



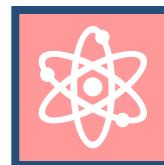
# Chapter 4

## the interaction

Instructors: Dr. Churee Techawut

Reference : Dix, A.J., Finlay, J.E., Abowd, G.D., and Beale, R. 2004.  
Human - Computer Interaction, 3<sup>rd</sup> ed. Prentice Hull Europe.

# Outline



interaction models  
translations between user and system



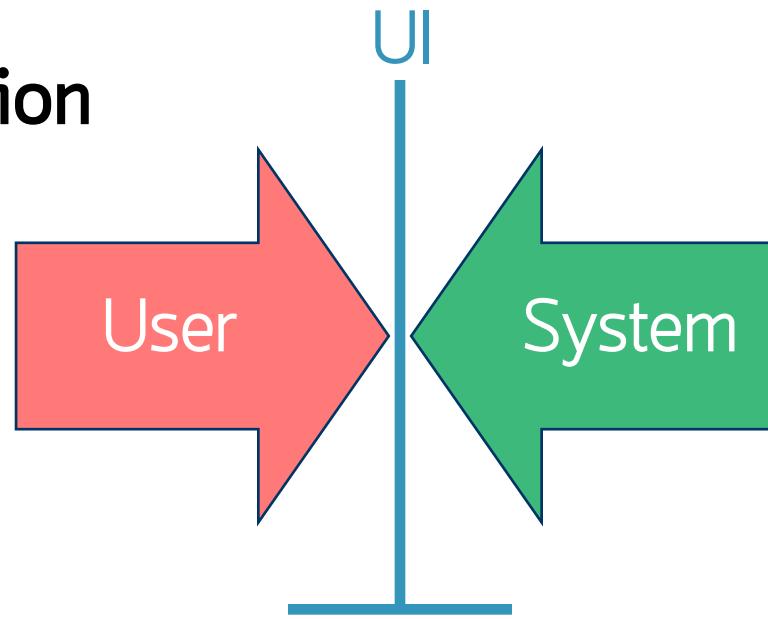
ergonomics  
physical characteristics of interaction



interaction styles  
the nature of user/system dialog

# What is interaction?

communication



but is that all ... ?

Indirect language (Not direct action)

# models of interaction

terms of interaction

Norman model

interaction framework

# Some terms of interaction

## domain

- the area of work under study  
e.g. graphic design



## goal

- what you want to achieve  
e.g. create a solid red triangle



## task

- how you go about doing it
- ultimately in terms of Operations or actions  
e.g. ... select fill tool, click over triangle



## intention

- pay attention to do something to achieve the goal

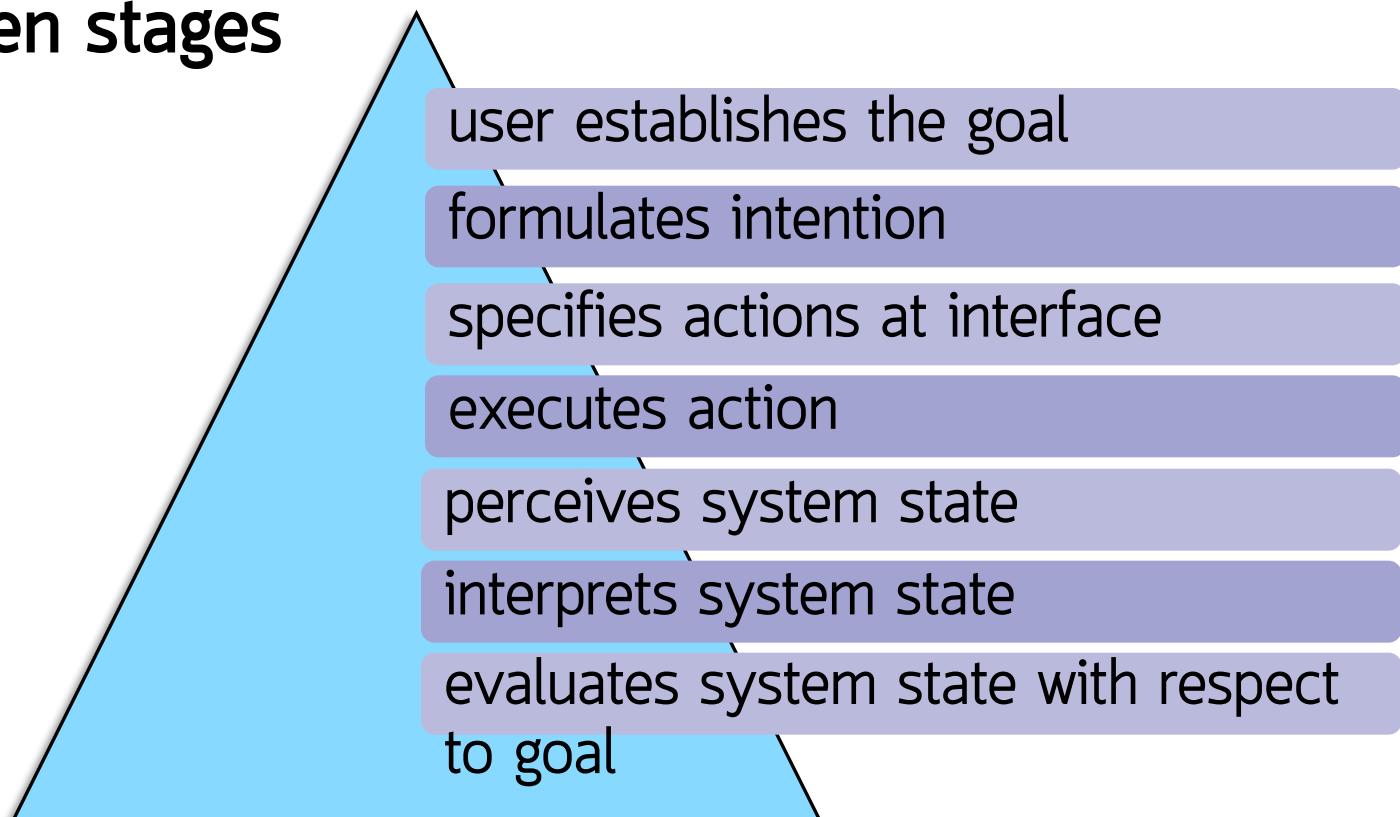


note ... - traditional interaction ...

- use of terms differs a lot especially task/goal !!!

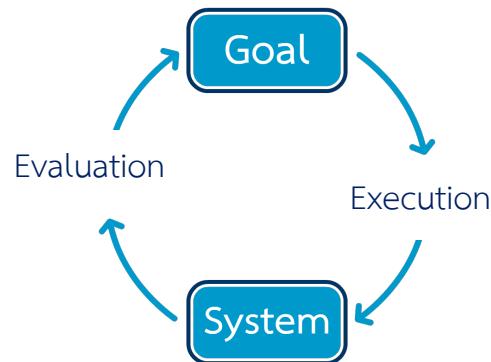
# Donald Norman's model

- Seven stages



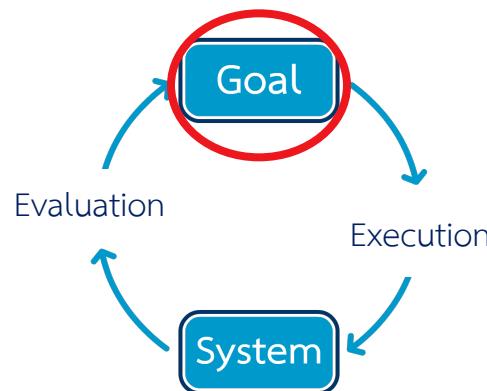
- Norman's model concentrates on user's view of the interface

# execution/evaluation loop



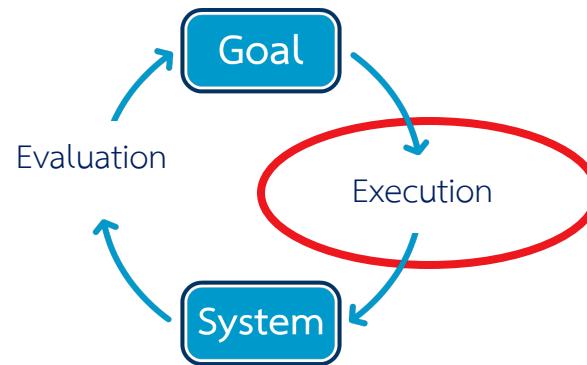
- user establishes the goal
- formulates intention
- specifies actions at interface
- executes action
- perceives system state
- interprets system state
- evaluates system state with respect to goal

# execution/evaluation loop



- user establishes the goal
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# execution/evaluation loop

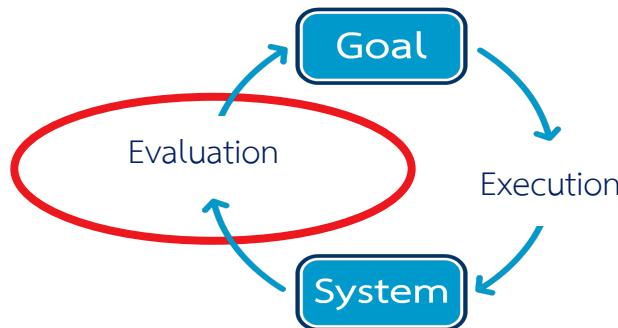


user establishes the goal

- formulates intention
- specifies actions at interface
- executes action

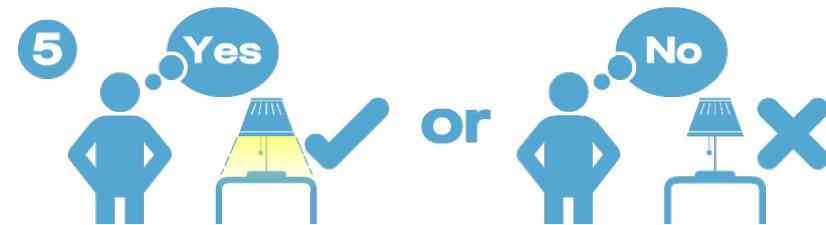
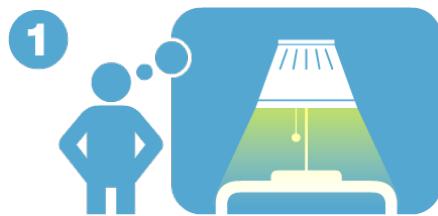
- perceives system state
- interprets system state
- evaluates system state with respect to goal

# execution/evaluation loop



- user establishes the goal
  - formulates intention
  - specifies actions at interface
  - executes action
- perceives system state
  - interprets system state
  - evaluates system state with respect to goal

# Example



# Using Norman's model

Some systems are harder to use than others

## Gulf of Execution

- user's formulation of actions
- ≠ actions allowed by the system

## Gulf of Evaluation

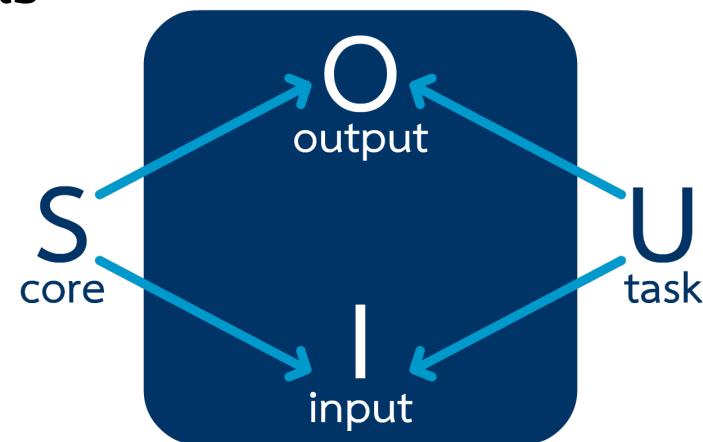
- user's expectation of changed system state
- ≠ actual presentation of this state

# Abowd and Beale framework

extension of Norman...

their interaction framework has 4 parts

- user
- input
- system
- output



each has its own unique language

interaction  $\Rightarrow$  translation between languages

problems in interaction = problems in translation

# Using Abowd & Beale's model

## user intentions

- translated into actions at the interface
  - translated into alterations of system state
    - reflected in the output display
    - interpreted by the user

## general framework for understanding interaction

- not restricted to electronic computer systems
- identifies all major components involved in interaction
- allows comparative assessment of systems
  - an abstraction

# ergonomics

physical aspects of interfaces  
industrial interfaces

# Ergonomics



Study of the physical characteristics of interaction



Also known as human factors - but this can also be used to mean much of HCI!



