Interaction Design

Direct Manipulation

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04-DEC-2002

Key references/literature:

D.J. Mayhew (1992) Principles and guidelines in software user interface design. Prentice Hall.

chapter 9: dialog styles - direct manipulation.

ISO/FDIS 9241 (1997) Ergonomic requirements for office work with visual display terminals (VDTs).

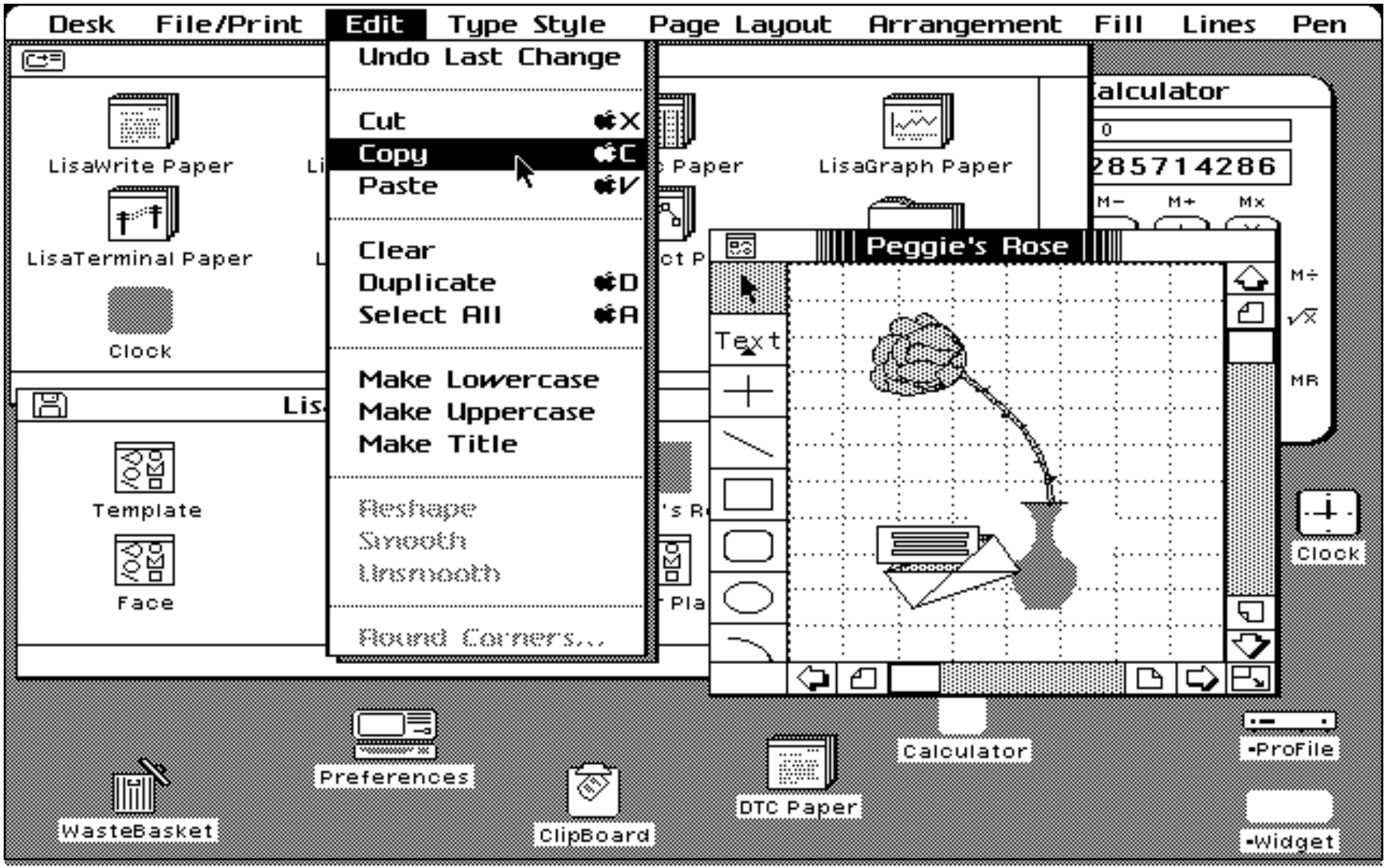
Part 16: direct-manipulation dialogues.

Dimensions of interaction styles

- Initiation
  - Degree to which initiation of the dialogue rests with the computer or the human user.
- Dialogue flexibility
  - number of ways in which a user can perform given functions.
- Degree of automation
  - Amount of work accomplished by the system in response to a single user command.
- Complexity of action space
  - Number of different options available to the user at any given point in the dialogue.
- Complexity of perception space
  - Degree to which the interactions absorbs the memory and reasoning power of the user.
- Interaction style and user type

[taken from Smith, 1997]

