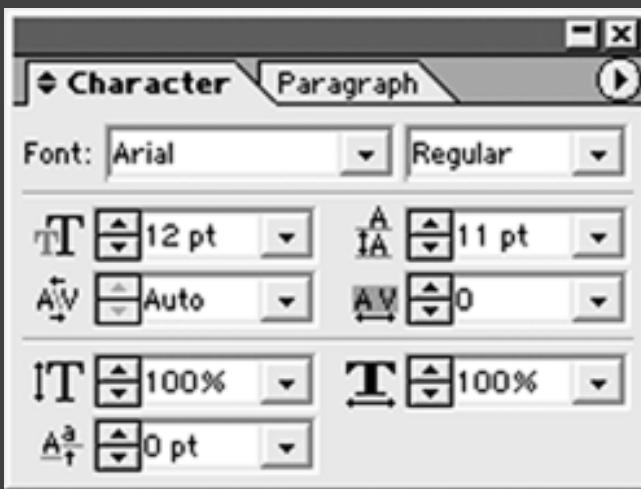


WIMP – DIALOG BOXES

- ❖ Dialog boxes are a type of secondary window
- ❖ They support less common tasks and provide sets of related functionality in a well-defined container
 - ❖ Implement a command (confirm actions, execute functions)
 - ❖ Respond to a question or an "alert"
 - ❖ Provide information about errors



WIMP – DIALOG BOXES



(a) Text formatting dialogue—Windows XP. (b) Preferences dialogue—Mac OS X.

WIMP – DIALOG BOXES

Dialog boxes can be modals or modeless

- **Modals**: block interaction, e.g. confirmation dialog box
- **Modeless**: do not block interaction (requested information is not essential to continue, and so the window can be left open while work continues elsewhere)

<https://www.nngroup.com/articles/modal-nonmodal-dialog/>

WIMP – OTHER ELEMENTS

Panels

- Are an efficient way to provide functionality required by other aspects of an application without forcing the user to leave the document window
- Group related functions
- Access to functions without using menus
- Help us remember how to use the system

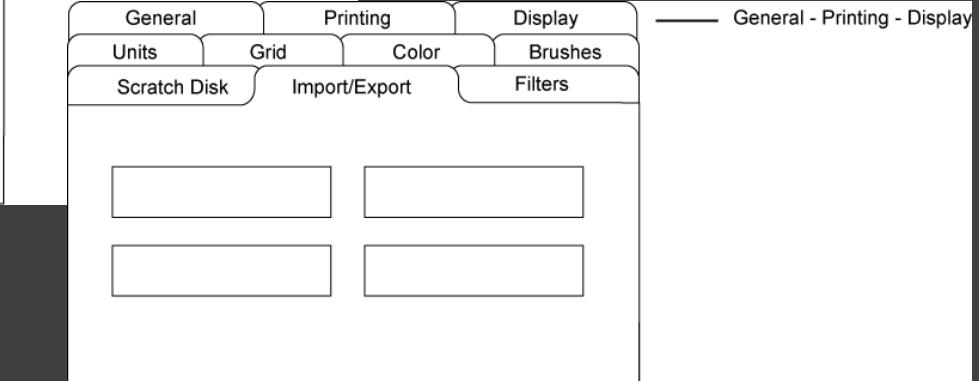
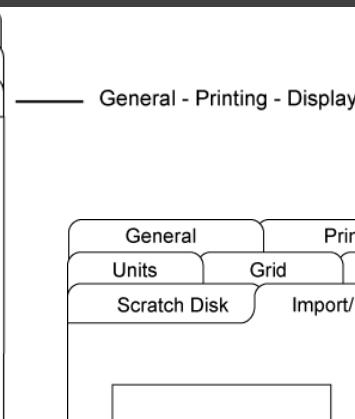
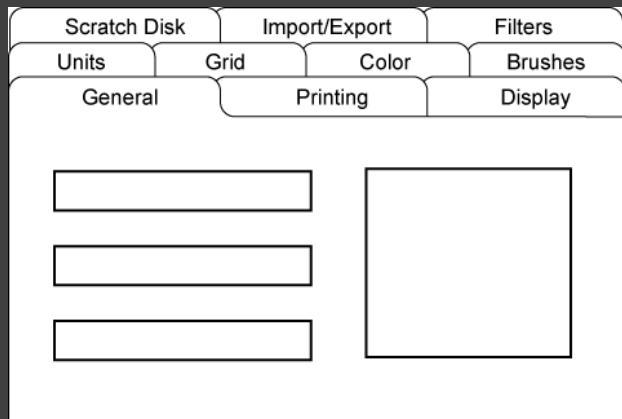
Frames