Ergonomics good at defining standards and guidelines for constraining the way we design certain aspects of systems



# Ergonomics - Definitions

- Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design to optimize human well-being and overall system performance.

Reference: International Ergonomics Association.  
Human Factors/Ergonomics (HF/E). Retrieved 7 June 2020.

# Ergonomics - Definitions

- Human factors and ergonomics are concerned with the "fit" between the user, equipment, and environment or "fitting a job to a person".

Reference: "Safety and Health Topics | Ergonomics | Occupational Safety and Health Administration".  
[www.osha.gov](http://www.osha.gov). Retrieved 28 March 2019.

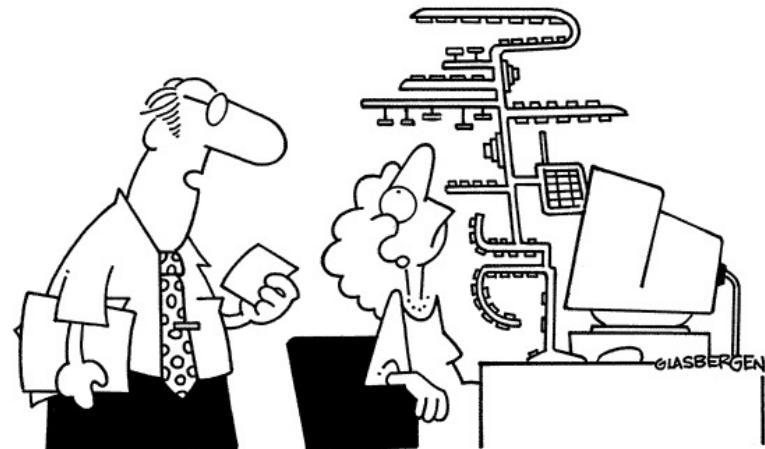


# Ergonomics - Definitions

- "fitting a job to a person".



Copyright 2002 by Randy Glasbergen.  
[www.glasbergen.com](http://www.glasbergen.com)



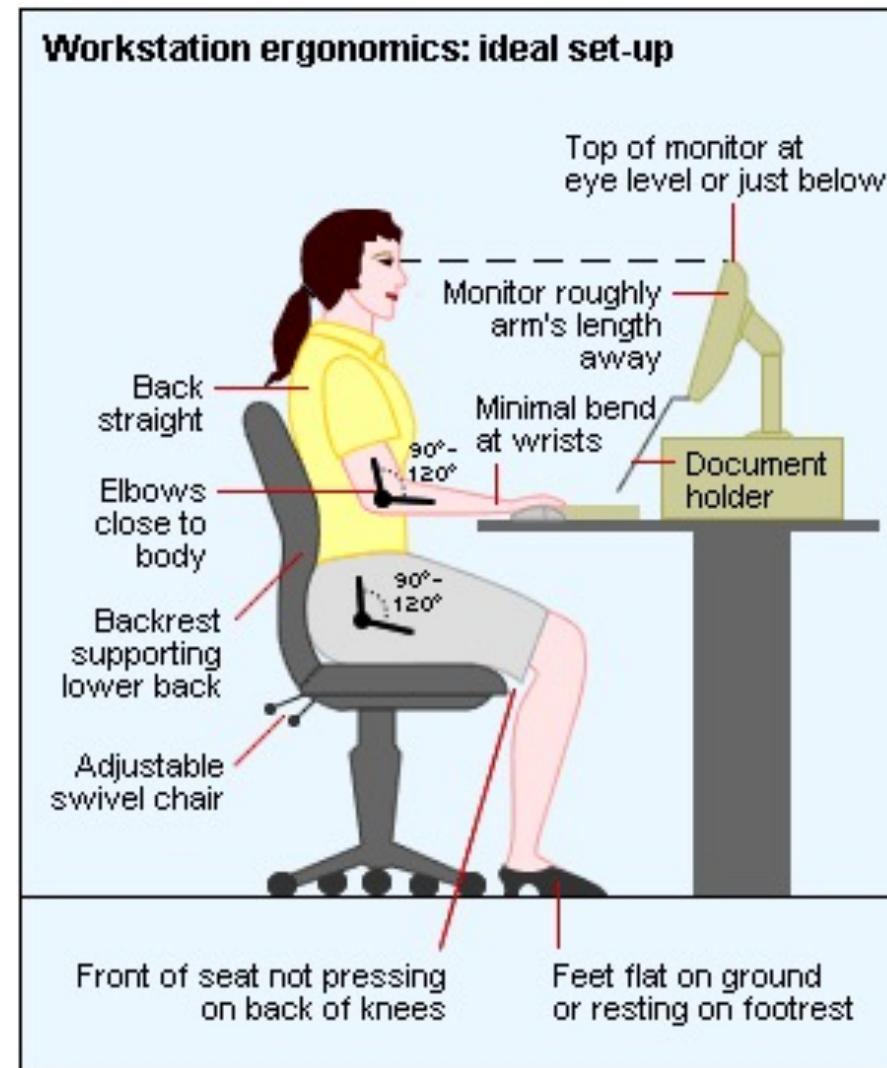
"It's an ergonomic keyboard. Once you learn how to use it, it will increase your speed by six percent!"

# Ergonomics - examples

- **arrangement of controls and displays**  
e.g. controls grouped according to function or frequency of use, or sequentially
- **surrounding environment**  
e.g. seating arrangements adaptable to cope with all sizes of user
- **health issues**  
e.g. physical position, environmental conditions (temperature, humidity), lighting, noise,
- **use of colour**  
e.g. use of red for warning, green for okay, awareness of colour-blindness etc.

# Ergonomics - examples

- arrangement of controls and displays



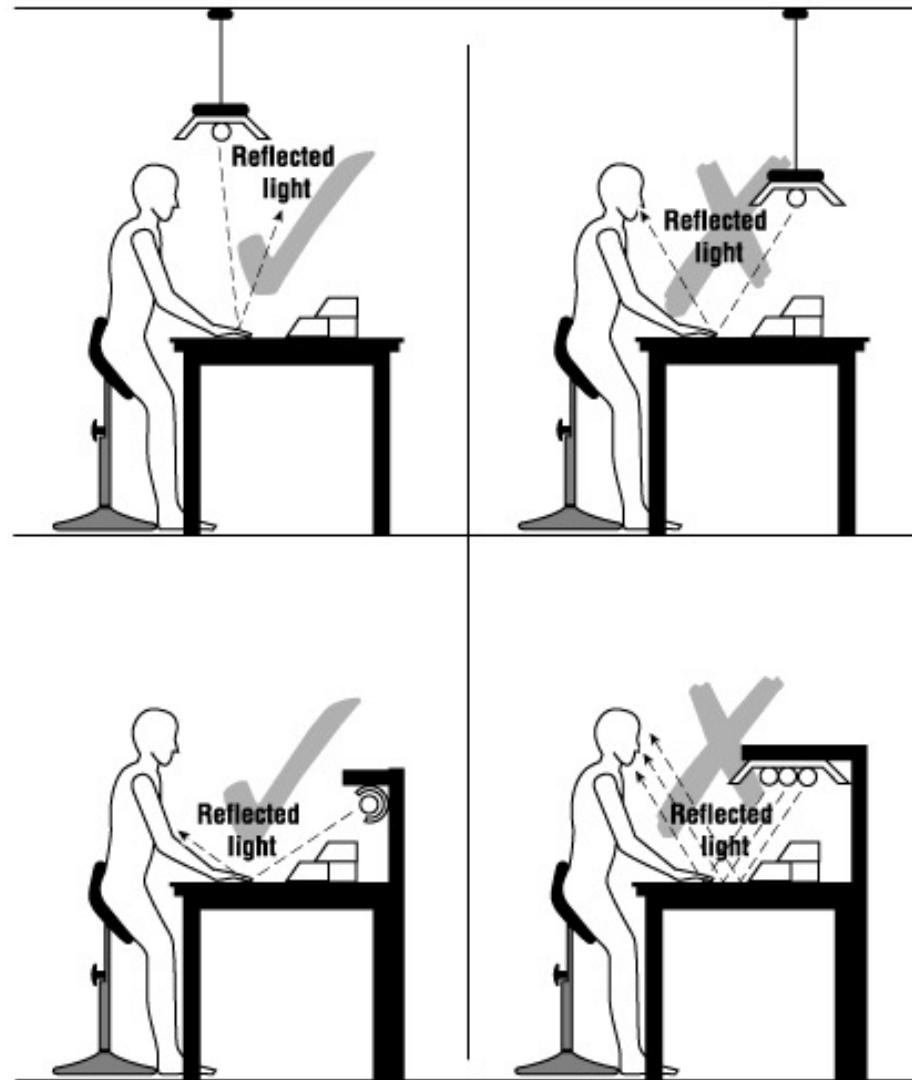
# Ergonomics - examples

- **surrounding environment**
  - Door size



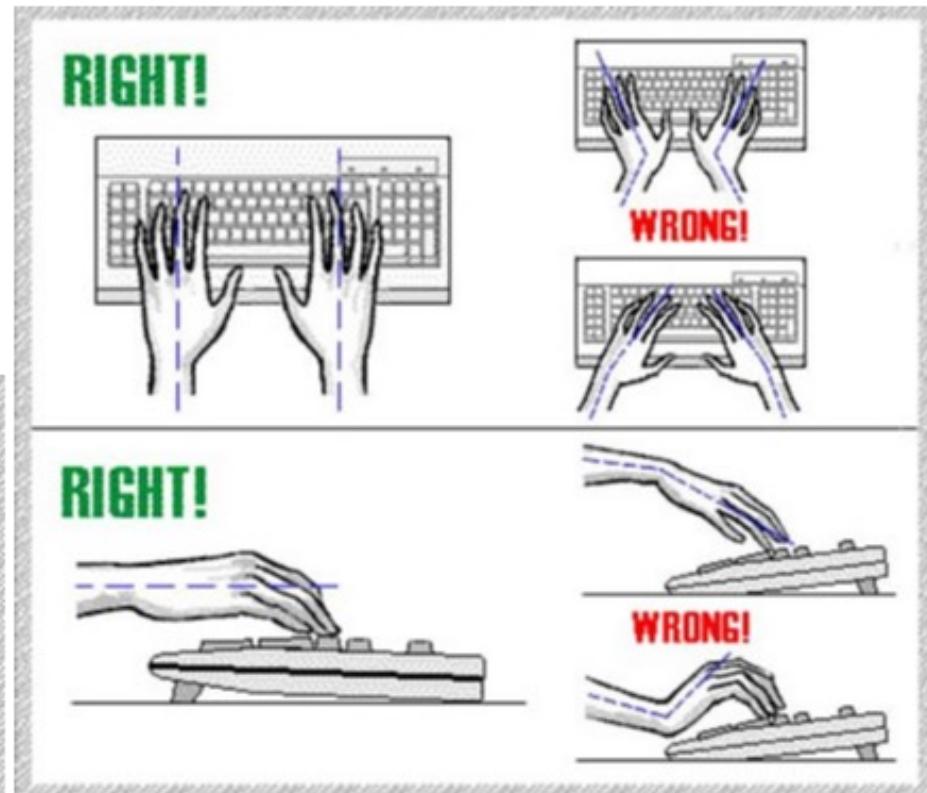
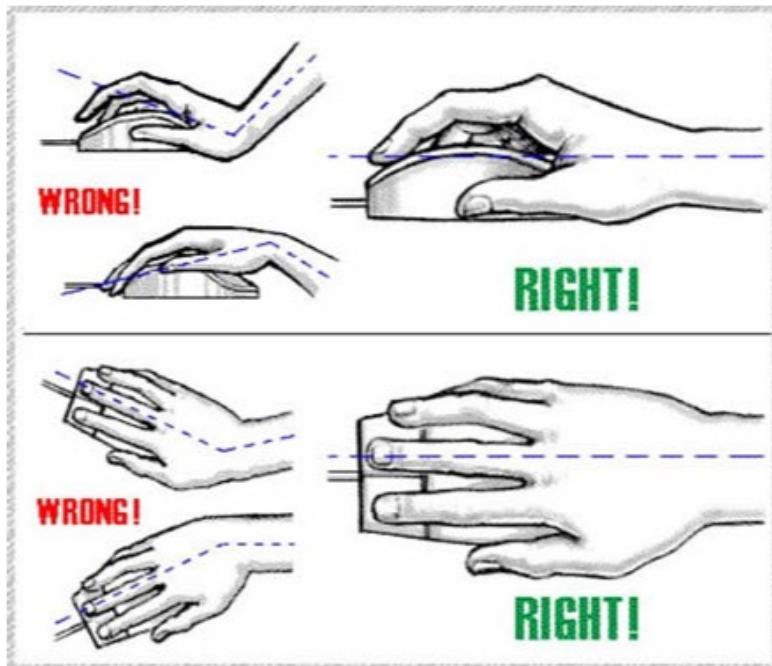
# Ergonomics - examples