Lisa Desktop, Apple, 1982

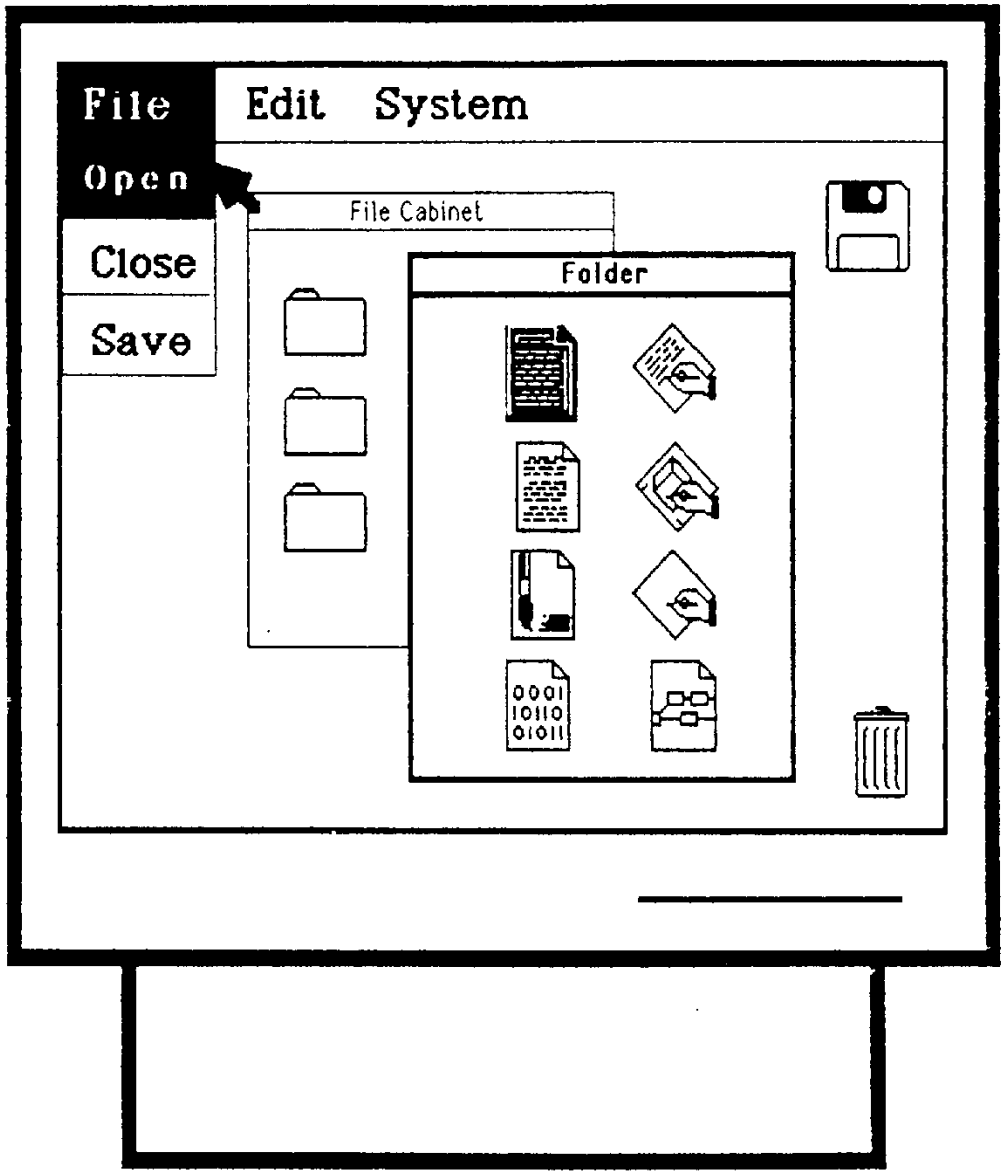


A Web Community, eBay, 1990s

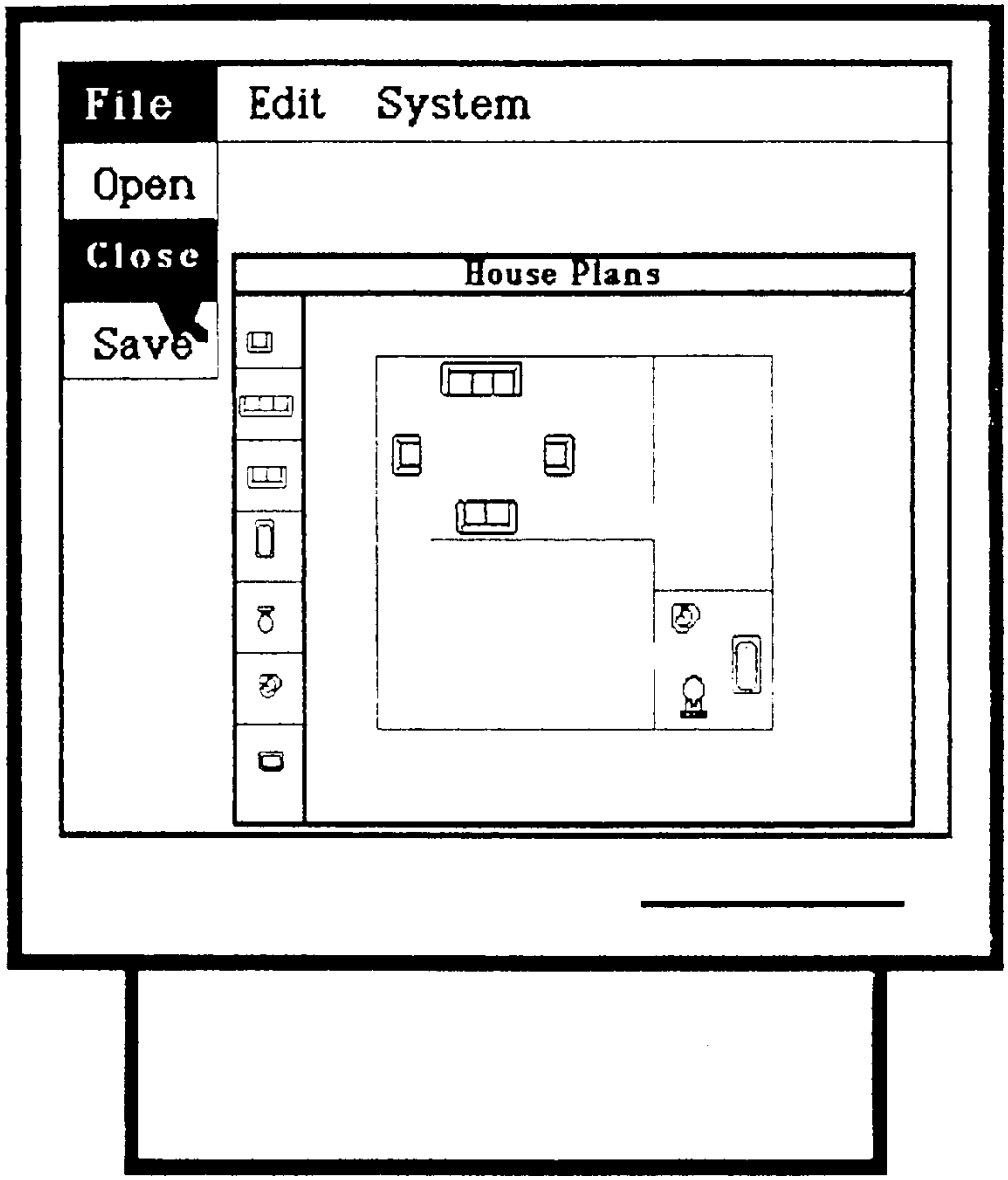
How to design Desktop Interfaces (DI)?

