

# The Computer & Interaction Style

## Chapter 6



# Input Devices

Keyboard,

Stylus,

Microphone ,

Mouse,

Trackball,

Touchpad,

Touch screen,

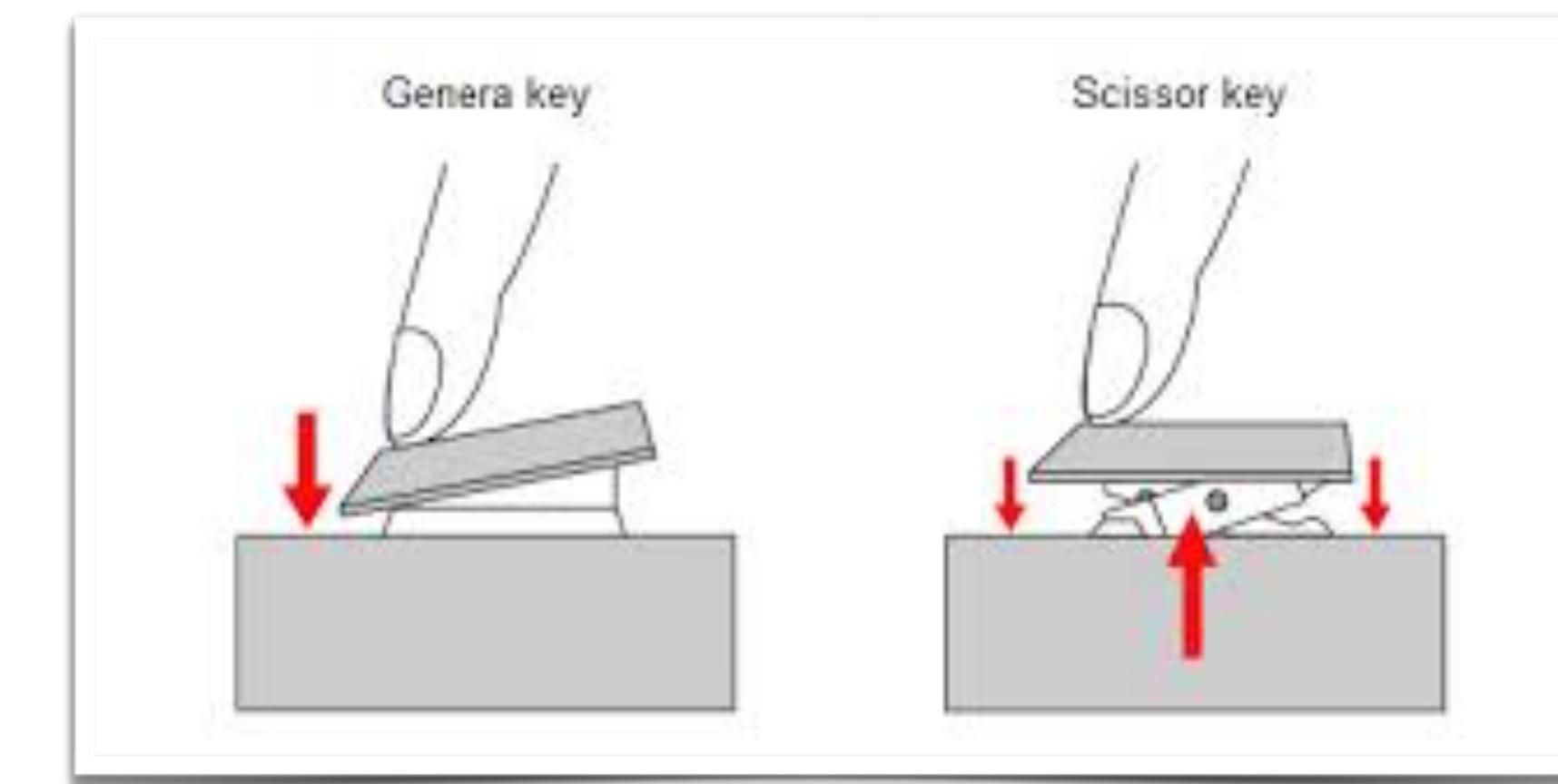
Camera,

Scanner...etc..

# Keyboard

Common input device for entering text

**QWERTY** is the standard layout (invented by Sholes, 1868)



Keypress closes connection, causing a character code to be sent

- Allow **RAPID** entry of text by experienced users
- QWERTY layout is **NOT** optimal for typing.
- Layout due to **TYPEWRITERS**
- Biased towards **LEFT HAND (L/H 57%, R/H 43%)**

## **OTHER** keyboard layouts:

- Dvorak
- Alphabetic

## DVORAK (1920s)

- Common letters under dominant fingers
- Common combinations of letters alternate between hands (e.g., ARE, WERE, GREAT)
- Biased towards right hand
  - (R/H 56%, L/H 44%)
- 10 -15% improvement in speed and reduction in fatigue.