- Health issues
  - Lighting



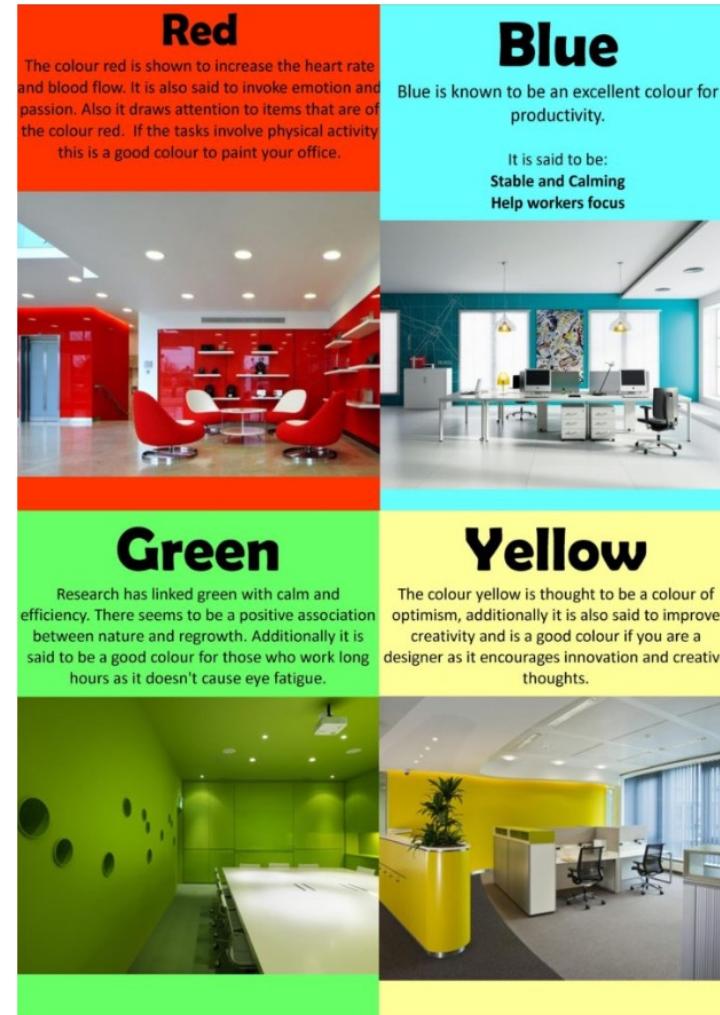
# Ergonomics - examples

- Health issues
  - Physical position

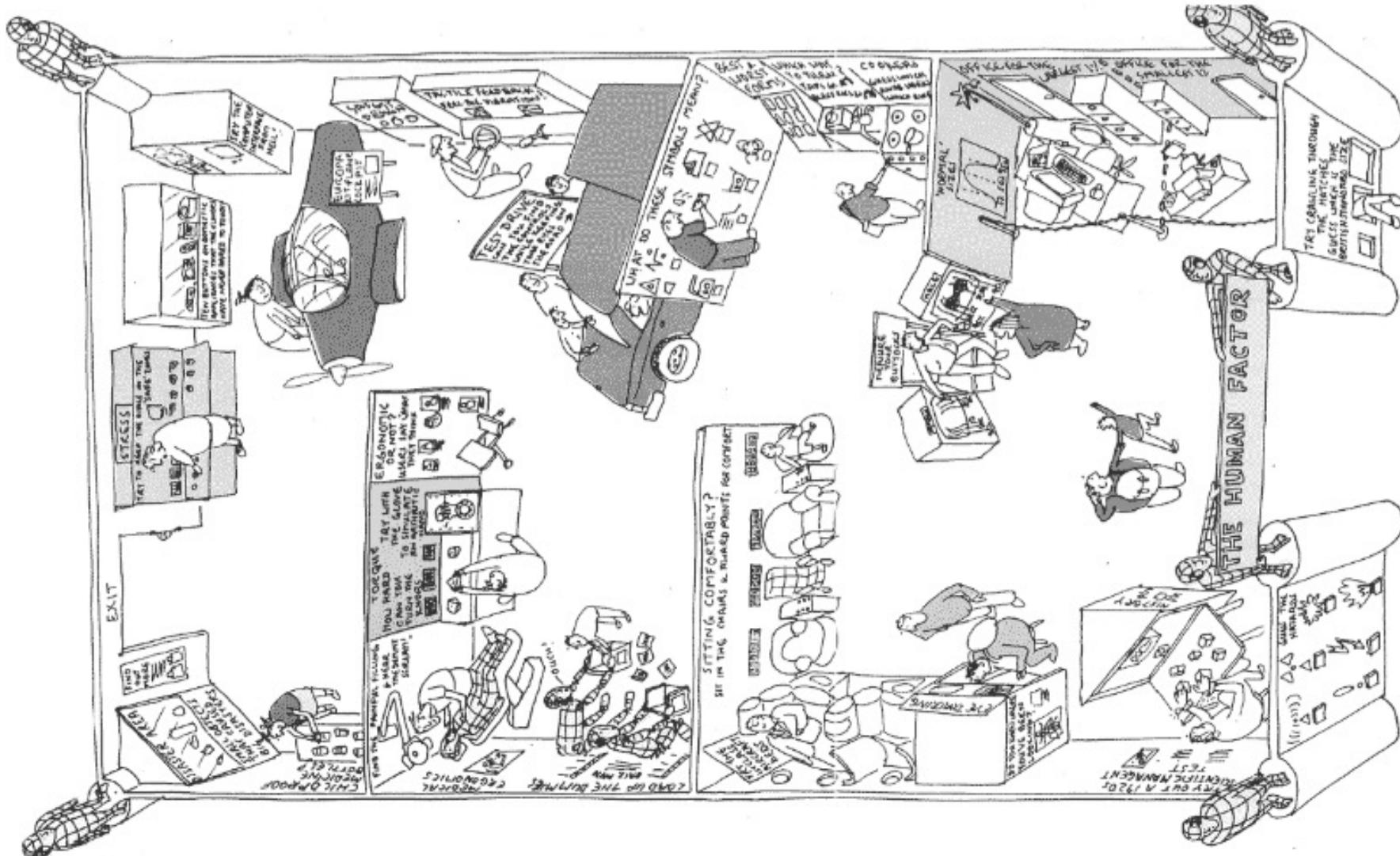


# Ergonomics - examples

- Use of Colour
  - Colour impacts productivity



# Ergonomics - examples

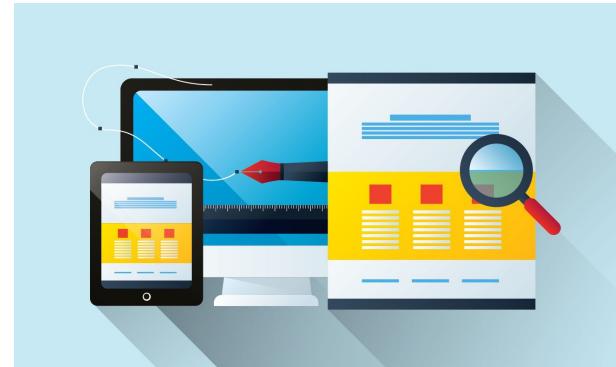


# interaction styles

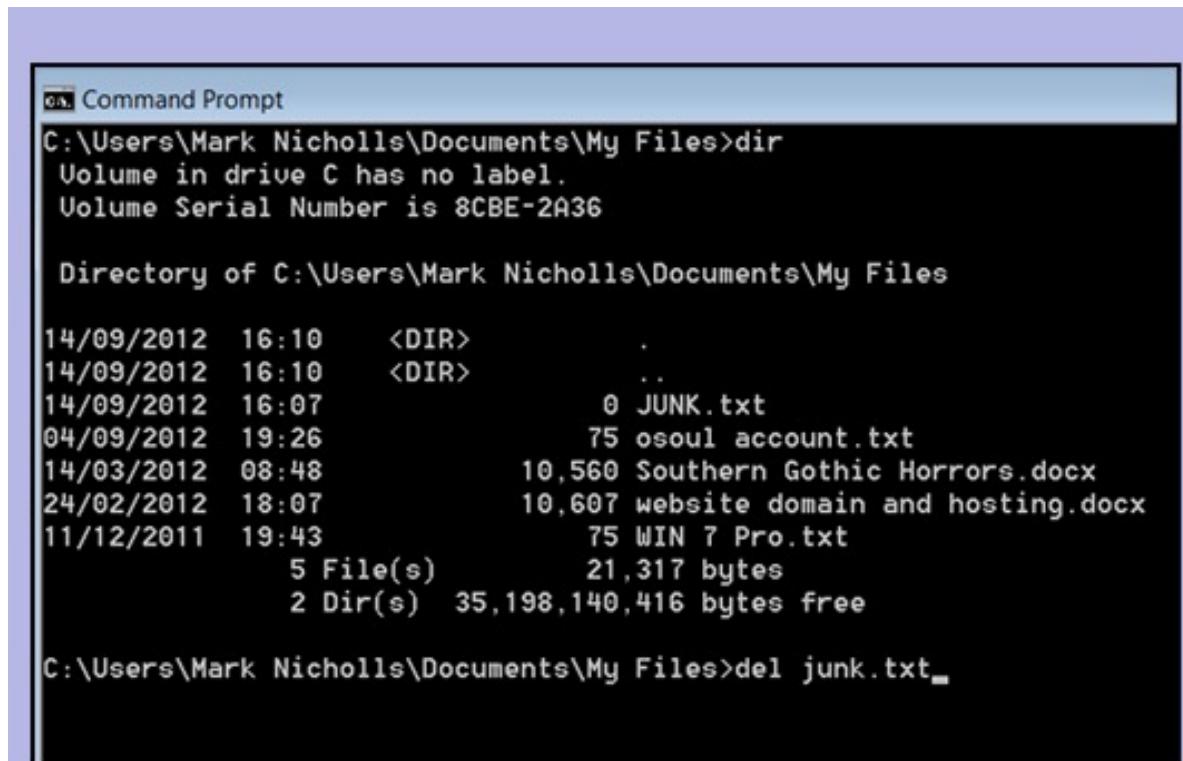
dialogue ... computer and user  
distinct styles of interaction

# Common interaction styles

- command line interface
- natural language
- question/answer and query dialogue
- form-fills and spreadsheets
- point and click
- three-dimensional interfaces
- WIMP



# Command line interface



```
cmd Command Prompt
C:\Users\Mark Nicholls\Documents\My Files>dir
Volume in drive C has no label.
Volume Serial Number is 8CBE-2A36

Directory of C:\Users\Mark Nicholls\Documents\My Files

14/09/2012  16:10    <DIR>      .
14/09/2012  16:10    <DIR>      ..
14/09/2012  16:07            0 JUNK.txt
04/09/2012  19:26            75 osoul account.txt
14/03/2012  08:48        10,560 Southern Gothic Horrors.docx
24/02/2012  18:07        10,607 website domain and hosting.docx
11/12/2011  19:43            75 WIN 7 Pro.txt
                           5 File(s)     21,317 bytes
                           2 Dir(s)   35,198,140,416 bytes free

C:\Users\Mark Nicholls\Documents\My Files>del junk.txt
```

Command Line Interface:

Commands are entered at the prompt

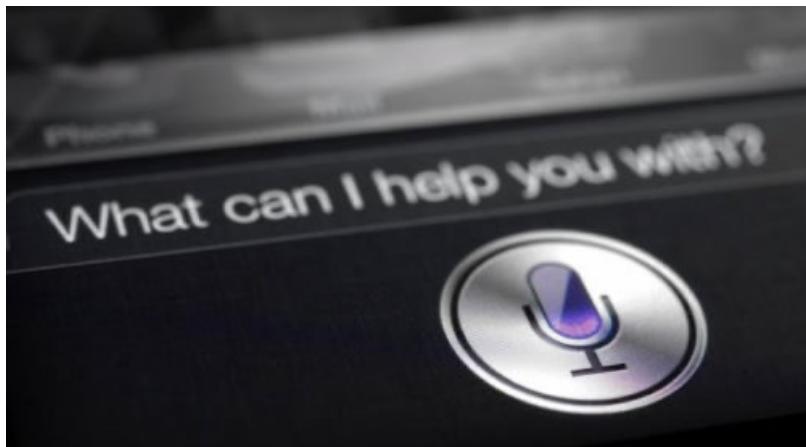
C:\Users\Mark Nicholls>

# Command line interface

- Way of expressing instructions to the computer directly
  - function keys, single characters, short abbreviations, whole words, or a combination
- suitable for repetitive tasks
- better for expert users than novices
- offers direct access to system functionality
- command names/abbreviations should be meaningful!