- Menu structure (I.e. pull-down menus)
- discrete and partially continuous actions
- WIMP = Windows, Icons, Mouse, Pointing
- ‘desktop’ is NOT ‘direct manipulation’
- the ‘desktop’ metaphor does NOT fit to all application domains

Desktop: example (1)



Desktop: example (2)



Desktop Interface (1): advantages

- Easy to learn and remember
- Direct, intuitive: allows user to focus on task semantics rather than on system semantics and syntax
- Flexible, easily reversible actions
- Provides context and instant, visual feedback
- Exploits human use of visual/spatial cues and motor behaviour
- Low typing requirements and visual feedback means less opportunity for user input error (and less error messages)

Desktop Interface (2): disadvantages

- Can be inefficient for high frequency experts, especially touch typist, and when there are more actions and objects than can be fit on one screen
- may be difficult to design recognizable icons for many objects and actions (‘what is it’ versus ‘where is it’)
- icons take more screen ‘real estate’ than words

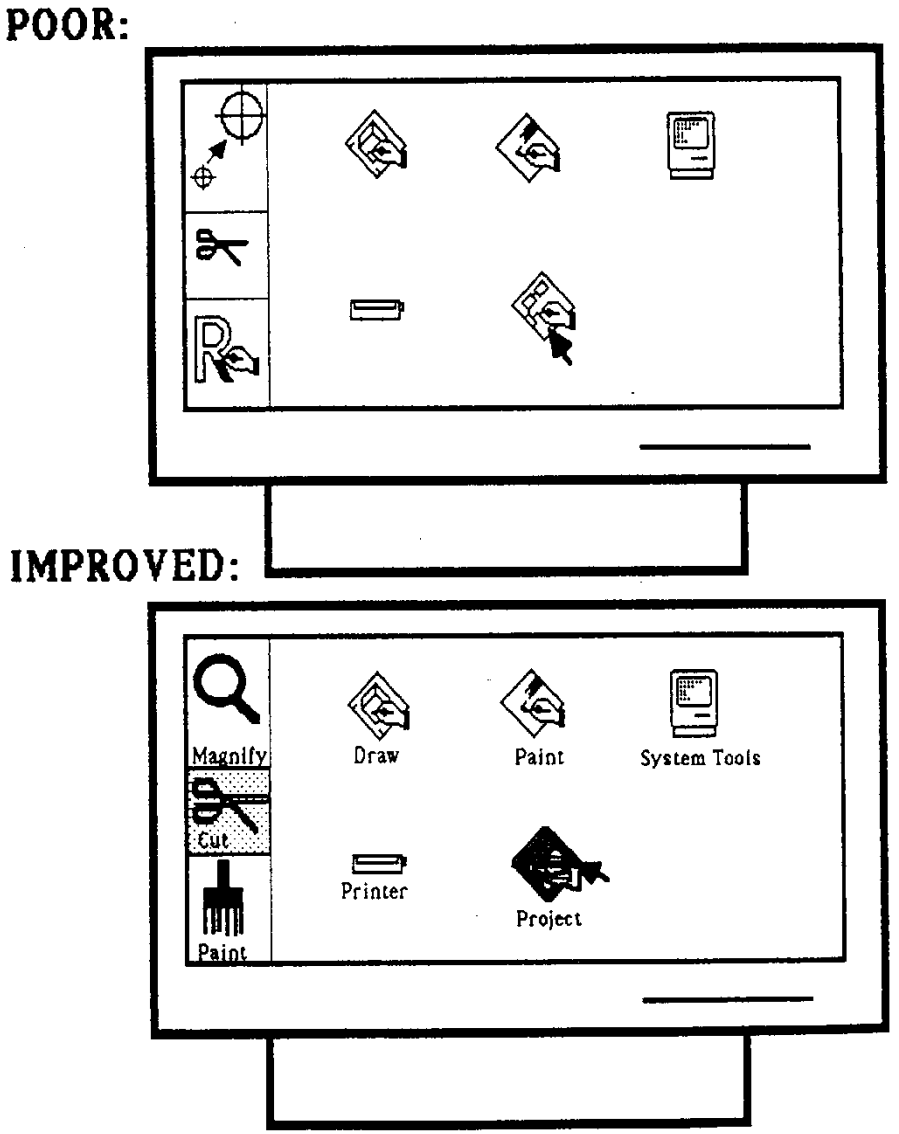
Desktop Interface (3)

Most appropriate for:

- Knowledge and experience
  - low typing skills
  - low system experience
  - low task experience
  - low application experience
  - high frequency of use of other systems
  - low computer literacy
- job and task characteristics
  - low frequency of use
  - little or no training
  - discretionary use
  - high turn over rate
  - low task importance
  - low task structure

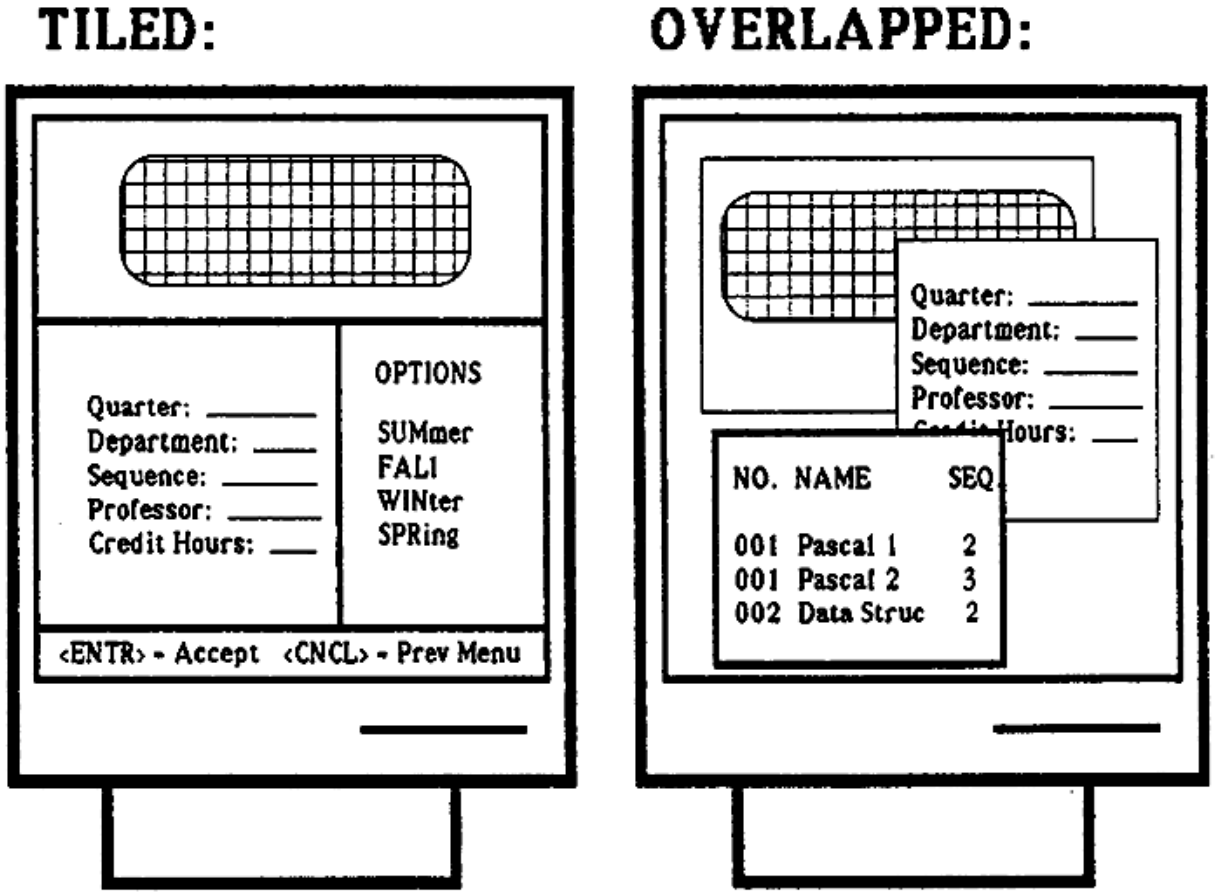
Desktop Interface (4)