## Alphabetic

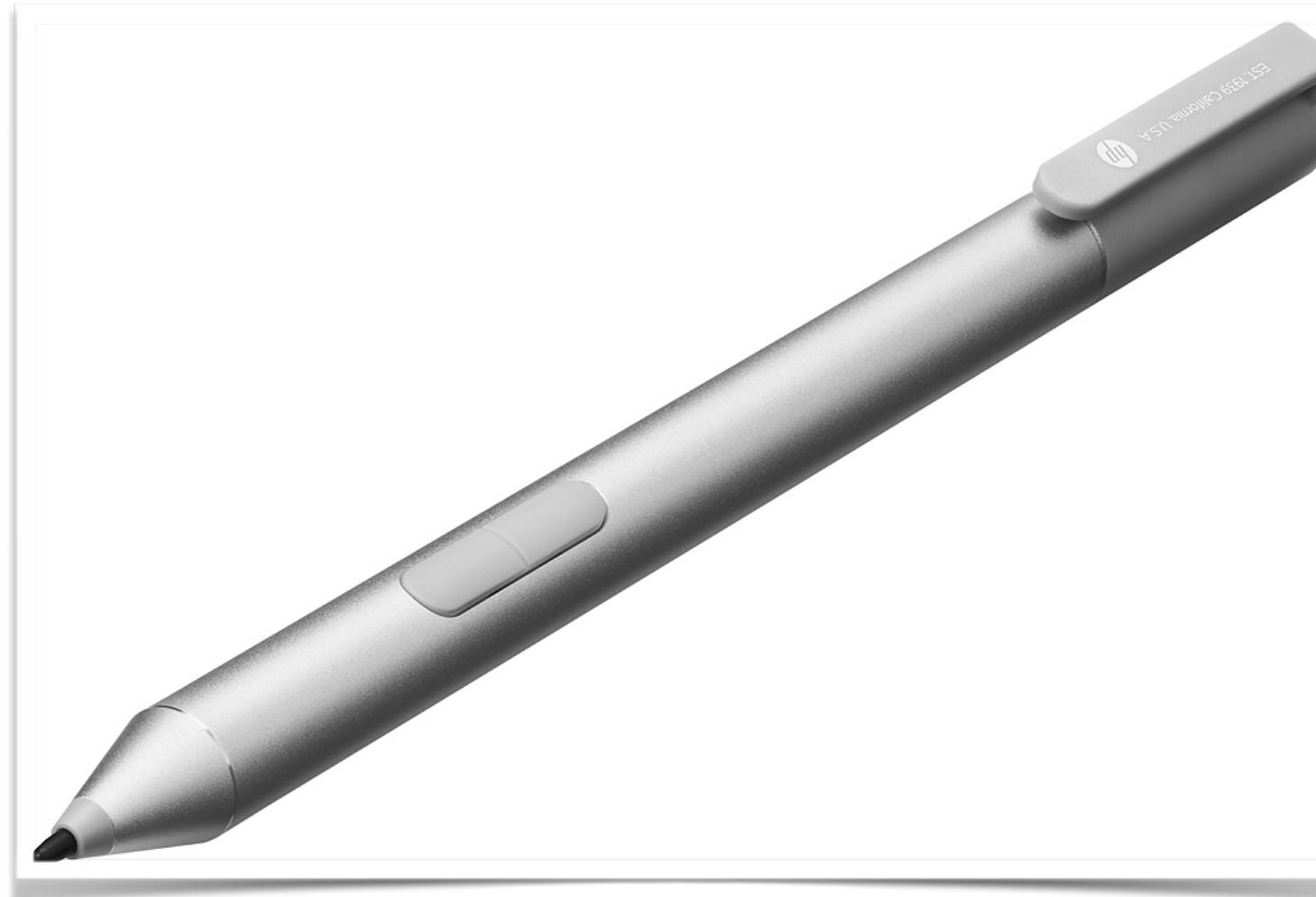
- Keys arranged in **ALPHABETIC ORDER**, A B C D E ... Z
- Not faster for trained typists.
- Not faster for **beginners** either.
- Mainly used in handheld devices



# Stylus

Input text into the computer, using a special pen

- Advantages: **No** training is needed, Compact size
- Disadvantages: Relatively **low** recognition accuracy



Russell's handwriting  
Janet's handwriting  
Gregory's handwriting  
Alan's handwriting.

# Mouse

A very common handheld **POINTING DEVICE** (Mechanical, optical, laser & wireless.)

Advantages:

- Allow diagonal & continuous movement
- **Easy** to use

Disadvantage:

- Require that the **hand** be removed from the keyboard

## The first mouse



## The foot mouse



# Trackball

## Advantages:

- Allow diagonal & continuous movement
- Comparing with mouse, **less** physical space is required

## Disadvantage:

- Require that the **hand** be removed from keyboard



# Touchscreen

Detect the presence of finger on the screen

Advantages:

- **Direct** (vs. select an item on screen with a mouse), Fast, Good for **menu** selection

Disadvantages:

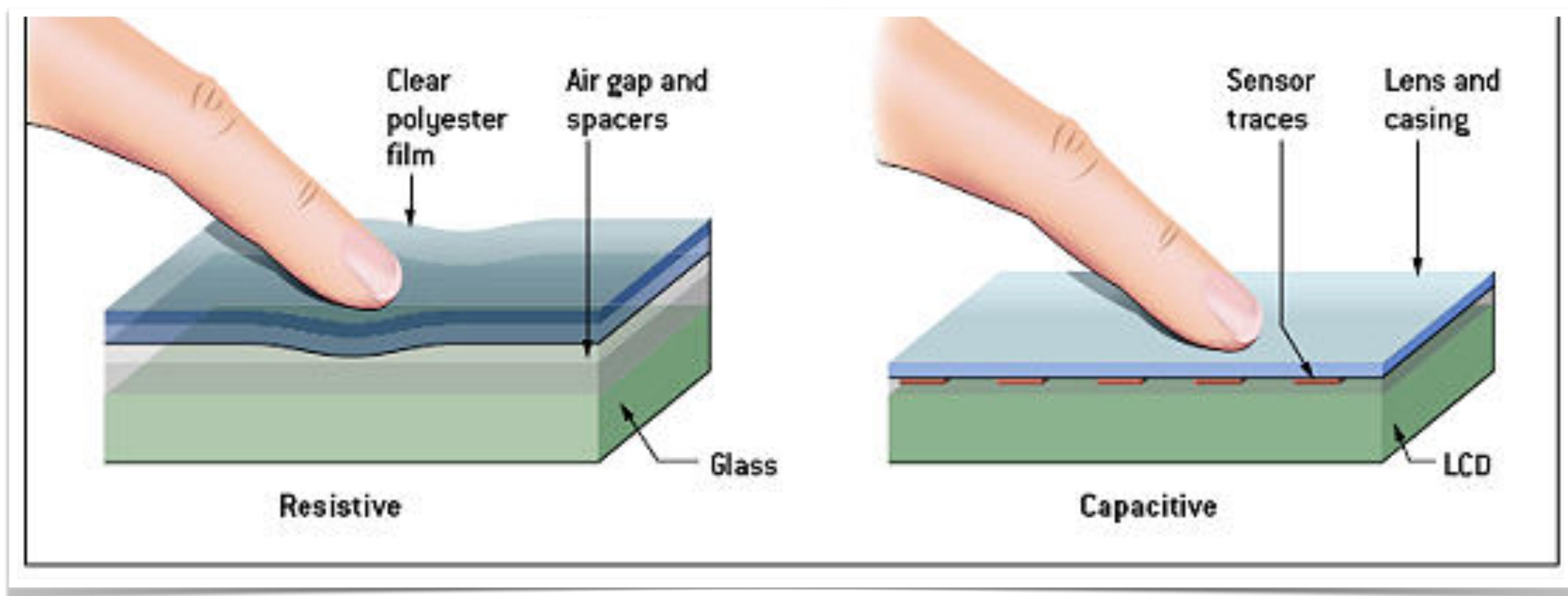
- **Finger print** can mark on the screen, Hand obscures screen, **Tiring** on the arm

Use touchscreen when:

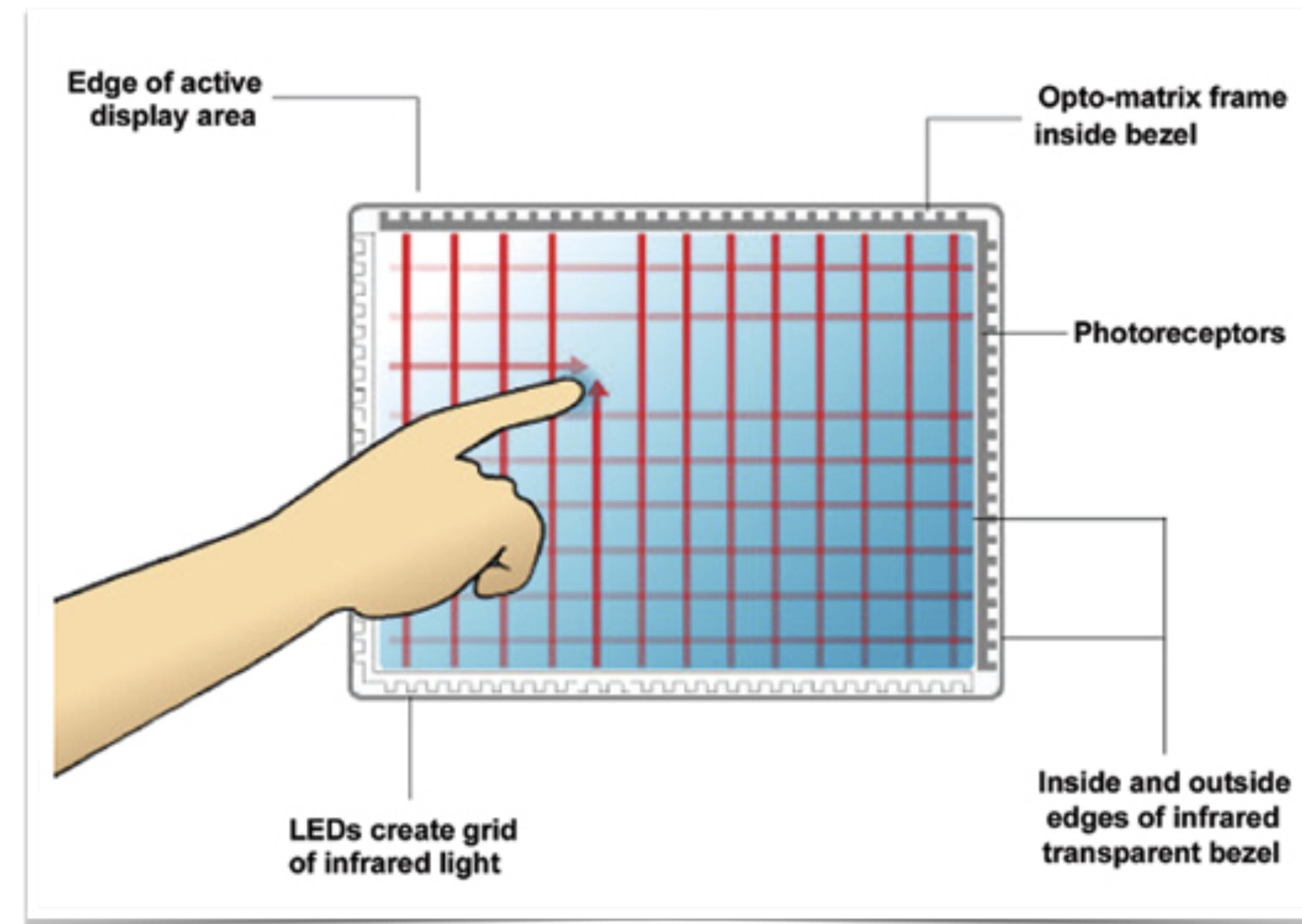
- opportunity for **training** is low
- desk space is **small** & the task requires little or no text input,e.g., tourist info kiosks, cashier system in shops,