Typical example: the Unix system

# Natural language



<http://media02.hongkiat.com/next-gen-user-interface/siri.jpg>



<https://i.ytimg.com/vi/3SC5rktnRA8/maxresdefault.jpg>

# Natural language

Familiar to user

speech recognition or  
typed natural language

## Problems

- vague
- ambiguous
- hard to do well!

## Solutions

- try to understand  
a subset
- pick on key words

# Query interfaces

**THE FIND**

bread maker

Try: michael kors wallet gucci fringe bag dolce gabbana dress purple liquid eyeliner more...

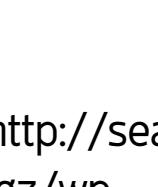
Click on an engine to compare

BizRate Google bing YAHOO! Shopping.com Nextag Pricegrabber shopz

11,764 PRODUCTS FROM 943 STORES FOR BREAD MAKER

Sort By: Best Results

1 2 3 4 5 ... NEXT >

						
Zojirushi BB-HAC10WZ Home Bakery Bread Baker	Zojirushi Home Bakery Supreme Bread Maker	Zojirushi Home Bakery Virtuoso Breadmaker	Panasonic SD-YD25D Automatic Bread Maker with Yeast Dispenser ★★★★★ (1,474) \$139.99 FREE SHIPPING	Cuisinart CMB200 Bread Maker ★★★★★ (70) \$189.99 FREE SHIPPING	Panasonic Automatic Bread Maker With Raisin And Nut Dispenser Macy's   ★★★★★ (2) \$175.00 FREE SHIPPING	Abt Electronics See at 71 stores from \$149
\$199.99 FREE SHIPPING Target   ★ See at 41 stores from \$160	\$249.99 Bed Bath & Beyond   ★ See at 26 stores from \$202	\$336.99 FREE SHIPPING Kohl's   ★ See at 24 stores from \$250	Amazon.com See at 57 stores from \$127	Macys   ★ See at 45 stores from \$90		

<http://searchengineland.com/figz/wp-content/seloads/2014/03/Screen-Shot-2014-03-14-at-5.54.23-AM1-600x300.png>

Find a property

Filter by keywords

Type of house ▾ City ▾

Pricerange  
\$110,000 \$450,000

Find properties

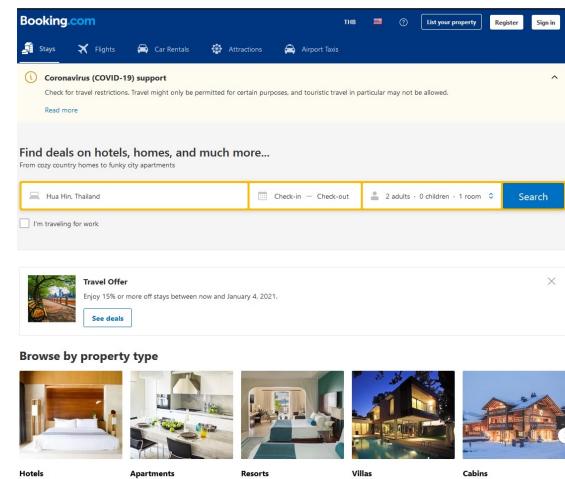
[https://image.freepik.com/free-psd/query-interface-buttons-and-input-boxes\\_280-13661247244603.jpg](https://image.freepik.com/free-psd/query-interface-buttons-and-input-boxes_280-13661247244603.jpg)

# Query interfaces

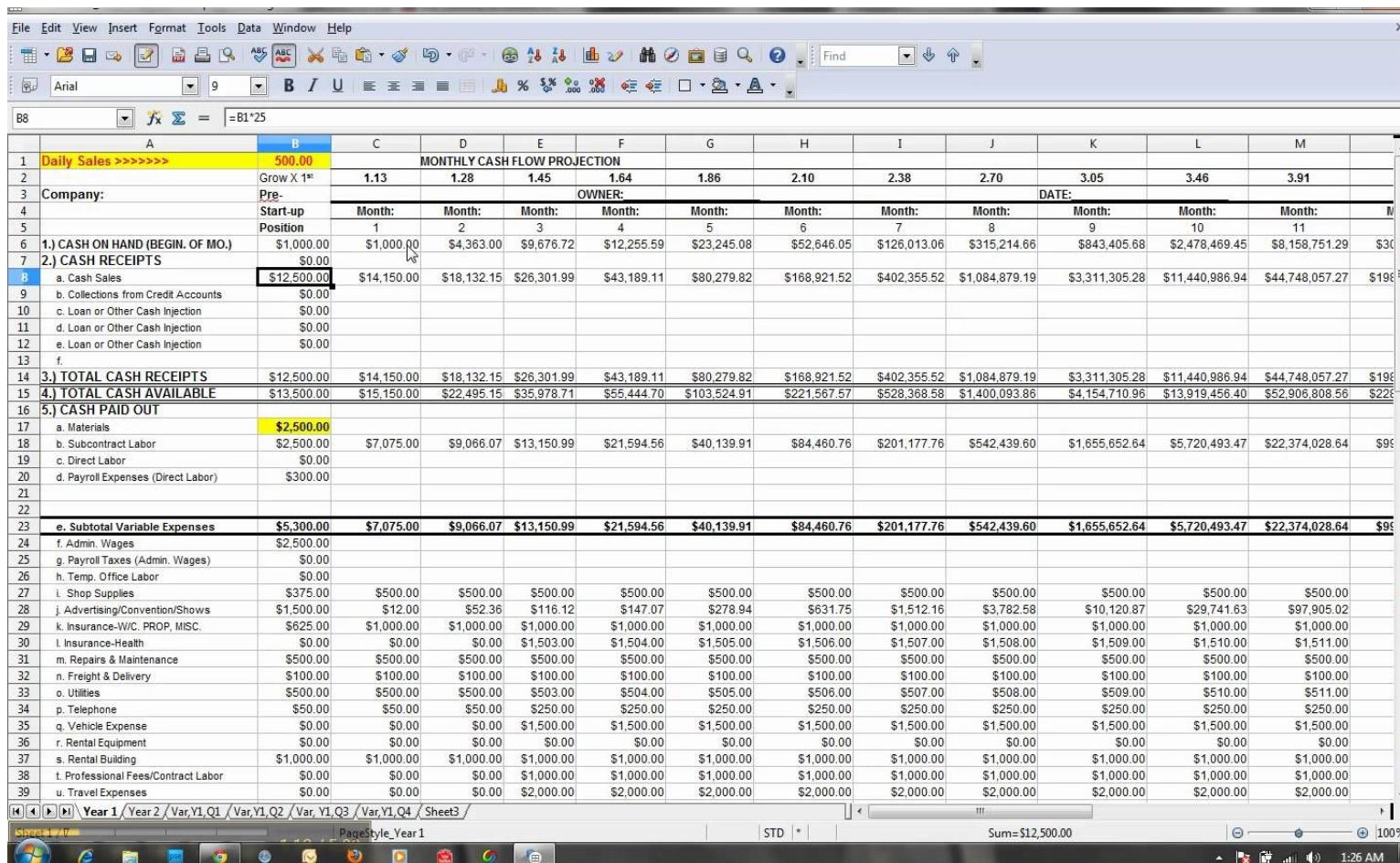
- **Question/answer interfaces**
  - user led through interaction via series of questions
  - suitable for novice users but restricted functionality
  - often used in information systems
- **Query languages (e.g. SQL)**
  - used to retrieve information from database
  - requires understanding of database structure and language syntax, hence requires some expertise

# Form-fills

- Primarily for data entry or data retrieval
- Screen like paper form.
- Data put in relevant place
- Requires
  - good design
- obvious correction facilities
- Primarily for data entry or data retrieval
- Screen like paper form.
- Data put in relevant place



# Spreadsheets



The screenshot shows a Microsoft Excel spreadsheet titled "Year 1". The spreadsheet contains a monthly cash flow projection for a company. The columns represent months from 1 to 12. The rows include various categories of cash inflows and outflows, such as "Daily Sales", "CASH RECEIPTS", "TOTAL CASH RECEIPTS", "CASH PAID OUT", and numerous expense items like "Materials", "Wages", "Taxes", "Health Insurance", etc. The total cash available at the end of the year is \$13,500.00.

	B	C	D	E	F	G	H	I	J	K	L	M	
1	<b>Daily Sales &gt;&gt;&gt;&gt;&gt;</b>	<b>\$500.00</b>	<b>MONTHLY CASH FLOW PROJECTION</b>										
2		Growth X 1 <sup>st</sup>	1.13	1.28	1.45	1.64	1.86	2.10	2.38	2.70	3.05	3.46	3.91
3	<b>Company:</b>	Pre-			OWNER:						DATE:		
4	Start-up Position	Month:	Month:	Month:	Month:	Month:	Month:	Month:	Month:	Month:	Month:	Month:	
5	1	2	3	4	5	6	7	8	9	10	11		
6	<b>1.) CASH ON HAND (BEGIN. OF MO.)</b>	\$1,000.00	\$1,000.00	\$4,363.00	\$9,676.72	\$12,255.59	\$23,245.08	\$52,646.05	\$126,013.06	\$315,214.66	\$843,405.68	\$2,478,469.45	\$8,158,751.29
7	<b>2.) CASH RECEIPTS</b>	\$0.00											
8	a. Cash Sales	<b>\$12,500.00</b>	\$14,150.00	\$18,132.15	\$26,301.99	\$43,189.11	\$80,279.82	\$168,921.52	\$402,355.52	\$1,084,879.19	\$3,311,305.28	\$11,440,986.94	\$44,748,057.27
9	b. Collections from Credit Accounts	\$0.00											
10	c. Loan or Other Cash Injection	\$0.00											
11	d. Loan or Other Cash Injection	\$0.00											
12	e. Loan or Other Cash Injection	\$0.00											
13	f.												
14	<b>3.) TOTAL CASH RECEIPTS</b>	\$12,500.00	\$14,150.00	\$18,132.15	\$26,301.99	\$43,189.11	\$80,279.82	\$168,921.52	\$402,355.52	\$1,084,879.19	\$3,311,305.28	\$11,440,986.94	\$44,748,057.27
15	<b>4.) TOTAL CASH AVAILABLE</b>	\$13,500.00	\$15,150.00	\$22,495.15	\$35,978.71	\$55,444.70	\$103,524.91	\$221,567.57	\$528,368.58	\$1,400,093.86	\$4,154,710.96	\$13,919,456.40	\$52,906,808.56
16	<b>5.) CASH PAID OUT</b>												
17	a. Materials	<b>\$2,500.00</b>											
18	b. Subcontract Labor	\$2,500.00	\$7,075.00	\$9,066.07	\$13,150.99	\$21,594.56	\$40,139.91	\$84,460.76	\$201,177.76	\$542,439.60	\$1,655,652.64	\$5,720,493.47	\$22,374,028.64
19	c. Direct Labor	\$0.00											
20	d. Payroll Expenses (Direct Labor)	\$300.00											
21													
22													
23	e. Subtotal Variable Expenses	\$5,300.00	\$7,075.00	\$9,066.07	\$13,150.99	\$21,594.56	\$40,139.91	\$84,460.76	\$201,177.76	\$542,439.60	\$1,655,652.64	\$5,720,493.47	\$22,374,028.64
24	f. Admin. Wages	\$2,500.00											
25	g. Payroll Taxes (Admin. Wages)	\$0.00											
26	h. Temp. Office Labor	\$0.00											
27	i. Shop Supplies	\$375.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	
28	j. Advertising/Convention/Shows	\$1,500.00	\$12.00	\$52.36	\$116.12	\$147.07	\$278.94	\$631.75	\$1,512.16	\$3,782.58	\$10,120.87	\$29,741.63	\$97,905.02
29	k. Insurance-W/C. PROP. MISC.	\$625.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	
30	l. Insurance-Health	\$0.00	\$0.00	\$0.00	\$1,503.00	\$1,504.00	\$1,505.00	\$1,506.00	\$1,507.00	\$1,508.00	\$1,509.00	\$1,510.00	\$1,511.00
31	m. Repairs & Maintenance	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00
32	n. Freight & Delivery	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00
33	o. Utilities	\$500.00	\$500.00	\$500.00	\$503.00	\$504.00	\$505.00	\$506.00	\$507.00	\$508.00	\$509.00	\$510.00	\$511.00
34	p. Telephone	\$50.00	\$50.00	\$50.00	\$250.00	\$250.00	\$250.00	\$250.00	\$250.00	\$250.00	\$250.00	\$250.00	\$250.00
35	q. Vehicle Expense	\$0.00	\$0.00	\$0.00	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00
36	r. Rental Equipment	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
37	s. Rental Building	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00
38	t. Professional Fees/Contract Labor	\$0.00	\$0.00	\$0.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00
39	u. Travel Expenses	\$0.00	\$0.00	\$0.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00