Guideline:
accompany icons with names



Desktop Interface (5)

Guideline: choose appropriate windowing strategy



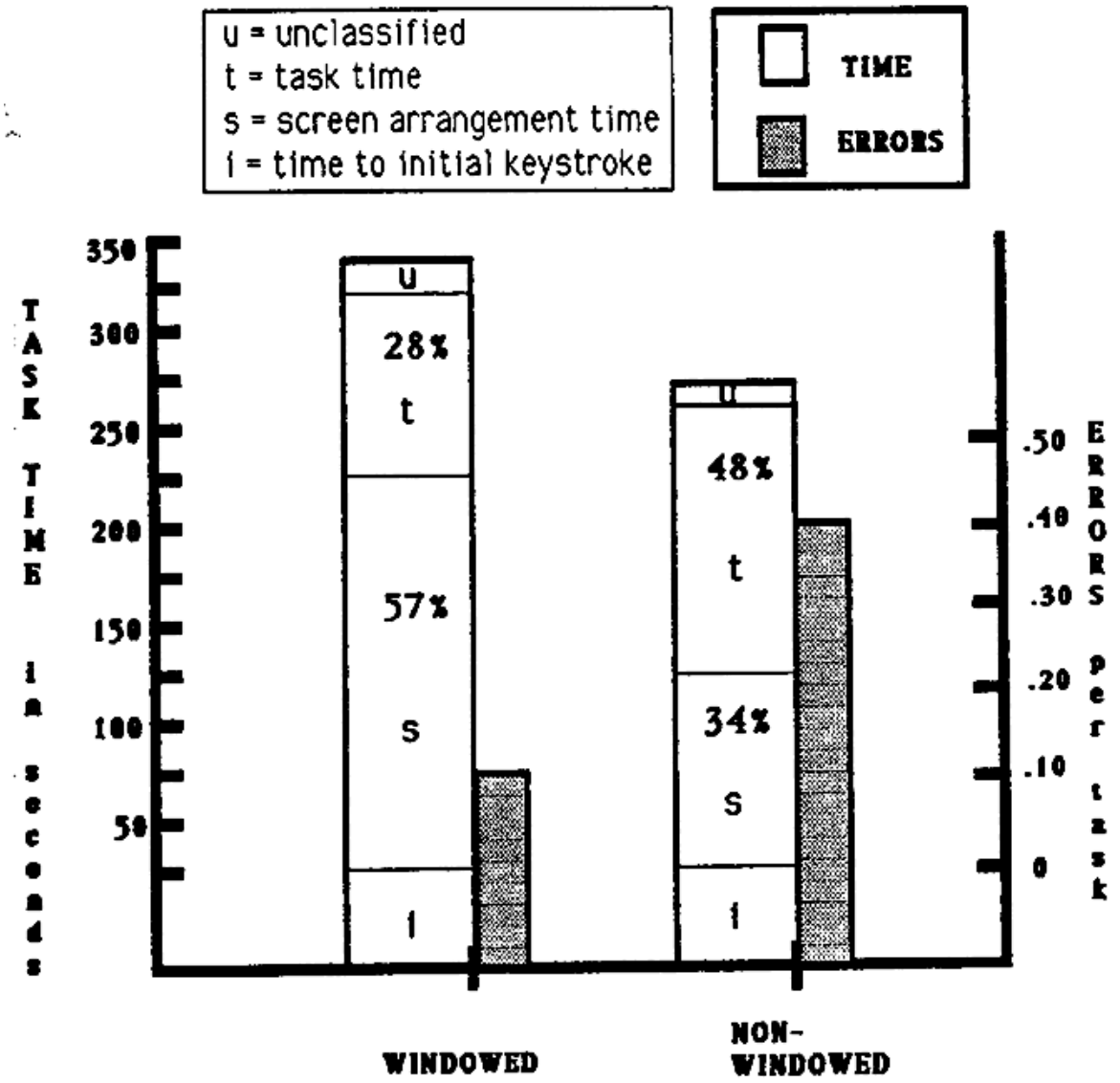
Desktop Interface (6)

- **Windowing uses:**
  - quick context switching with place-saving
  - work in one, monitor another
  - cut and paste
  - compare
  - show more detail, preserve context
  - give command, see results
  - get HELP, preserve context
  - display same object in different forms
- **Windowing types:**
  - system-controlled
  - user-controlled, tiled
  - user-controlled, overlapping

Desktop Interface (7)

Windowing:
experimental study

[S.E. Davies, K.F. Bury and M.J. Darnell (1985) An experimental comparison of a widowed vs. a non-windowed operating system environment. Proceedings of the Human Factors Society 29th Annual Meeting, pp. 250-254]



Desktop Interface (8)