- Change size (e.g. minimize)
- On web pages, several areas

WIMP – OTHER ELEMENTS

Tabs

- Stacking levels and more elements in the same window / dialog box
- Potential lack of consistency: different number of elements in tabs



Icons

- ❖ Icons are assumed to be easier to learn and remember than commands
- ❖ Can be designed to be compact and variably positioned on a screen
- ❖ Now pervasive in every interface
 - ❖ e.g. represent desktop objects, tools (e.g. paintbrush), applications (e.g. web browser), and operations (e.g. cut, paste, next, accept, change)



Icons

- ❖ Since the Xerox Star days icons have changed in their look and feel:
 - ❖ black and white -> color, shadowing, photorealistic images, 3D rendering, and animation
- ❖ Many designed to be very detailed and animated making them both visually attractive and informative
- ❖ The mapping between the representation and underlying referent can be:
 - ❖ similar (e.g., a picture of a file to represent the object file) ← most effective
 - ❖ analogical (e.g., a picture of a pair of scissors to represent ‘cut’)
 - ❖ arbitrary (e.g., the use of an X to represent ‘delete’)

Evolution



Menus

- ❖ A number of menu interface styles
 - ❖ flat lists, drop-down, pop-up, contextual, and expanding ones, e.g., scrolling and cascading
- ❖ Flat menus
 - ❖ small number of options at the same time in a small display
- ❖ Expanding menu
 - ❖ More options on a single screen
 - ❖ More flexible navigation
 - ❖ Most popular are cascading ones
 - ❖ they require precise mouse control to avoid overshooting or selecting wrong options

Cascading menu



Menus

- ❖ Contextual menu
 - ❖ Provide access to often-used commands that make sense in the context of a current task
 - ❖ Appear when the user presses the Control key while clicking on an interface element
 - ❖ e.g., clicking on a photo in a website together with holding down the Control key results in options ‘open it in a new window,’ ‘save it,’ or ‘copy it’
 - ❖ Helps overcome some of the navigation problems associated with cascading menus
- ❖ Choice of menu to use determined by application and type of system
 - ❖ flat menus are best for displaying a small number of options at one time
 - ❖ expanding menus are good for showing a large number of options

2. WIMP and GUI

- ❖ Same basic building blocks as WIMPs but more varied
 - ❖ Color, 3D, sound, animation,
 - ❖ Many types of menus, icons, windows
 - ❖ New graphical elements, e.g. toolbars, docks, rollovers
- ❖ Challenge now is to design GUIs that are best suited for tablet, smartphone and smartwatch interfaces

GUI Design Guidelines

- ❖ Apple: Human Interface Guidelines (macOS, iOS, watchOS, tvOS)

<https://developer.apple.com/design/human-interface-guidelines/>

- ❖ Microsoft: UX checklist for Windows desktop applications

<https://docs.microsoft.com/en-us/windows/desktop/uxguide/guidelines>

- ❖ Google. Android material design.