# Spreadsheets

- first spreadsheet VISICALC, followed by Lotus 1-2-3  
MS Excel most common today
- sophisticated variation of form-filling.
  - grid of cells contain a value or a formula
  - formula can involve values of other cells
    - e.g. sum of all cells in this column
  - user can enter and alter data spreadsheet maintains consistency

# Point and click interfaces

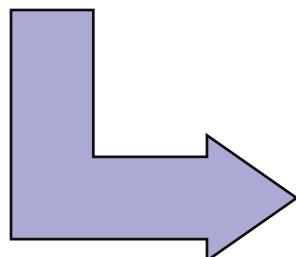
http://beta.typepad.com/.a/6a00e55403cc9f8834010535  
5a058e970b-pi

[http://images.macworld.com/images/article/2012/09  
/icloud-menu2-294630.png](http://images.macworld.com/images/article/2012/09/icloud-menu2-294630.png)

# Point and click interfaces

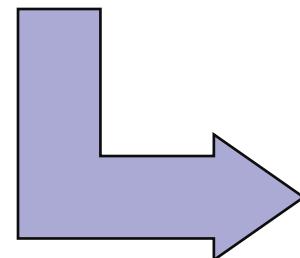
used in ..

- multimedia
- web browsers
- hypertext



just click  
something!

- icons, text links or location on map



minimal  
typing

# Three dimensional interfaces



<http://deliveryimages.acm.org/10.1145/580000/571765/gfx/3Dbrowse1.jpg>

# Three dimensional interfaces

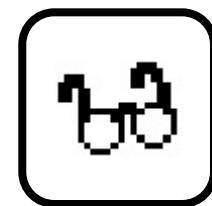
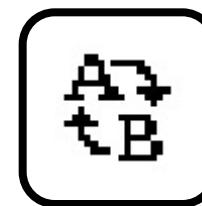
- **virtual reality**

'ordinary'  
window sys

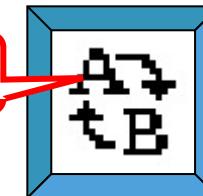
- highlighting
- visual affordance
- indiscriminate use  
just confusing!

3D  
workspaces

- use for extra virtual space
- light and occlusion give depth
- distance effects

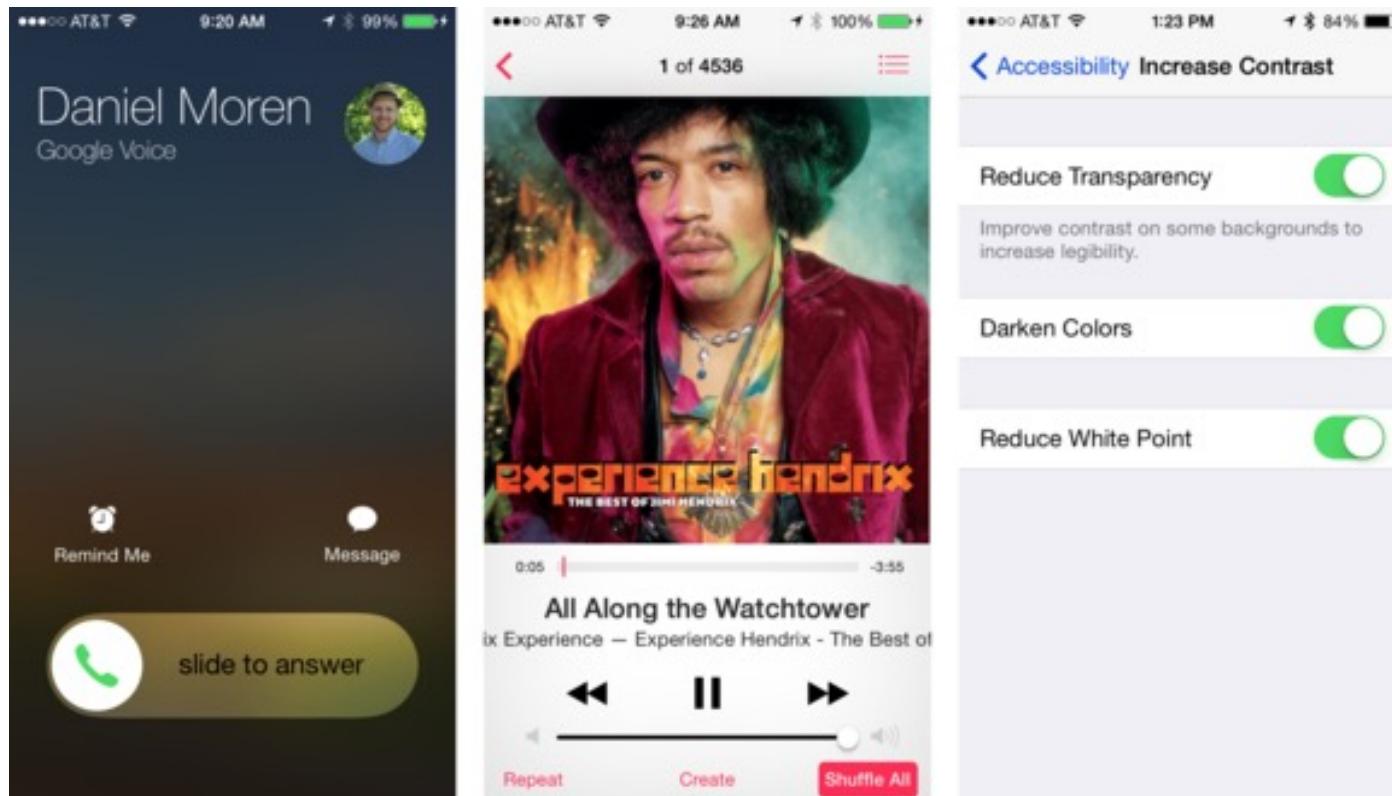


flat buttons ...



... or sculptured

# Point and slide interfaces



<http://images.techhive.com/images/article/2014/03/ios71-changes-100249608-large.png>

# Point and slide interfaces

used in ..

- multimedia
- Mobile devices

just slide on screen

- slider bar

minimal typing



# elements of the wimp interface

windows, icons, menus, pointers

+++

buttons, toolbars,  
palettes, dialog boxes

also see supplementary material  
on choosing wimp elements

# WIMP Interface

w.i.m.p

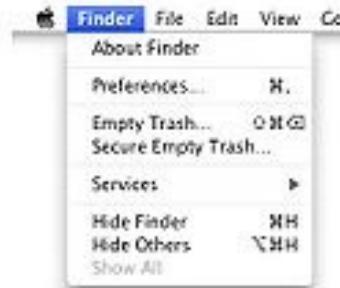
window



icon



menu



pointer



[http://1.bp.blogspot.com/\\_UtxaLxoqdsU/SwyLgCYuxml/AAAAAAEe/JRHpMtiqWxY/s1600/450px-Wimp.jpg](http://1.bp.blogspot.com/_UtxaLxoqdsU/SwyLgCYuxml/AAAAAAEe/JRHpMtiqWxY/s1600/450px-Wimp.jpg)

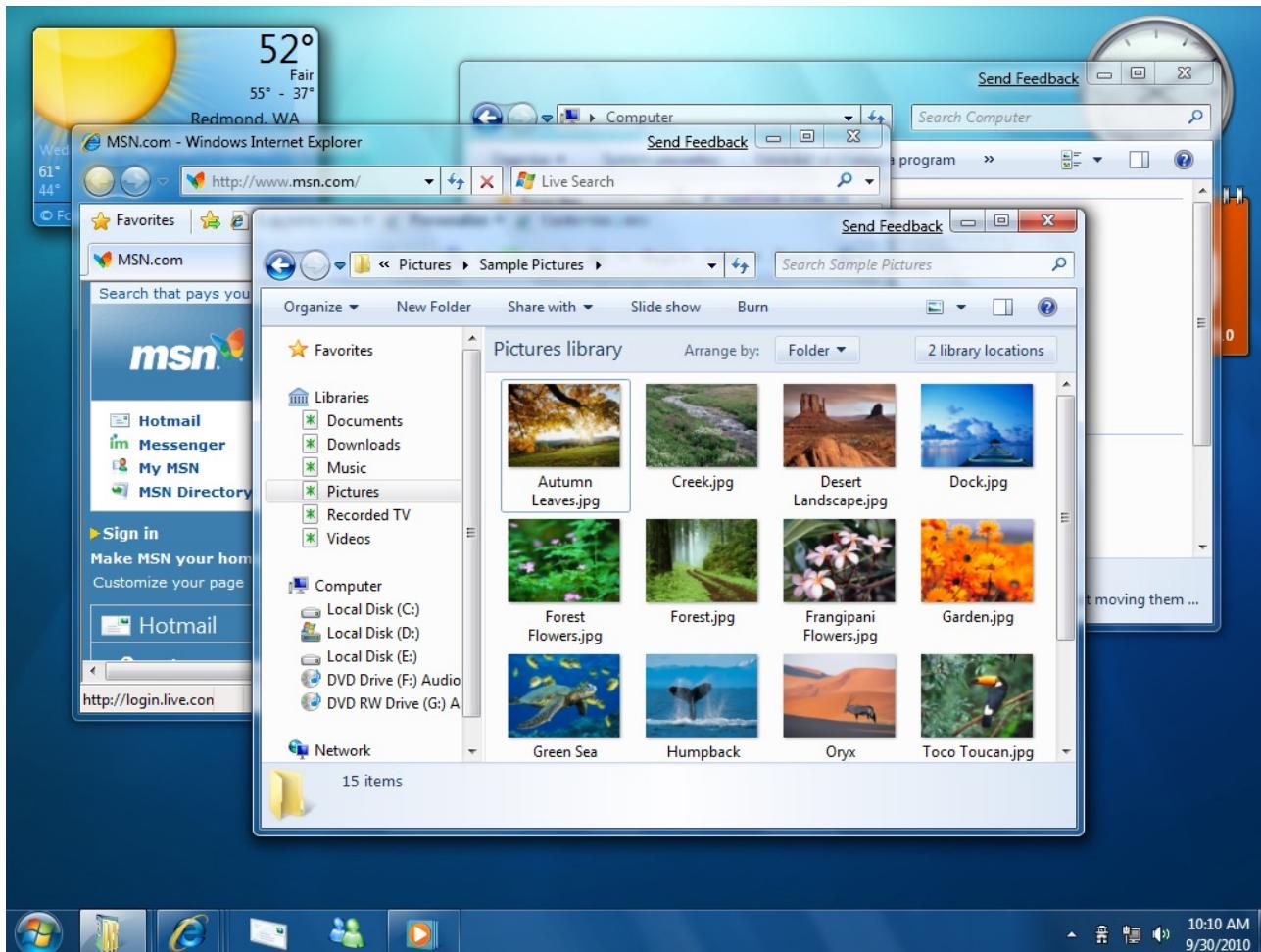
# WIMP Interface

Windows  
Icons  
Menus  
Pointers

... or windows, icons, mice, and pull-down menus!

default style for majority of interactive computer systems, especially PCs and desktop machines

# Windows



<http://origin.arsTechnica.com/images/windows7/Peek%20-%20Before.png>

# Windows

- Areas of the screen that behave as if they were independent
  - can contain text or graphics
  - can be moved or resized
  - can overlap and obscure each other, or can be laid out next to one another (tiled)
- scrollbars
  - allow the user to move the contents of the window up and down or from side to side
- title bars
  - describe the name of the window