Windowing:
experimental study

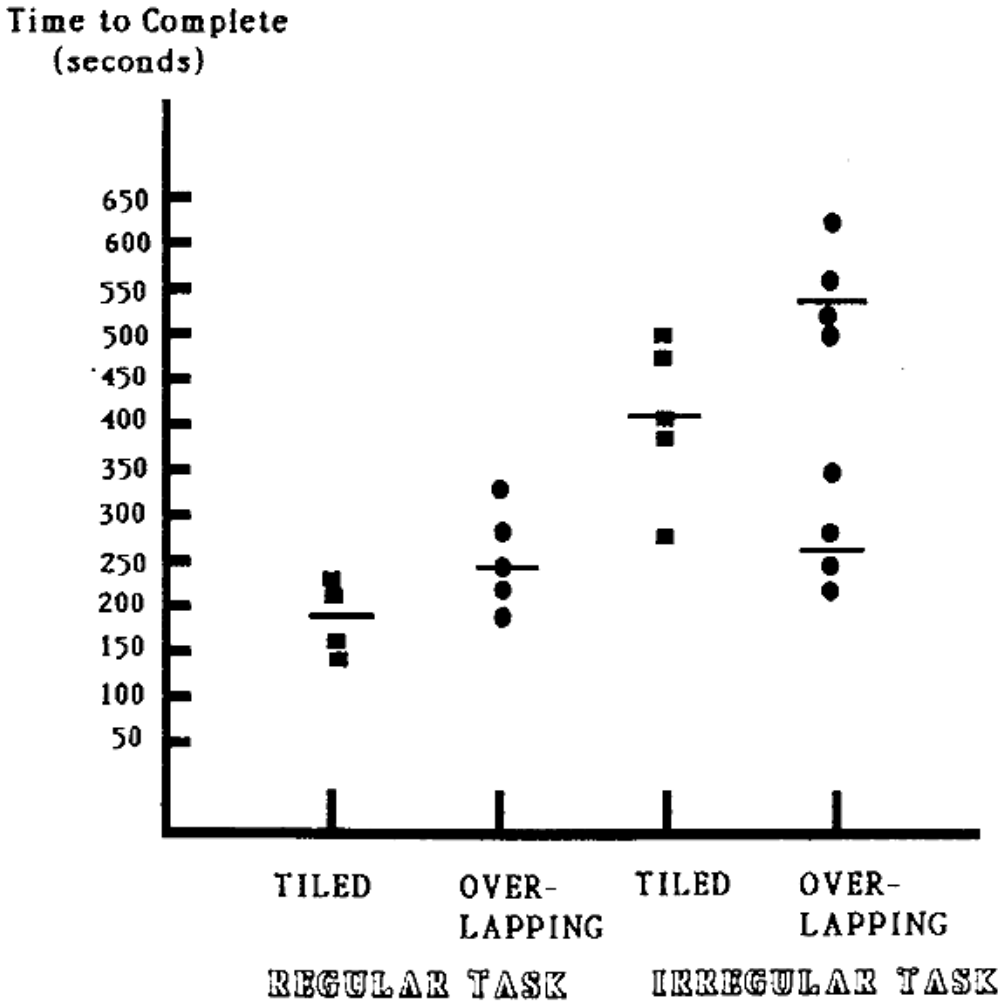
[K. Gaylin (1986) How are window used? Some notes on creating an empirically based windowing benchmark task. Proceedings CH'86, ACM, pp. 96-100]]

	% TOTAL COMMANDS	
	TOTAL SESSION	LOGIN ONLY
NAVIGATE	59.5	32.4
OPEN	10.6	18.1
CREATE	7.5	17.1
DELETE	8.3	2.9
MOVE	4.3	17.1
RESIZE	2.0	12.4
OTHER	7.8	

Desktop Interface (9)

Windowing:
experimental study

[S.A. Bly and J.K. Rosenberg (1986) A comparison of tiled versus overlapping windows. Proceedings CHI'86, ACM, pp. 101-106]



Desktop Interface (10)

- **Windowing design guidelines:**
  - design easy to use and learn window operations (complexity of windowing interfaces should NOT cancel out advantages).
  - minimise the number of window operations necessary to achieve a desired effect.
  - make navigation between windows particularly easy and efficient to do.
  - make setting up windows particularly easy to remember.
  - provide salient visual cues to identify ‘active’ window.
  - provide a consistent ‘user model’ of windows (window is an object OR workspace OR dialog box).
  - allow overlapping when displays are unpredictable, screens are small, and users are fairly frequent and experienced.
  - in overlapping windowing, provide powerful commands for arranging windows on the screen in user-tailorable configurations.

REFERENTS	ABSTRACT SYMBOLS	CONCRETE SYMBOLS	PROPOSED SYMBOLS
1. Achieve Dial Tone			
2. Answer Ringing Call			
3. Call Log			
4. Conference			
5. Dialpad			
6. Drop			
7. Help Specific			?
8. Help System			i
9. HFAI			
10. Hold			
11. Message			
12. Music On Hold			

REFERENTS	ABSTRACT SYMBOLS	CONCRETE SYMBOLS	PROPOSED SYMBOLS
13. Mute			
14. Notes			
15. Phone Call Active			
16. Retrieve			
17. Ringer Select			
18. Speakerphone			
19. Speed Dial			
20. Store			
21. Switch Hook Control			
22. Transfer Call			
23. Volume			

[taken from Dominic Paul T. Piamonte (2000): Using Multiple Performance Parameters in Testing Small Graphical Symbols. Doctoral thesis, Institutionen för Arbetsvetenskap Avdelningen för Industriell ergonomi.• ISSN: 1402-1544]

Graphical symbols used in the main studies as based on Böcker (1993) for the European Telecommunications Standards Institute (ETSI, 1993).

	Camera	Document Camera	Handsfree	Micro-phone	Selfview	Still Picture	Video-Phone
SET 1	[1]	[4]	[7]	[10]	[13]	[16]	[19]
SET 2	[2]	[5]	[8]	[11]	[14]	[17]	[20]
SET 3	[3]	[6]	[9]	[12]	[15]	[18]	[21]

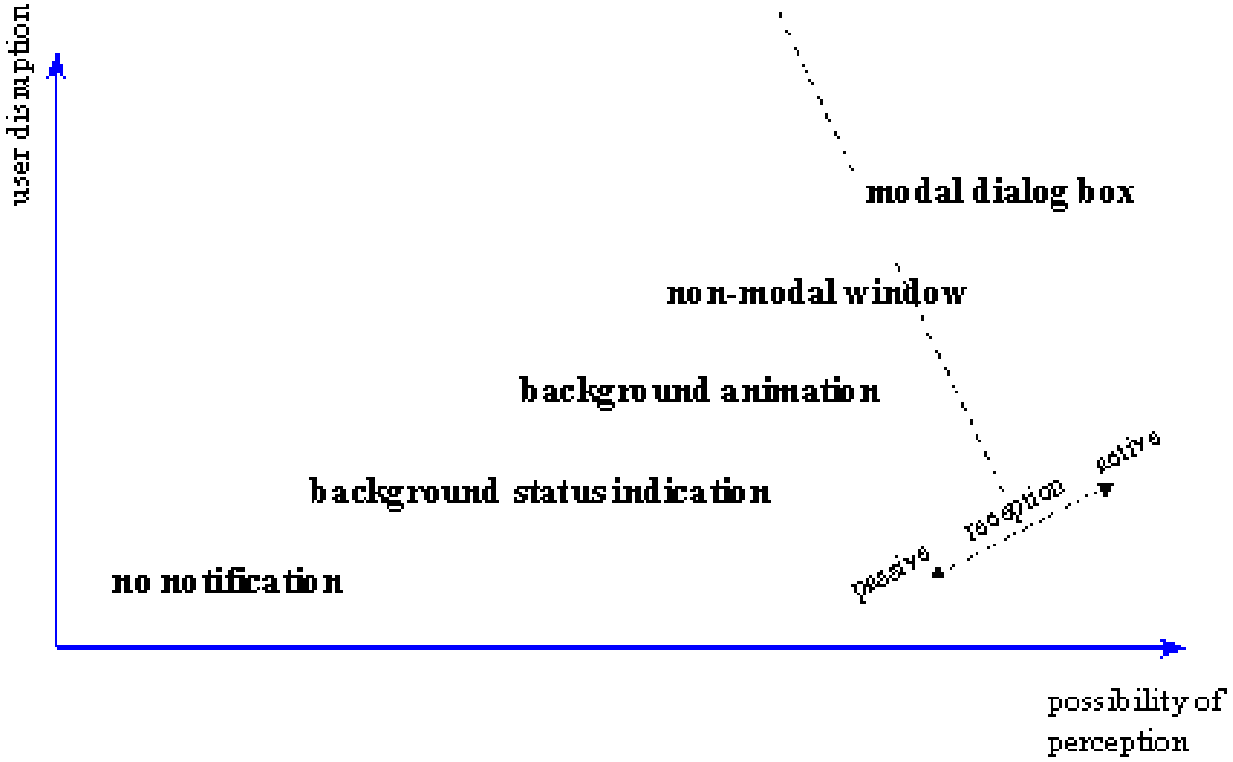
Best videophone symbols when combining hit rates, false alarms (confusions) and missing values (no answers), per country.
Numbers indicate Symbol Set.