## Types of touchscreens:

- Capacitive touch – More responsive.
- Resistive touch – Less sensitive



- Perimeter based – Emit light or soundwaves with a sensor to detect movement. Convert existing display to touch.



# Output Devices

Computer Screens (CRT, Plasma, LCD, Touch Screen (TS), OLED)

Speakers (Speech output, Audio)

Braille Display

Printers....etc...

# Cathode Ray Tube (CRT)

## Advantages

- High resolution
- More accurate colour balance
- Fast response time
- Better viewing angle

## Disadvantages

- Bulky and heavy
- Radiation emission
- Impractical to produce larger screen > 40 inches.



# Liquid Crystal Display (LCD)

## Advantages

- Smaller and lighter
- No radiation emission
- Lower power consumption
- Flicker free

## Disadvantages

- Less accurate colour reproduction
- Lower response time

# Speech Output

- **Digitized speech** - recorded human speech directly in digital format (e.g. the number you dial cannot be reached, ... after the beep)
- **Synthesized speech** - generated using computers via speech processing techniques



- Advantages:
  - Useful when user's EYES ARE BUSY or user cannot access the screen (e.g. next station Bangsar)
  - Also useful when users have VISUAL IMPAIRMENTS (e.g. doors are closing, ten floor, 12 floor, etc)
- Disadvantages:
  - SLOW pace compared to visual output Use it WHEN:

**AVOID** using it in the open environment. Can be problematic in a very **NOISY** environment.

# Audio (sound)

Used as FEEDBACK and ENTERTAINMENT

Examples:

- Confirm **actions**
- Offer **warning**
- Provide **mood** context in games

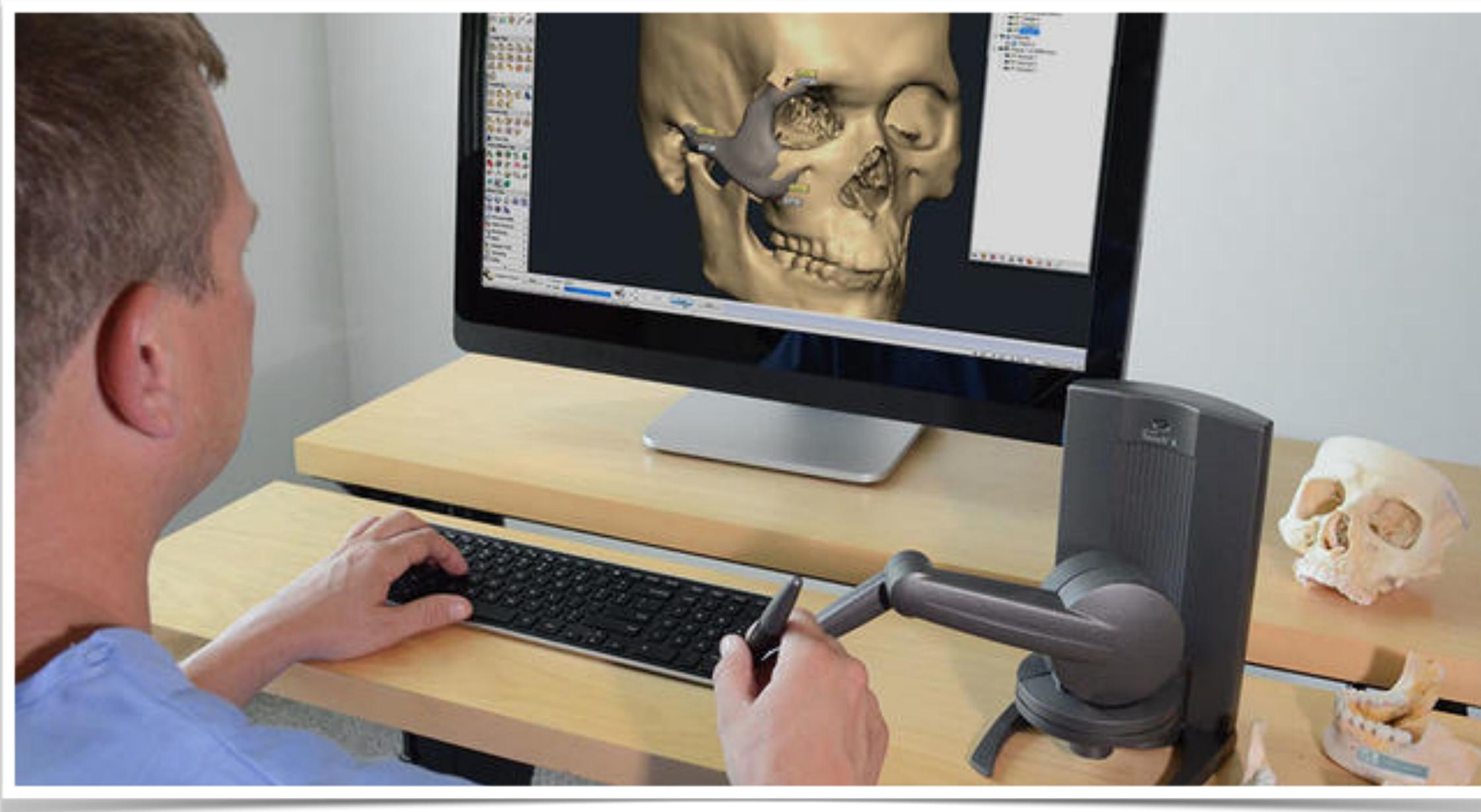


# Braille Display

Pins provide output for the blind



# Haptic Feedback



Geomagic Touch X Haptic device

# Interaction Types

There are four types of interactions (Rogers, Y., Sharp, H. & Preece, J):

**Instructing**- Issuing commands and selecting options.

**Conversing** - Interacting with a system like having a conversation.

**Manipulating** - Interacting with objects in a virtual or physical space.

**Exploring** - Moving through a virtual environment.

\*Rogers, Y., Sharp, H. & Preece, J. 2011. Interaction Design: Beyond Human-Computer Interaction. Third Edition. Chichester:John Wiley & Sons.