<https://material.io/design/>

3. Multimedia

- ❖ Combines different media within a single interface with various forms of interactivity
 - ❖ graphics, text, video, sound, and animations
- ❖ Facilitates rapid access to multiple representations of information
- ❖ Can provide better ways of presenting information than can any media alone
- ❖ Can enable easier learning, better understanding, more engagement, and more pleasure



4. Virtual reality

- ❖ Computer-generated graphical simulations providing “the illusion of participation in a synthetic environment rather than external observation of such an environment” (Gigante, 1993) . The feeling of “being there”.
- ❖ Provide new kinds of experience, enabling users to interact with objects and navigate in 3D space.
- ❖ Create highly engaging user experiences with a high sense of presence where someone is totally engrossed by the experience.
- ❖ Much research on how to design safe and realistic VRs to facilitate training, e.g. flying simulators.

<https://www.youtube.com/watch?v=n534e-OL1bl>

5. Dashboards

- ❖ Computer-generated interactive graphics of complex data
- ❖ Amplify human cognition, enabling users to see patterns, trends, and anomalies in the visualization (Card et al, 1999) to enhance discovery, decision-making, and explanation of phenomena
- ❖ Techniques include: 3D interactive maps that can be zoomed in and out of and which present data via webs, trees, clusters, scatterplot diagrams, and interconnected nodes
- ❖ Whether to use animation and/or interactivity, color codes, forms of navigation, provide additional information, ...

Which dashboard is best?

1. British Airways frequent flier



Which dashboard is best?

2. London City general information

Mon 18 Aug @ 17:26:47
[Go to Map](#) - [Go to Grid](#) - [Change City](#)

London 51.51 N, 0.13 W

WEATHER STATIONS (MULTIPLE SOURCES)								
STATION	WIND SPEED	WIND GUSTS	DIRECTION	TEMPERATURE	HUMIDITY	RAIN TODAY	PRESSURE	FORECAST
CASA Office; Bloomsbury W1	0 mph	0 mph	N ↕	19.1 °C	61%	3.0 mm	1009.2 mbars	Cloudy
Lambeth Motors; Brixton SW9	3.6 mph	3.6 mph	S ↑	19.1 °C	57%	0.0 mm	1010.6 mbars	Dry Clear
Hampstead NW3	2.4 mph	2.9 mph	NW ↘	17.2 °C	80%	0.0 mm	1009.0 mbars	Mainly Fine

WEATHER (METAR)								
London City Airport			FORECAST (YAHOO! WTH)					
Mostly cloudy Light rain showers			5 at 5 mph	16 C	Mon	19 C	Shower Early	10 C
					Tue		Partly Cloudy	

TUBE LINE STATUS (TFL)								
Line	Service Status							
Bakerloo	Good Service							
Central	Good Service							
Circle	Good Service							
District	Good Service							
H & C	Good Service							
Jubilee	Good Service							
Metropolitan	Good Service							
Northern	Good Service							
Piccadilly	Good Service							
Victoria	Good Service							
W & D	Good Service							
Overground	Good Service							
DLR	Good Service							

LONDON CYCLE HIRE (TFL)								
Available Bikes (last 24h)			Bikes Available			Bikes or Docks Faulty		
3.4 %	Stations Full	2.5 %	Stations Empty	8931	456	7213	London buses	443
							Underground trains	

IN SERVICE (TFL)											
BUSES			UNDERGROUND TRAINS			AIR POLLUTION (DEPRA)					
7213	London buses	443	Underground trains	μg/m³	TIME AHEAD	OZONE	NO₂	SO₂			
						29	41	6	PM _{2.5}	PM ₁₀	
						Bloomsbury	21	69	7	?	?
						Marylebone Rd	49	18	?	?	?
						N Kensington					

AIR POLLUTION (DEPRA)								
Location	μg/m³	Time Ahead	Ozone	NO₂	SO₂	PM _{2.5}	PM ₁₀	
Bloomsbury	29	41	6	?	?	?	?	
Marylebone Rd	21	69	7	?	?	?	?	
N Kensington	49	18	?	?	?	?	?	