# Icons



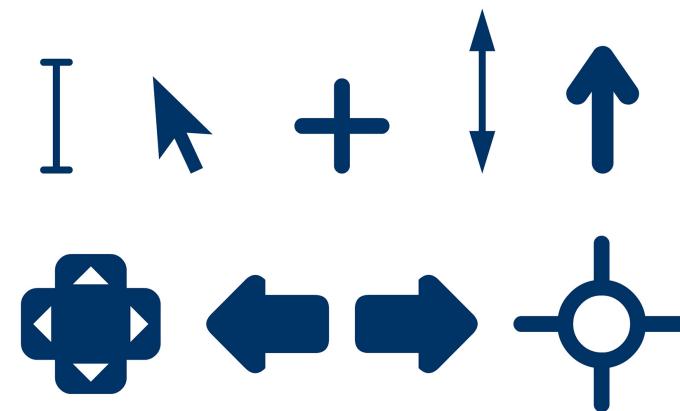
<http://cdn.redmondpie.com/wp-content/uploads/2009/07/Windows7Icons.png>

# Icons

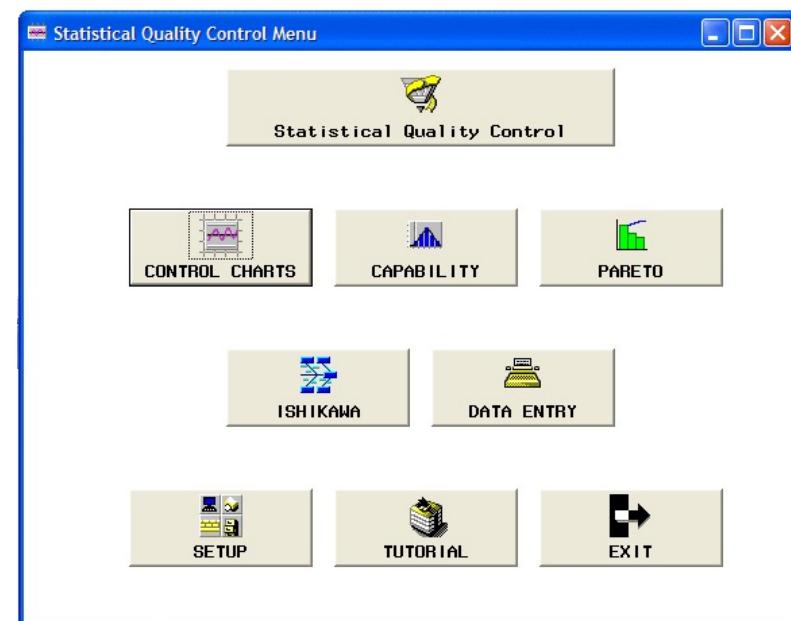
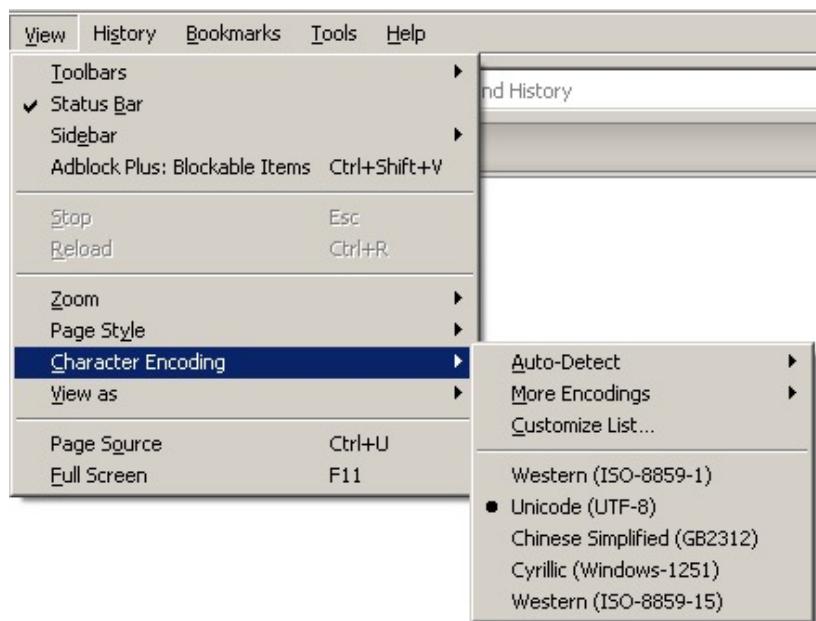
- small picture or image
- represents some object in the interface
  - often a window or action
- windows can be closed down (iconised)
  - small representation for many accessible windows
- icons can be many and various
  - highly stylized
  - realistic representations.

# Pointers

- important component
  - WIMP style relies on pointing and selecting things
- uses mouse, trackpad, joystick, trackball, cursor keys or keyboard shortcuts
- wide variety of graphical images



# Menus



[https://upload.wikimedia.org/wikipedia/commons/e/e6/View\\_menu\\_and\\_submenu.PNG](https://upload.wikimedia.org/wikipedia/commons/e/e6/View_menu_and_submenu.PNG)

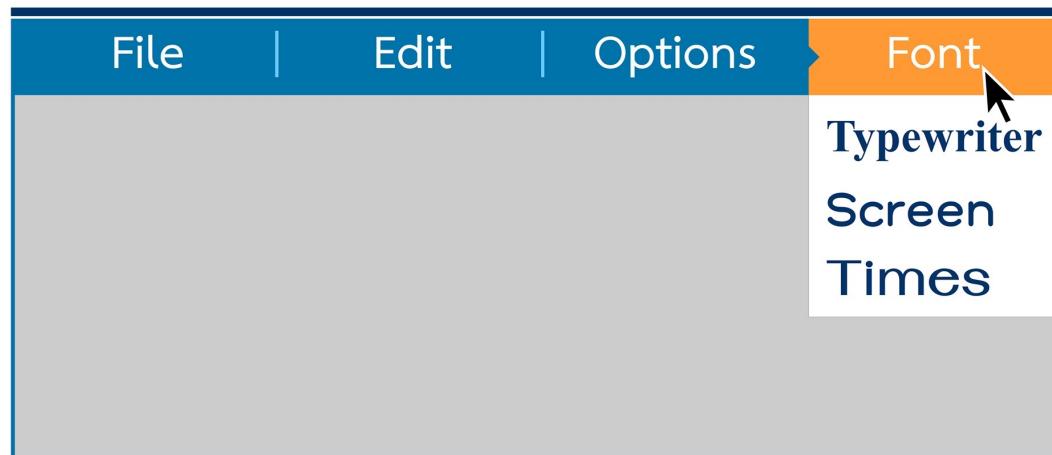
<http://support.sas.com/rnd/app/qc/sqc/sqcmenu.gif>

# Menus

- Set of options displayed on the screen
- Options visible
  - less recall - easier to use
  - rely on recognition so names should be meaningful
- Selection by:
  - numbers, letters, arrow keys, mouse
  - combination (e.g. mouse plus accelerators)
- Often options hierarchically grouped
  - sensible grouping is needed
- Restricted form of full WIMP system

# Menus

- Choice of operations or services offered on the screen
- Required option selected with pointer



problem - take a lot of screen space

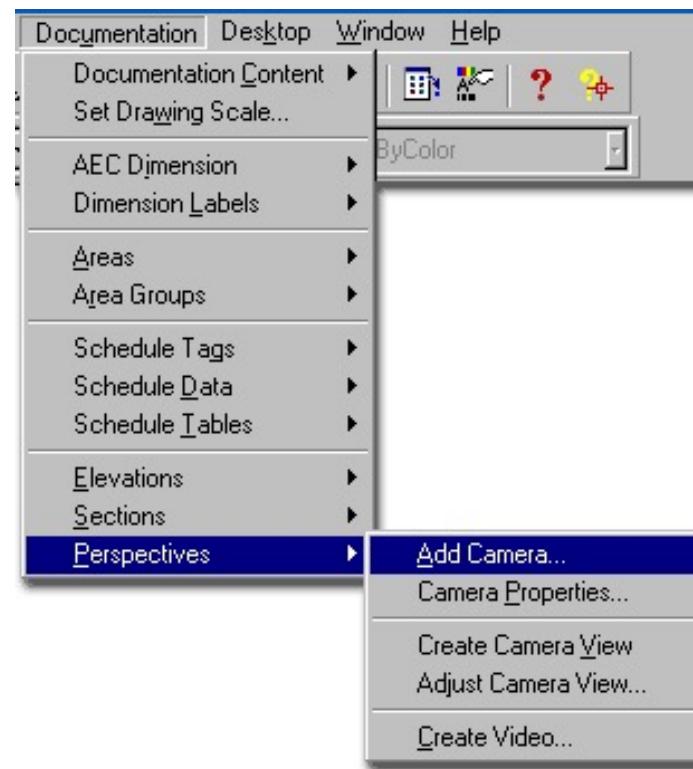
solution - pop-up: menu appears when needed

# Kinds of Menus

- **Menu Bar at top of screen (normally), menu drags down**
  - pull-down menu - mouse hold and drag down menu
  - drop-down menu - mouse click reveals menu
  - fall-down menus - mouse just moves over bar!
- **Contextual menu appears where you are**
  - pop-up menus - actions for selected object
  - pie menus - arranged in a circle
    - easier to select item (larger target area)
    - quicker (same distance to any option)
      - ... but not widely used!