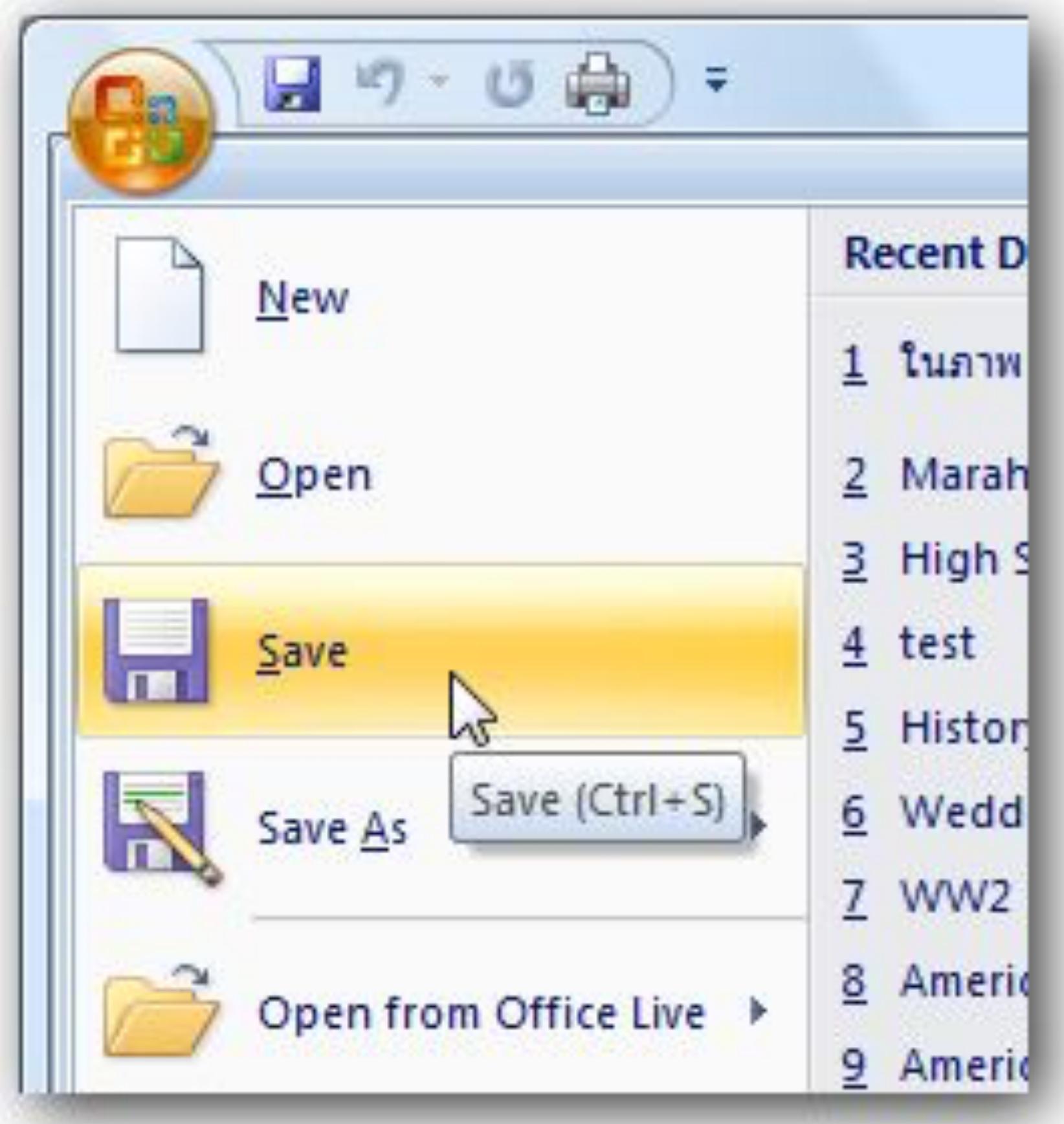
# Interaction Types

## Instructing

Where users instruct a system and tell it what to do, e.g. tell the time, print a file, save a file

Benefits:

- supports quick and efficient interaction
- good for repetitive kinds of actions performed on multiple objects



```
himanshu@mylinuxbook-Inspiron-1545:~$ cd /home/
himanshu:home$
```

# Interaction Types

## Conversing

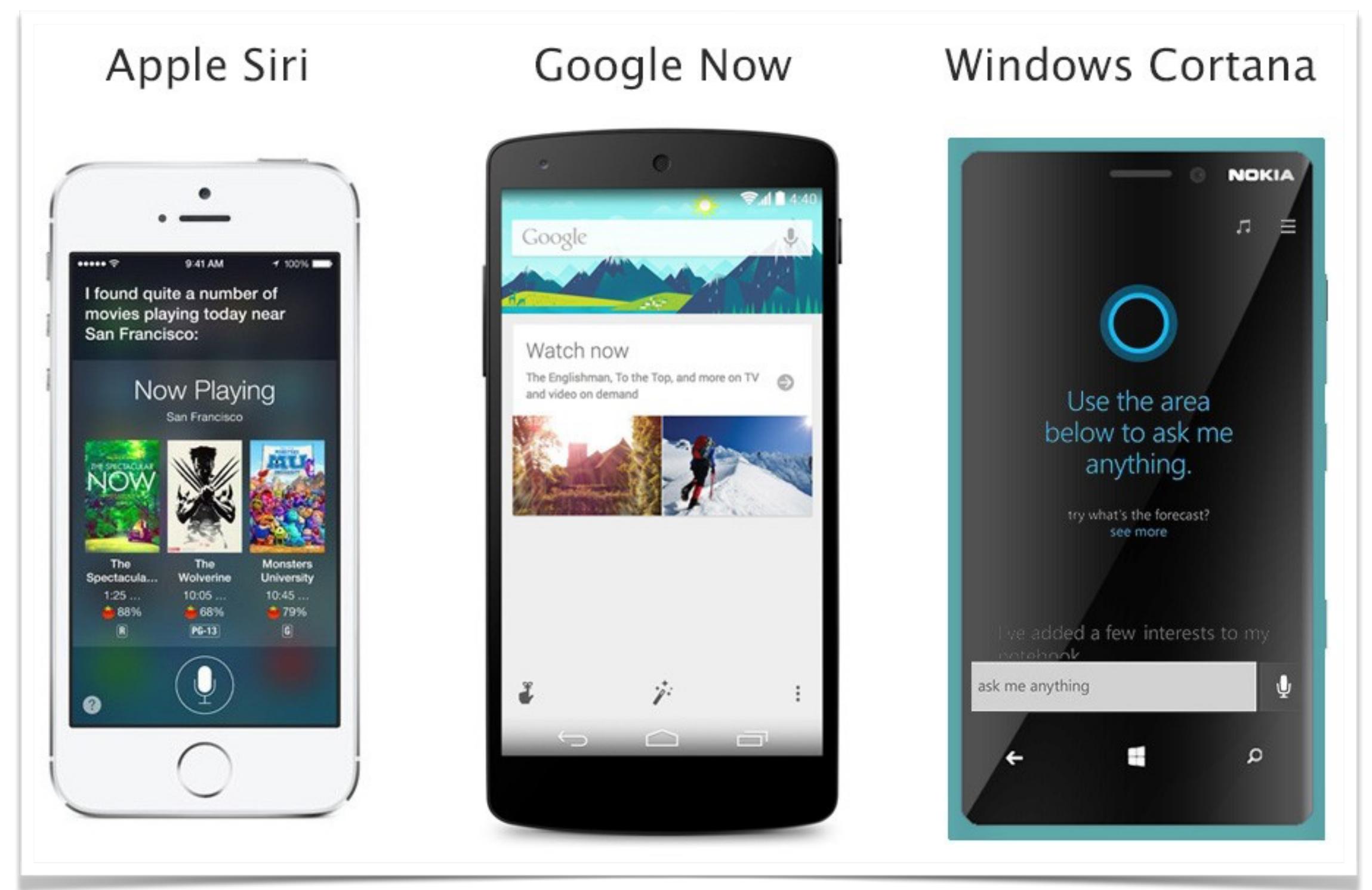
Underlying model of having a conversation with another human i.e. voice recognition system or natural language dialogues, e.g. virtual agents, chatbots