Best performing symbols for each referent tested using the three symbol sets (Sets 1 ,2 and 3)

Referent	Ind.	Mal.	Phi.	Thai.	S.L.	Swe.	USA
Camera	1	1	1	1	1	1	1
Doc. Camera	1	1 & 3	1	1 & 3	1	1	1
Handsfree	1	1 & 3	1 & 2	1	3	1	1
Microphone	1 & 3	1 & 3	3	1	3	1	1
Selfview	3	1	1	1	2	1	1
Still Picture	1	1	1	1	3	3	1
Videophone	1	1	1	1	1	3	1

Legend: Ind.=Indonesia, Mal.=Malaysia, Phi.=Philippines, Thai.=Thailand, S.L.=Sri Lanka, Swe.=Sweden, U.S.A.=United States of America.

Feedback of system status information



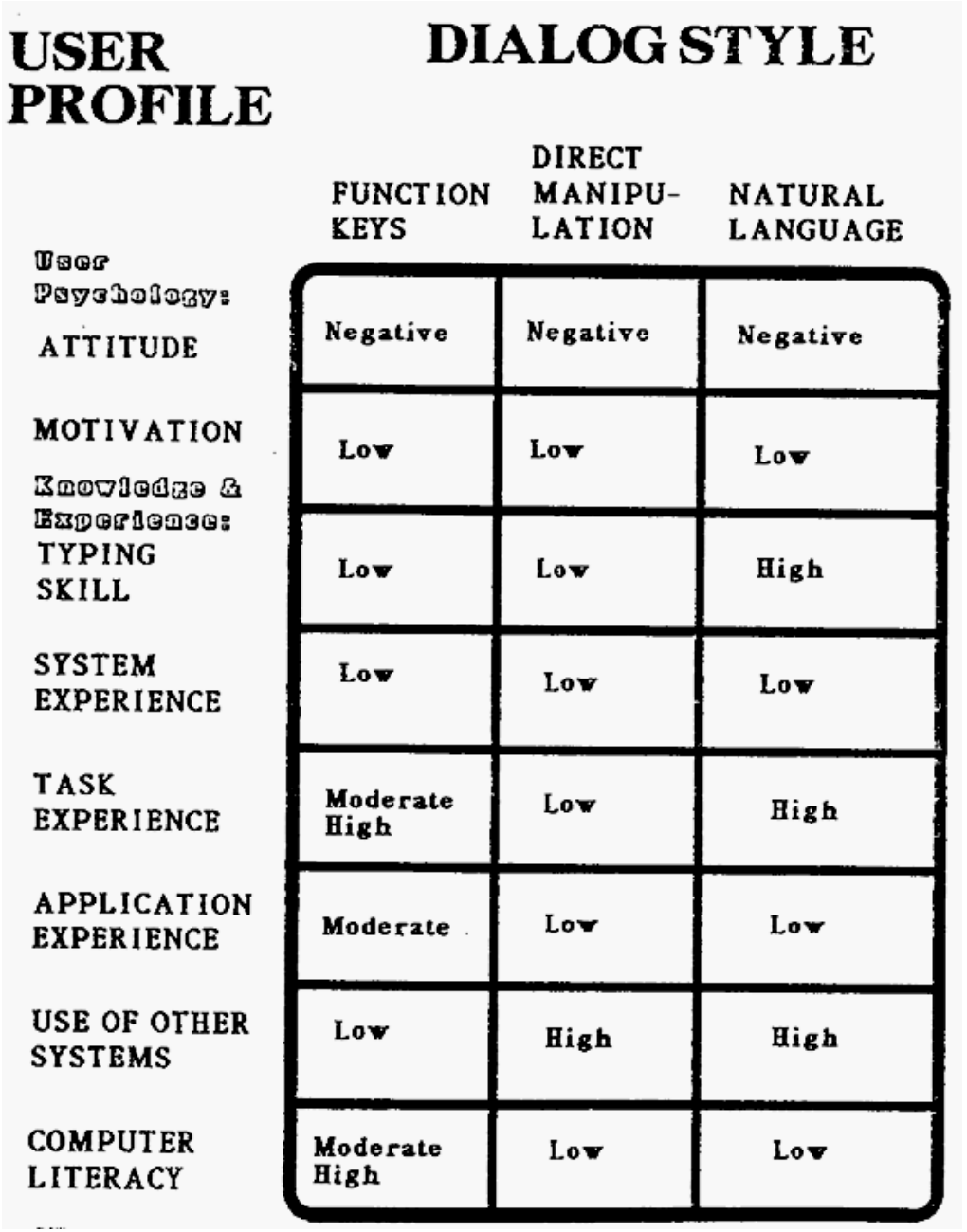
Desktop Interface: design guidelines

- provide alternative interface for high frequency, expert user
- choose a consistent icon design scheme:
  - depict ‘before and after’
  - depict tool
  - depict action
- accompany icons with name/labels
- provide visual feedback for position, selection and movement, and physical feedback for modes!