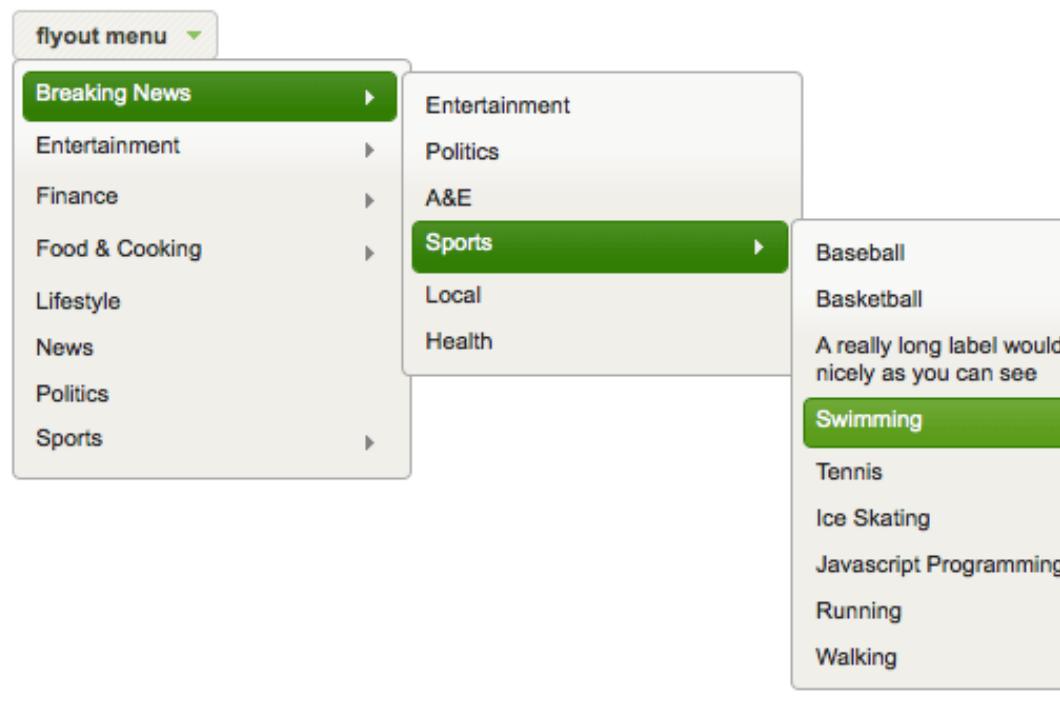
# Kinds of Menus

- Pull-down menu



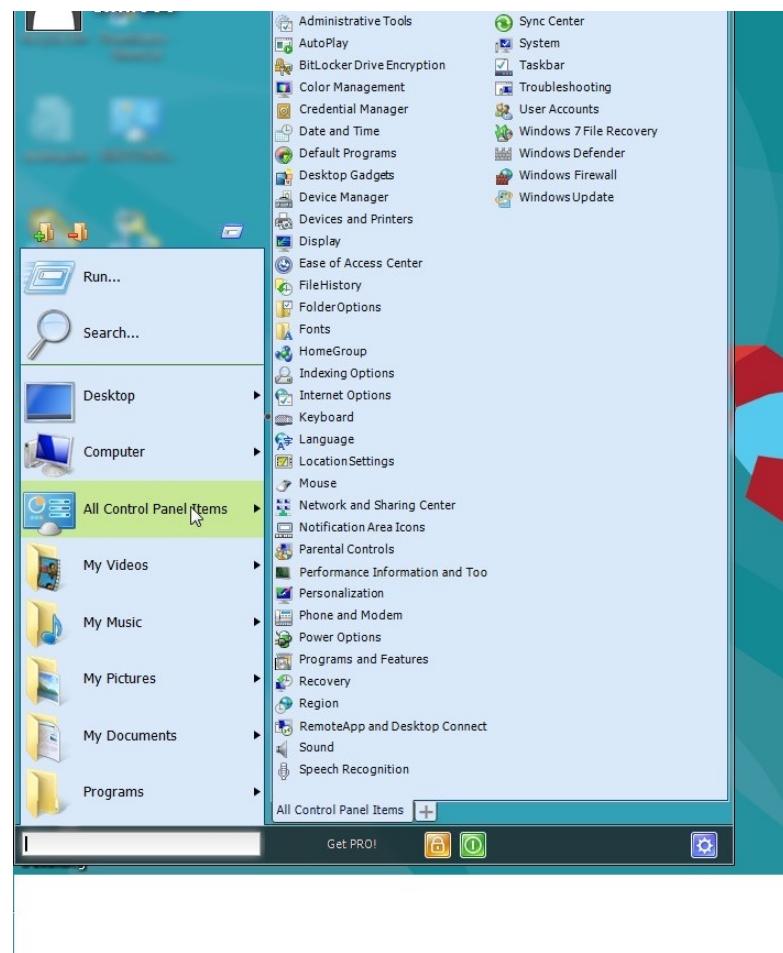
# Kinds of Menus

- Drop-down menu



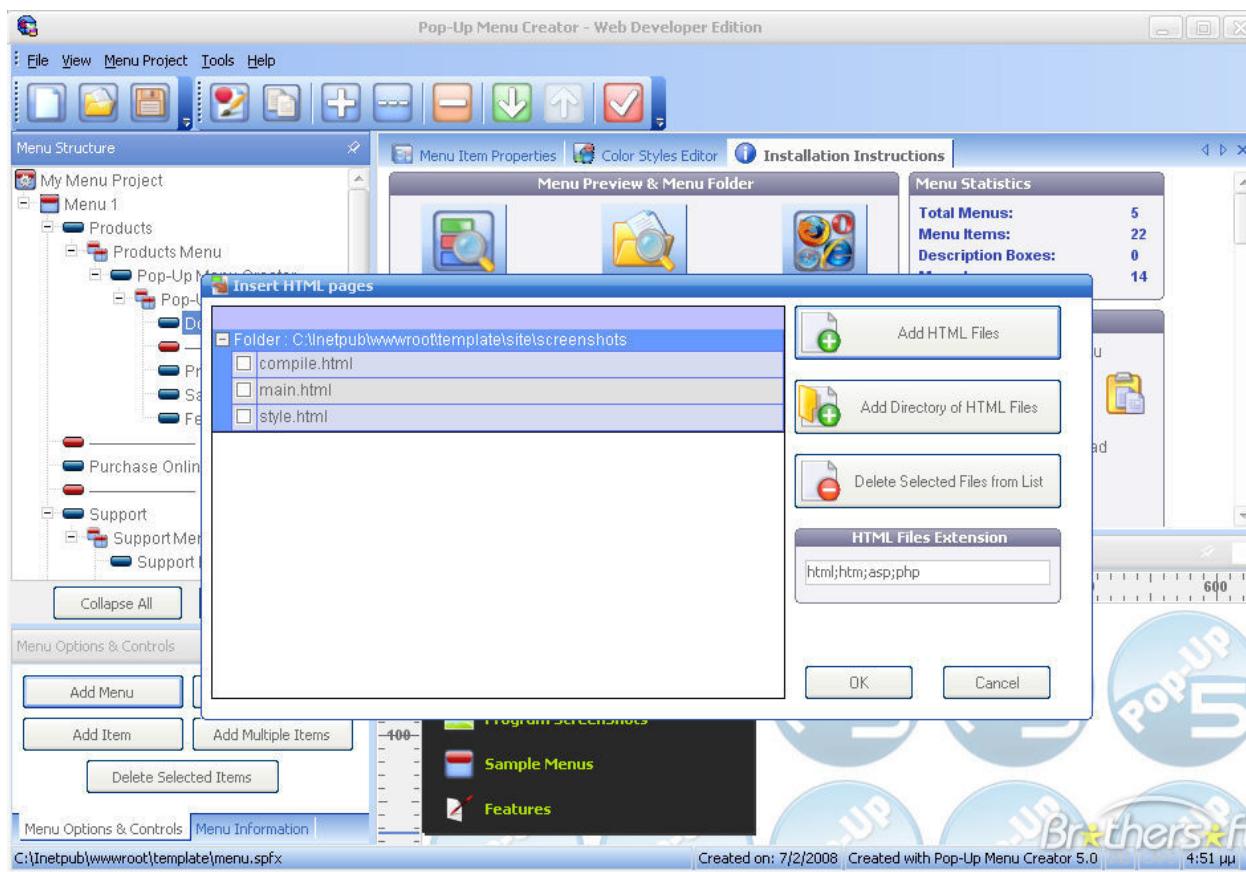
# Kinds of Menus

- Fall-down menu



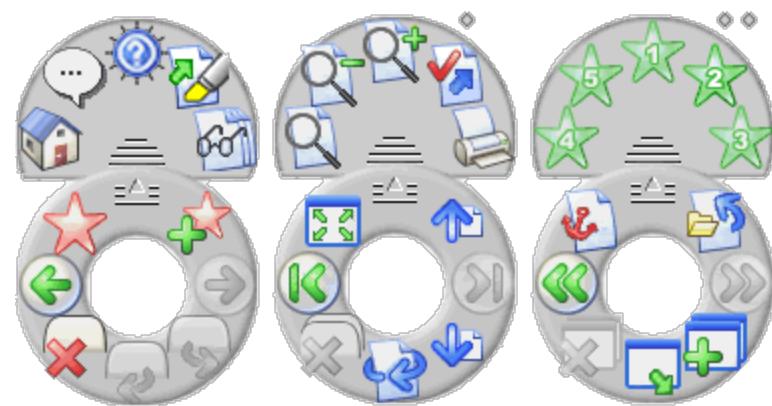
# Kinds of Menus

- Pop-up menu



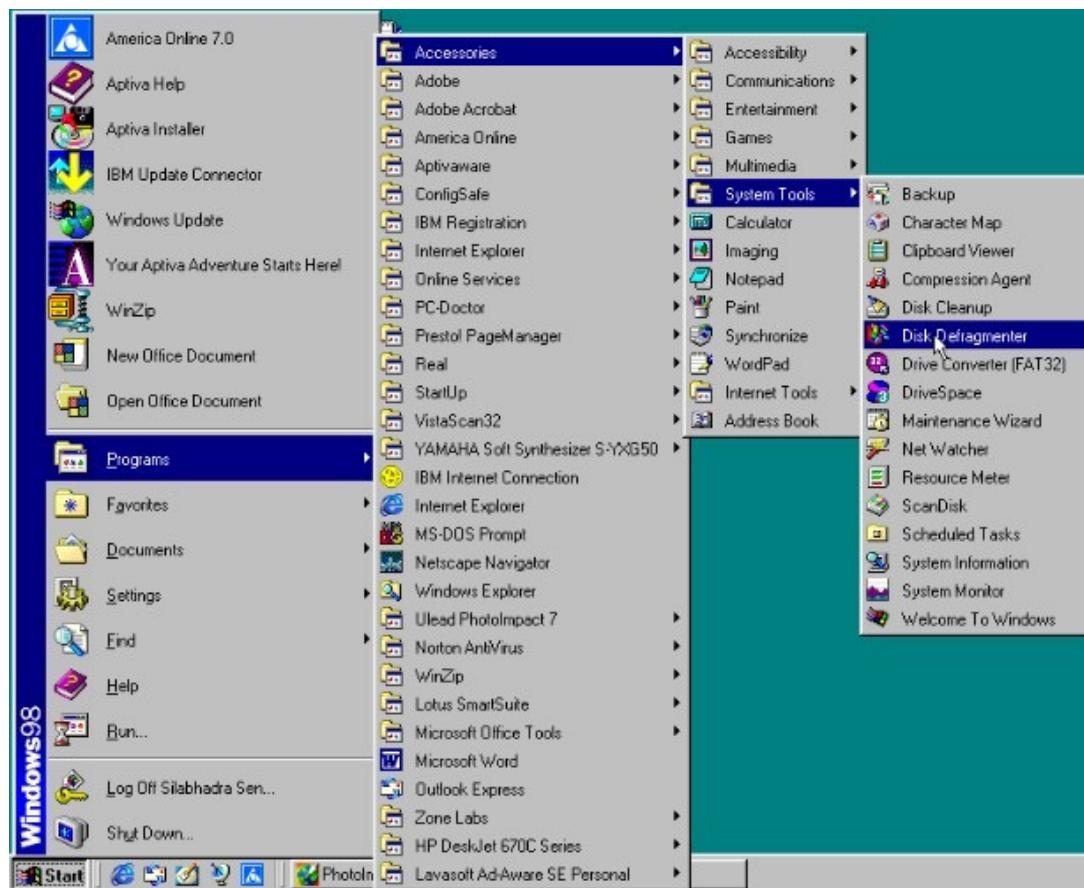
# Kinds of Menus

- pie menu



# Menus extras

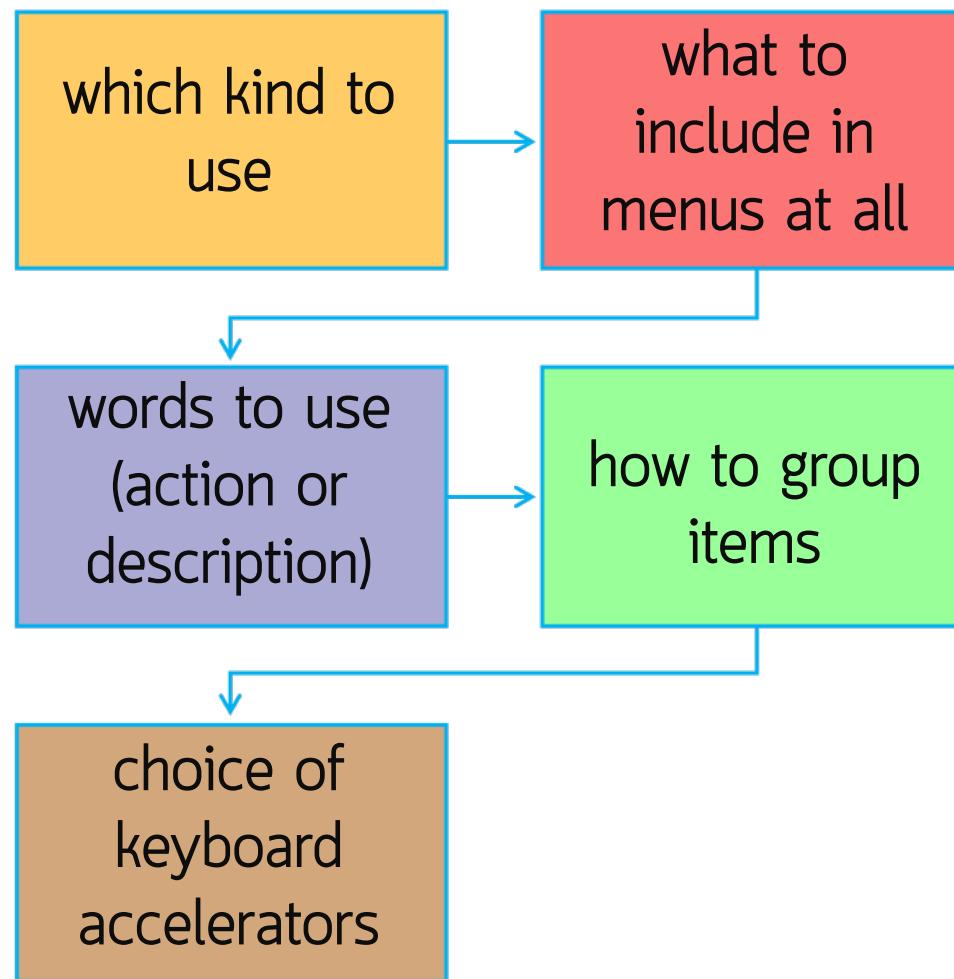
- Cascading menus



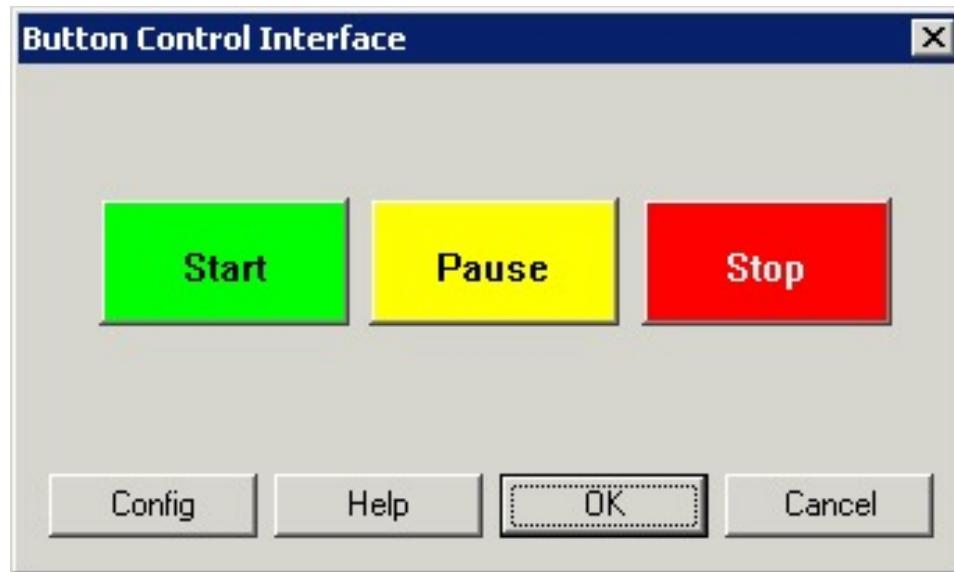
# Menus extras

- **Cascading menus**
    - hierarchical menu structure
    - menu selection opens new menu
    - and so in ad infinitum
  - **Keyboard accelerators**
    - key combinations - same effect as menu item
    - two kinds
      - active when menu open - usually first letter
      - active when menu closed - usually Ctrl + letter
- usually different !!!

# Menus design issues



# Buttons



[http://www.roborealm.com/help/Button\\_Interface.gif](http://www.roborealm.com/help/Button_Interface.gif)

# Buttons

- individual and isolated regions within a display that can be selected to invoke an action
- Special kinds radio buttons
  - set of mutually exclusive choices
- check boxes
  - set of non-exclusive choices

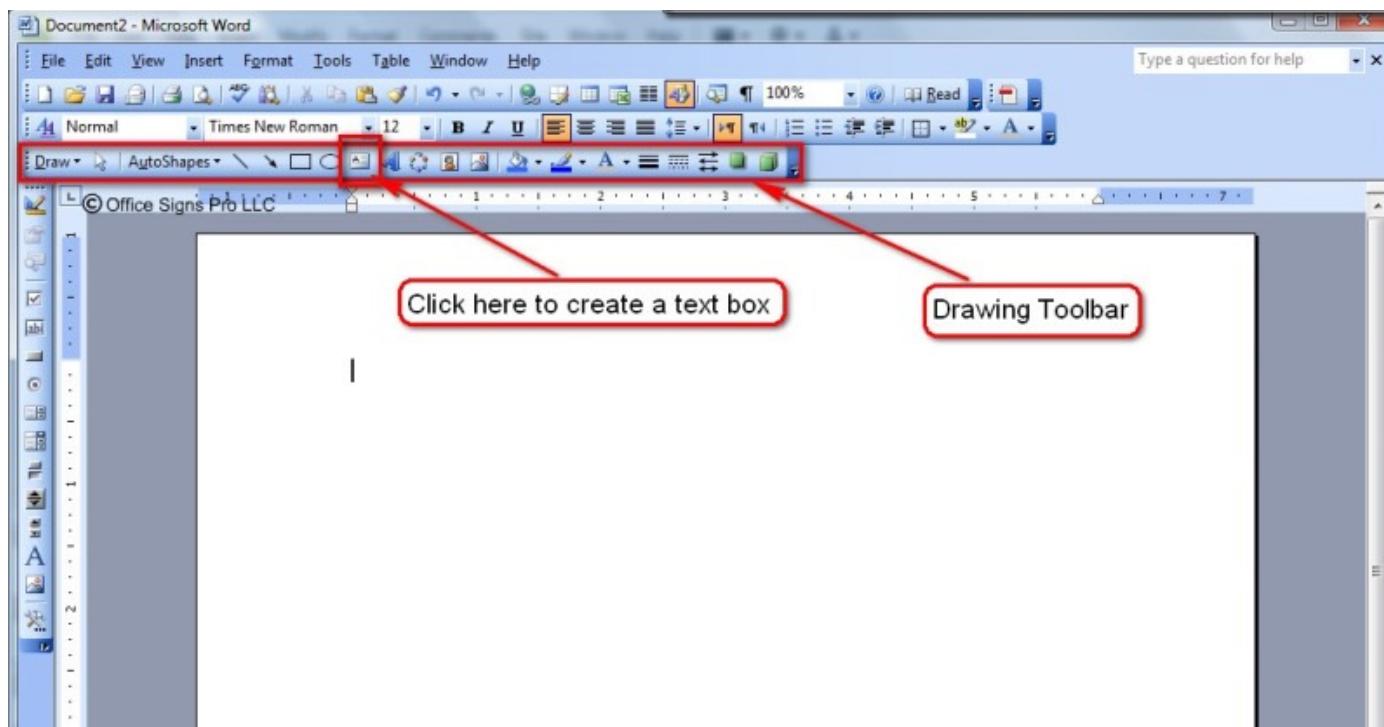
Gender :  Male  Female

.....

Sport :  Football  Tennis  Volleyball  Basketball

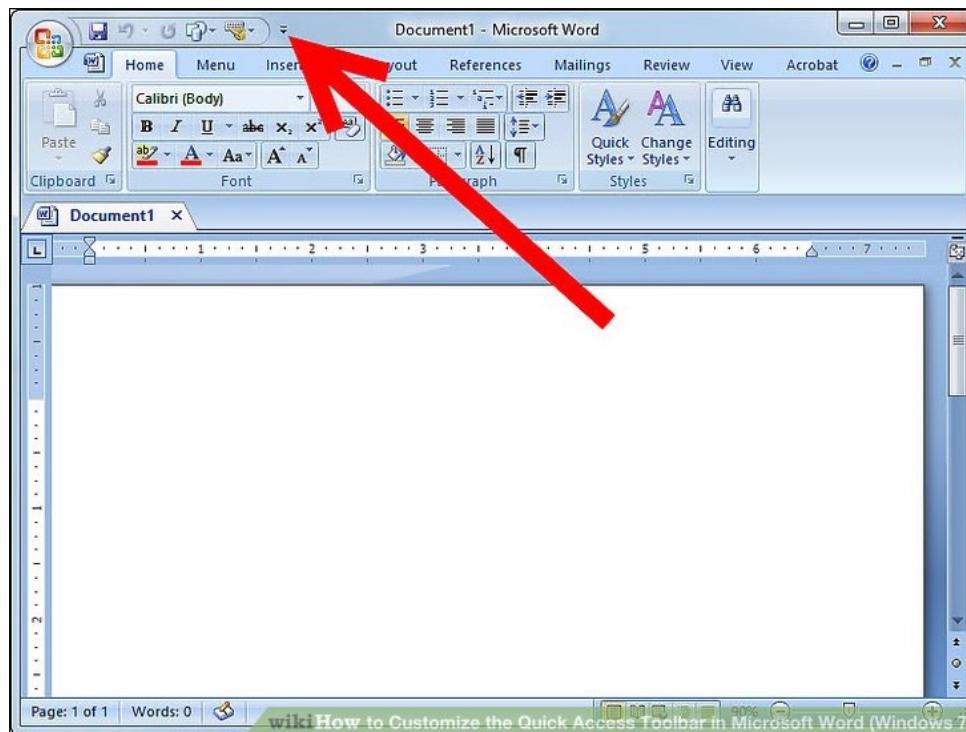