### Benefits

- allows users, especially novices and technophobes, to interact with the system in a way that is familiar
- makes them feel comfortable, at ease and less scared

### Problems

- Misunderstandings can arise when the system does not know how to parse what the user says



# Interaction Types

## Manipulating

Involves dragging, selecting, opening, closing and zooming actions on virtual objects

### Direct Manipulation (DM)

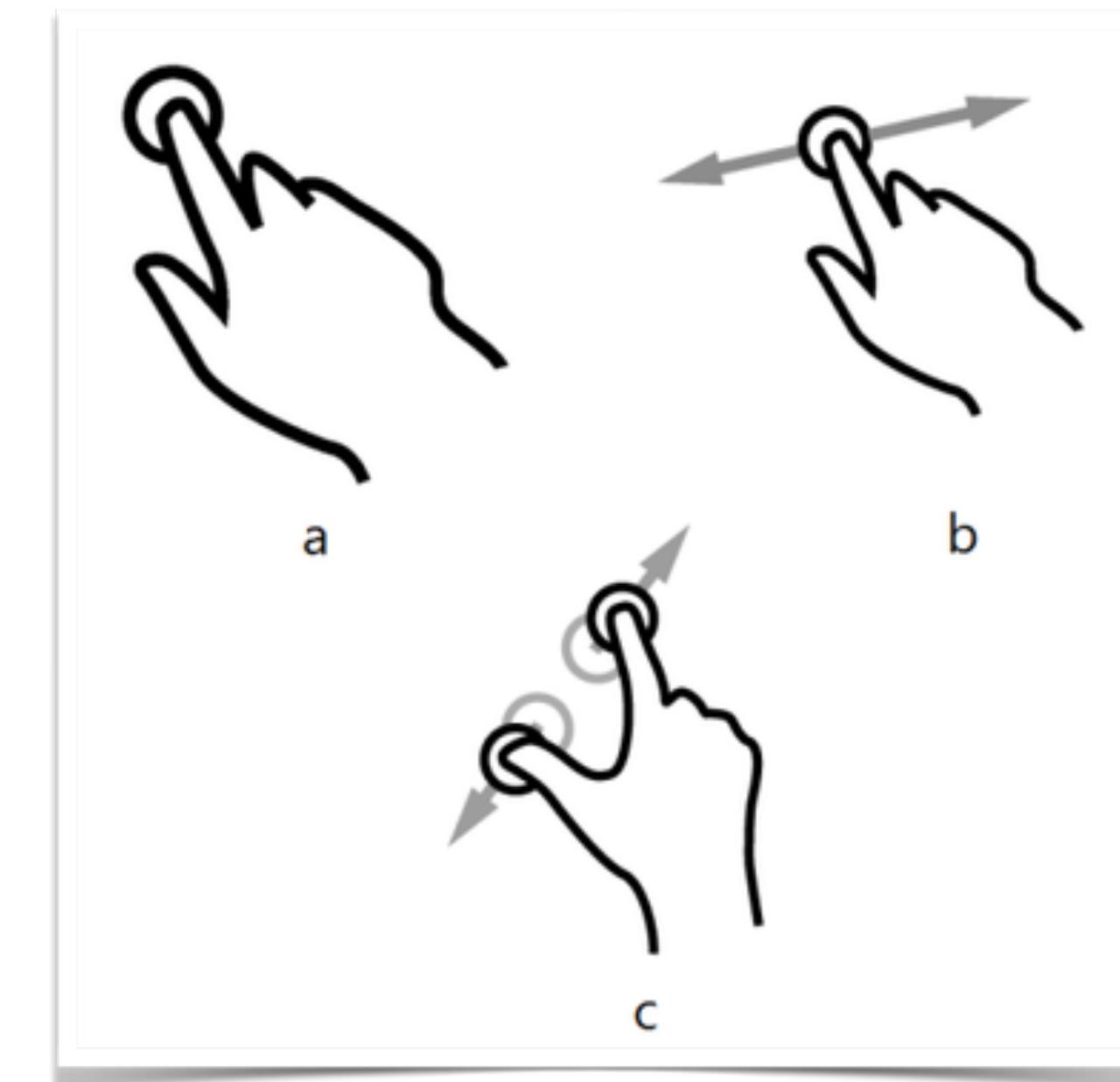
- Shneiderman (1983) coined the term DM, came from his fascination with computer games at the time, e.g. pressing buttons instead using text commands

Why are DM interfaces so enjoyable?