Summary (1)

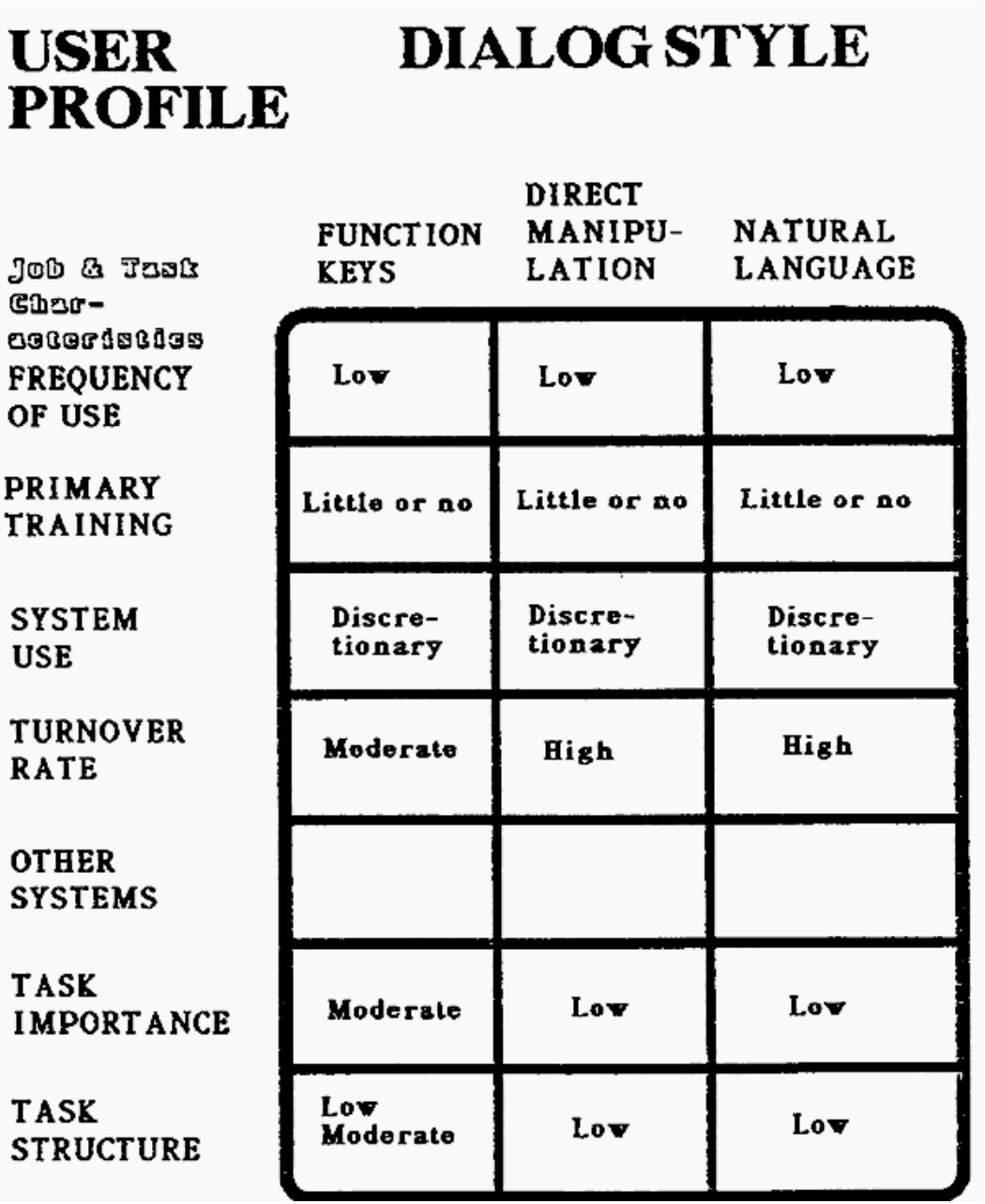
USER PROFILE	DIALOG STYLE: MENU	FILL-IN FORMS	QUESTION & ANSWER	COMMAND LANGUAGE
User Psychology: ATTITUDE	Negative	Negative Neutral	Negative	Positive
MOTIVATION	Low	Low Moderate	Low	High
Knowledge & Experience: TYPING SKILL	Low	Moderate High	Moderate High	Moderate High
SYSTEM EXPERIENCE	Low	Low Moderate	Low Moderate	High
TASK EXPERIENCE	Low	Moderate High	Low	High
APPLICATION EXPERIENCE	Low	Low Moderate	Moderate	High
USE OF OTHER SYSTEMS	Frequent	Moderate Frequent	Moderate Frequent	Infrequent
COMPUTER LITERACY	Low	Moderate High	Low	High

Summary (2)



USER PROFILE	DIALOG STYLE: FUNCTION KEYS	DIRECT MANIPULATION	NATURAL LANGUAGE
User Psychology: ATTITUDE	Negative	Negative	Negative
MOTIVATION	Low	Low	Low
Knowledge & Experience: TYPING SKILL	Low	Low	High
SYSTEM EXPERIENCE	Low	Low	Low
TASK EXPERIENCE	Moderate High	Low	High
APPLICATION EXPERIENCE	Moderate	Low	Low
USE OF OTHER SYSTEMS	Low	High	High
COMPUTER LITERACY	Moderate High	Low	Low

Summary (3)



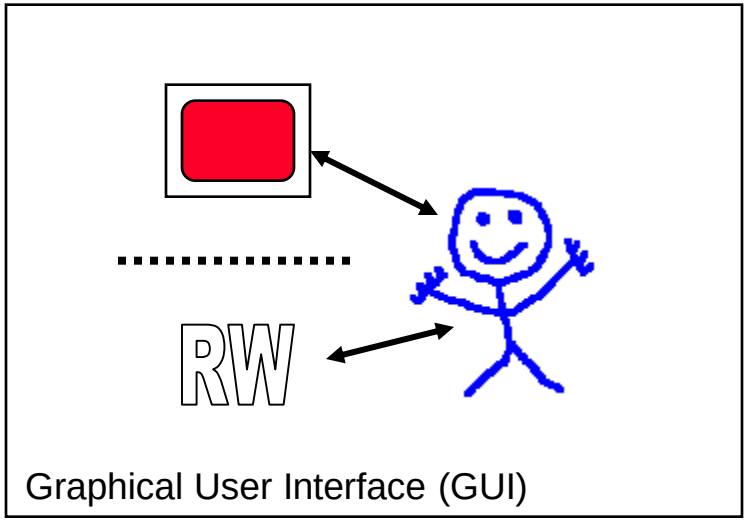
USER PROFILE — **DIALOG STYLE**

Job & Task Characteristics	FUNCTION KEYS	DIRECT MANIPULATION	NATURAL LANGUAGE
FREQUENCY OF USE	Low	Low	Low
PRIMARY TRAINING	Little or no	Little or no	Little or no
SYSTEM USE	Discretionary	Discretionary	Discretionary
TURNOVER RATE	Moderate	High	High
OTHER SYSTEMS			
TASK IMPORTANCE	Moderate	Low	Low
TASK STRUCTURE	Low Moderate	Low	Low