BICYCLES (LBH)								
Available Bikes (last 24h)			Bicycles Available			Bicycles or Docks Faulty		
2134	Goldsmiths' Row	yesterday	Thames (Tower Pier)	4.72	metres	STOCKS (YAHOO)	FTSE 100 Index	6741.25
						+52.17 (0.77%)		

RIVER LEVEL (PLA)								
Available Bikes (last 24h)			River Level Available			River Level Faulty		
2134	Goldsmiths' Row	yesterday	Thames (Tower Pier)	4.72	metres	STOCKS (YAHOO)	FTSE 100 Index	6741.25
						+52.17 (0.77%)		

TRAFFIC CAMERAS (TWO AT RANDOM) (TFL)								
Location	Image	Status						
A10 North of Brooke Road		Normal						
Limehouse Trl HH Westerry Rd		Normal						

BBC LONDON NEWS (BBC)								
Headline	Image	Summary						
Men found guilty of shooting murder. Three arrests over 21m journey from 1st appearance to jail		Men found guilty of shooting murder. Three arrests over 21m journey from 1st appearance to jail						

OPENSTREETMAP UPDATES (OSM)								
Update Type	Details							
Route 16-19 converted to new style relation								
Stone Square bus stops converted to	Add private alleyway connecting to Carter's Gardens, changed format of collection							

(b)

6. Mobile

- ❖ Handheld devices intended to be used while on the move
- ❖ Have become pervasive, increasingly used in all aspects of everyday and working life
- ❖ Apps running on mobiles have greatly expanded, e.g. used in restaurants to take orders, car rentals to check in car returns, supermarkets for checking stock, ...
- ❖ Smaller screens, small number of physical keys and restricted number of controls
- ❖ Many apps not designed for any need, want or use but purely for idle moments to have some fun

App just for fun



7. Speech

- ❖ Where a person talks with a system that has a spoken language application, e.g. timetable, travel planner
- ❖ Used most for inquiring about very specific information, e.g. flight times or to perform a transaction, e.g. buy a ticket
- ❖ Also used by people with disabilities, e.g. speech recognition word processors, page scanners, web readers, ...
- ❖ Examples, iOS SIRI, Amazon Alexa,...



8. Shareable

- ❖ Shareable interfaces are designed for more than one person to use
 - ❖ provide multiple inputs and sometimes allow simultaneous input by co-located groups
 - ❖ large wall displays where people use their own pens or gestures
 - ❖ interactive tabletops where small groups interact with information using their fingertips
- ❖ More fluid and direct styles of interaction involving freehand and pen-based gestures
- ❖ Core design concerns include whether size, orientation, and shape of the display have an effect on collaboration

DiamondTouch Tabletop



9. Brain-computer interfaces

- ❖ Brain–computer interfaces (BCI) provide a communication pathway between a person’s brain waves and an external device, such as a cursor on a screen, for games or for enabling paralysed people to control robots
- ❖ Person is trained to concentrate on the task, e.g. moving the cursor
- ❖ BCIs work through detecting changes in the neural functioning in the brain

<https://youtu.be/wxIgdOIT2cY>

<http://edition.cnn.com/2017/03/28/health/paralyzed-man-uses-arm-with-aid-of-neuroprosthetic/index.html>

Which interface?

- ❖ Many innovative interfaces have emerged post the WIMP/GUI era, including speech, mobile, shareable and brain
 - ❖ e.g. how best to represent information to the user so they can carry out ongoing activity or task
- ❖ Will depend on task, users, context, cost, robustness, etc.
- ❖ Mobile platforms taking over from PCs
- ❖ Speech interfaces also being used much more for a variety of commercial services
- ❖ Shareable and tangible interfaces entering our homes, schools, public places, and workplaces

References

- ❖ Human-Computer Interaction. Alan Dix, Hanet Finlay, Gregory Abowd, Russel Beale
- ❖ Interaction Design: Beyond Human - Computer Interaction. Jenny Preece, Yvonne Rogers, Helen Sharp. J. Wiley & Sons, 2002.
- ❖ Teaching material from www.id-book.com