**Submit**

# Toolbars



[https://www.google.co.th/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiskMPh1pTWAhXHNI8KHQcsCaEQjRwlBw&url=http%3A%2F%2Fwww.officesignspro.com%2FWall-Frames%2FInserts%2F&psig=AFQjCNFyHo6RfgjwT\\_iL-BxrP8\\_nfzDvsA&ust=1504928786219899](https://www.google.co.th/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiskMPh1pTWAhXHNI8KHQcsCaEQjRwlBw&url=http%3A%2F%2Fwww.officesignspro.com%2FWall-Frames%2FInserts%2F&psig=AFQjCNFyHo6RfgjwT_iL-BxrP8_nfzDvsA&ust=1504928786219899)

# Toolbars

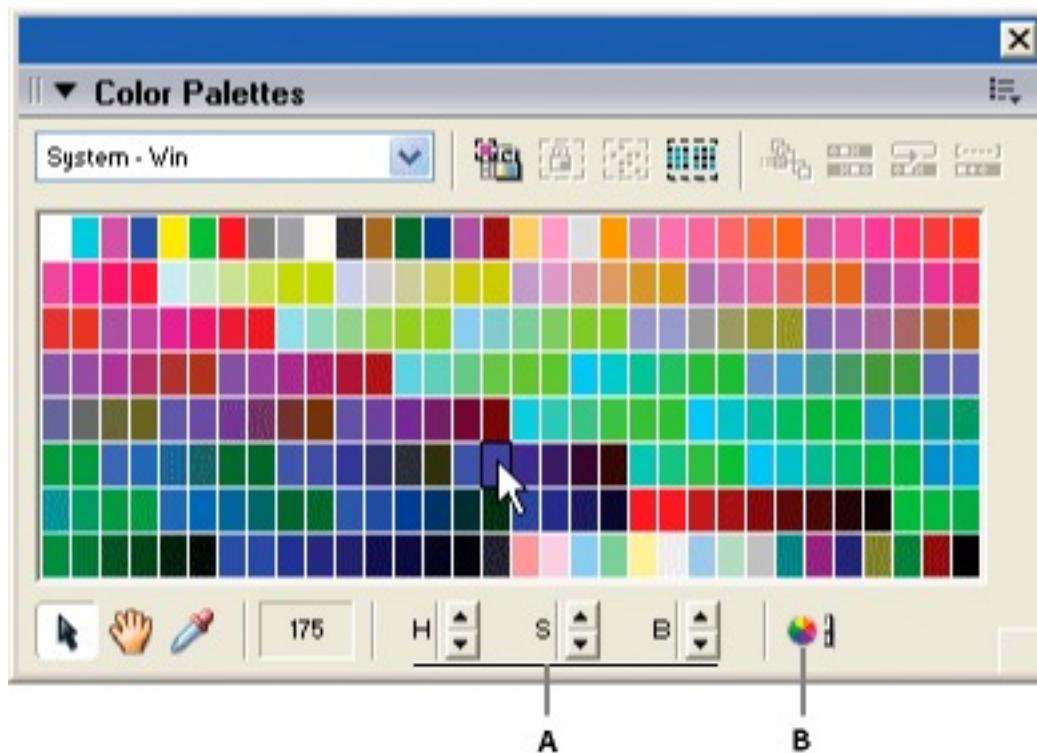


<http://pad1.whstatic.com/images/thumb/3/38/Customize-the-Quick-Access-Toolbar-in-Microsoft-Word-%28Windows-7%29-Step-1.jpg/aid3171921-v4-728px-Customize-the-Quick-Access-Toolbar-in-Microsoft-Word-%28Windows-7%29-Step-1.jpg>

# Toolbars

- **long lines of icons ...**  
... but what do they do?
- **fast access to common actions**
- **often customizable:**
  - choose *which* toolbars to see
  - choose *what* options are on it

# Palettes and tear-off menus



# Palettes and tear-off menus

- **Problem**  
menu not there when you want it
- **Solution**
  - palettes - little windows of actions
    - shown/hidden via menu option  
e.g. available shapes in drawing package
  - tear-off and pin-up menus
    - menu 'tears off' to become palette

# Dialogue boxes



<https://i-msdn.sec.s-msft.com/dynimg/IC726268.png>

# Dialogue boxes

- information windows that pop up to inform of an important event or request information.
  - e.g: when saving a file, a dialogue box is displayed to allow the user to specify the filename and location. Once the file is saved, the box disappears.



# Questions and Answers