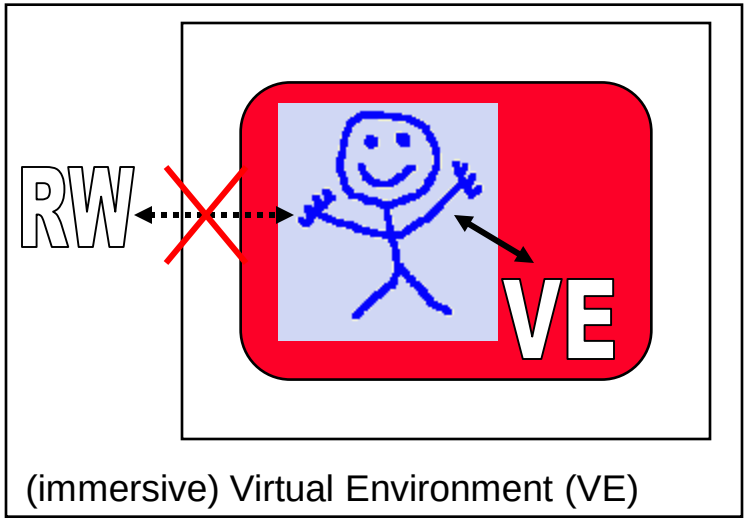
Summary (4)

USER PROFILE	DIALOG STYLE			
Job & Task Characteristics:	MENU	FILL-IN FORMS	QUESTION & ANSWER	COMMAND LANGUAGE
FREQUENCY OF USE	Low	Moderate High	Low	High
PRIMARY TRAINING	Little or no	Little or no	Little or no	Formal
SYSTEM USE	Discre-tionary	Discre-tionary	Discre-tionary	Mandatory
TURNOVER RATE	High	Low Moderate	High	Low
OTHER SYSTEMS		Paper Forms		
TASK IMPORTANCE	Low	Moderate	Low	High
TASK STRUCTURE	High	High	High	Low

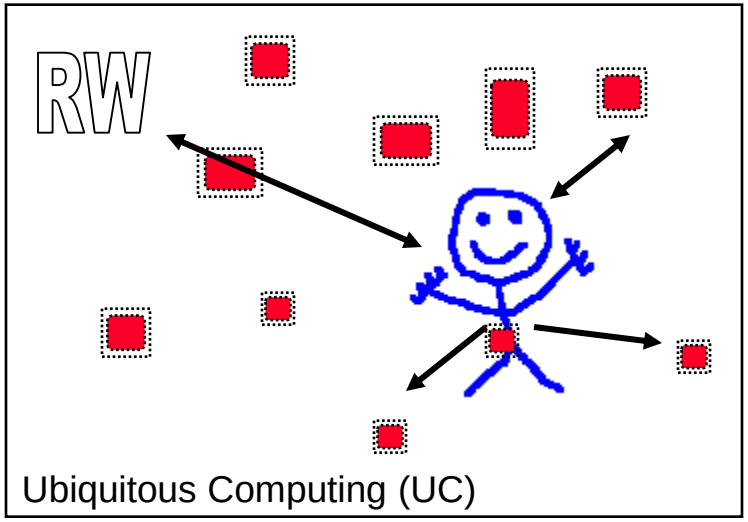
User Interface Types



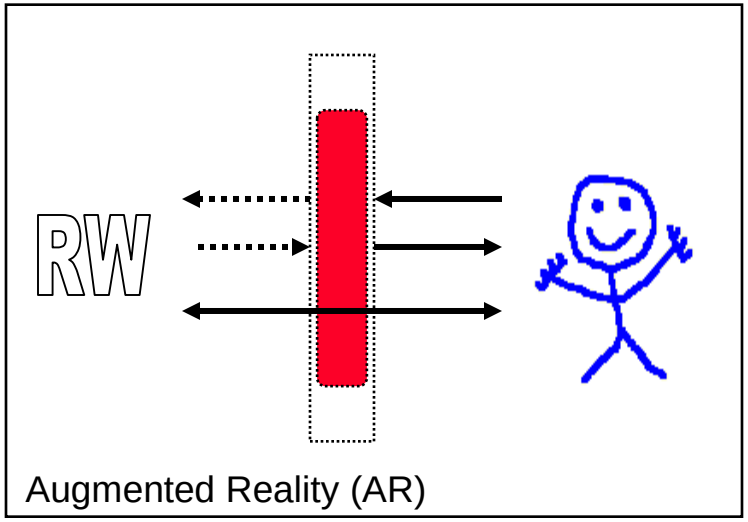
Graphical User Interface (GUI)



(immersive) Virtual Environment (VE)



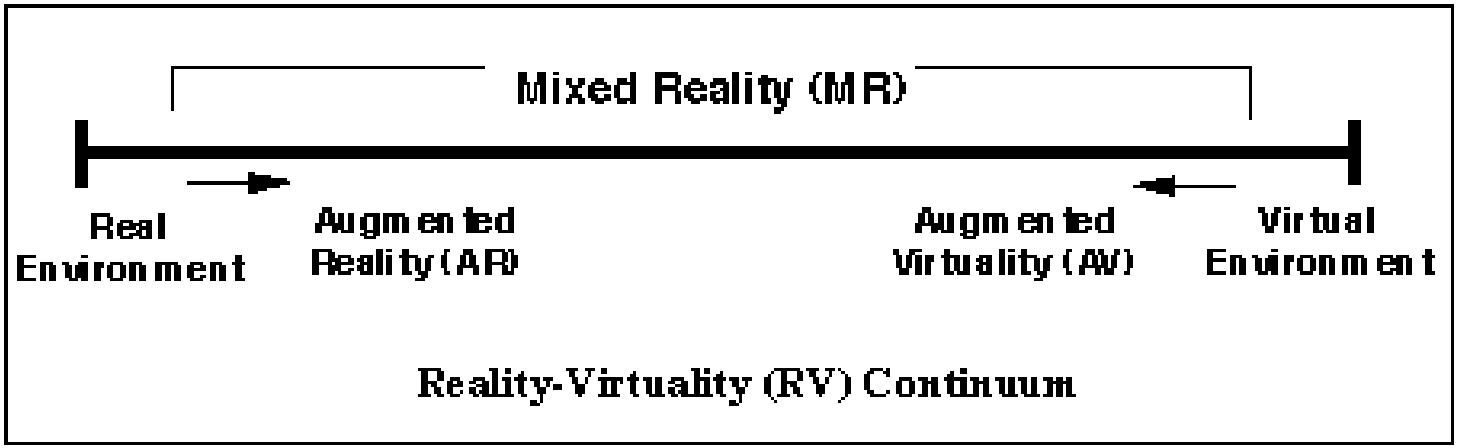
Ubiquitous Computing (UC)



Augmented Reality (AR)

Augmented Reality (AR) Characteristics

- Combines real and virtual: virtual objects superimposed or composited with the real world (adding and/or removing)
- Interactive in real time
- Registered in 3-D
- In contrast to VE's, AR *supplements* reality rather than replacing it



The Designer's Outpost, UC Berkeley, 2001