- Users experience less anxiety
- Users gain confidence and mastery and feel in control

Disadvantages of DM interfaces

- Not all actions can be done directly e.g. spell checking



# Interaction Types

## Exploring

- Involves users moving through virtual or physical environments
- Similar to how people browse information with existing media e.g. multimedia, web





- Which is the best interaction type?
  - Direct manipulation is good for ‘doing’ types of tasks, e.g. designing, drawing, flying, driving, sizing windows
  - Issuing instructions is good for repetitive tasks, e.g. spell-checking, file management
  - Having a conversation is good for children, computer-phobic, disabled users and specialised applications (e.g. phone services)
  - Hybrid conceptual models are often employed, where different ways of carrying out the same actions is supported at the interface - but can take longer to learn

# Interface Types

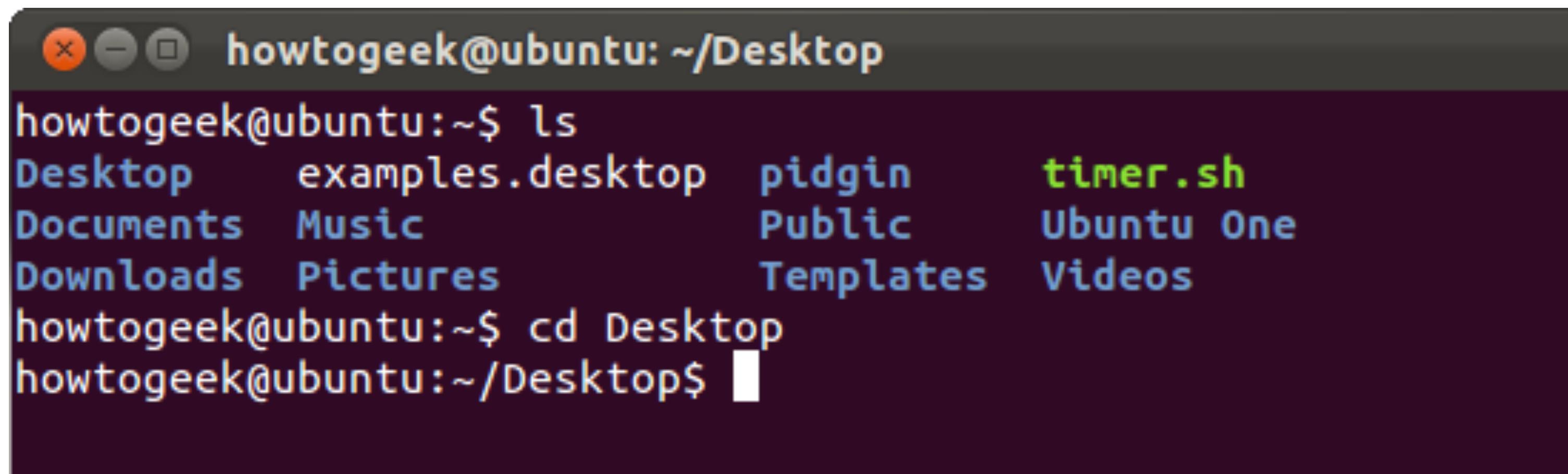
- Command Line Interface
- Direct Manipulation
- Menu
- Fill-in Form

# Interface Types

## Command Line Interface

Original, traditional style human-computer interface

User types in command by using **artificial language** with its own semantics, vocabulary & syntax, e.g: “cd” “mkdir” “cp”



A screenshot of a terminal window titled "howtogeek@ubuntu: ~/Desktop". The window shows a command-line session where the user runs the "ls" command to list files in the current directory, which includes "Desktop", "Documents", "Downloads", "examples.desktop", "Music", "Pictures", "pidgin", "Public", "Templates", "timer.sh", "Ubuntu One", and "Videos". The user then runs the "cd Desktop" command to change the working directory to "Desktop". The terminal has a dark background with light-colored text and standard window controls at the top.

```
howtogeek@ubuntu:~/Desktop
howtogeek@ubuntu:~$ ls
Desktop      examples.desktop    pidgin        timer.sh
Documents    Music              Public        Ubuntu One
Downloads   Pictures           Templates     Videos
howtogeek@ubuntu:~$ cd Desktop
howtogeek@ubuntu:~/Desktop$ █
```

## Advantages:

- **Powerful, fast & efficient:** a few keystrokes can express complex command
- Flexible & user controlled
- Fast for experts

## Disadvantages:

- **Difficult** to learn & remember
- Enhancement are invisible
- Assume typing skill
- **Hardest** for the novice users.

```
$ (ps -au | sort > ps.txt; echo done) &
```

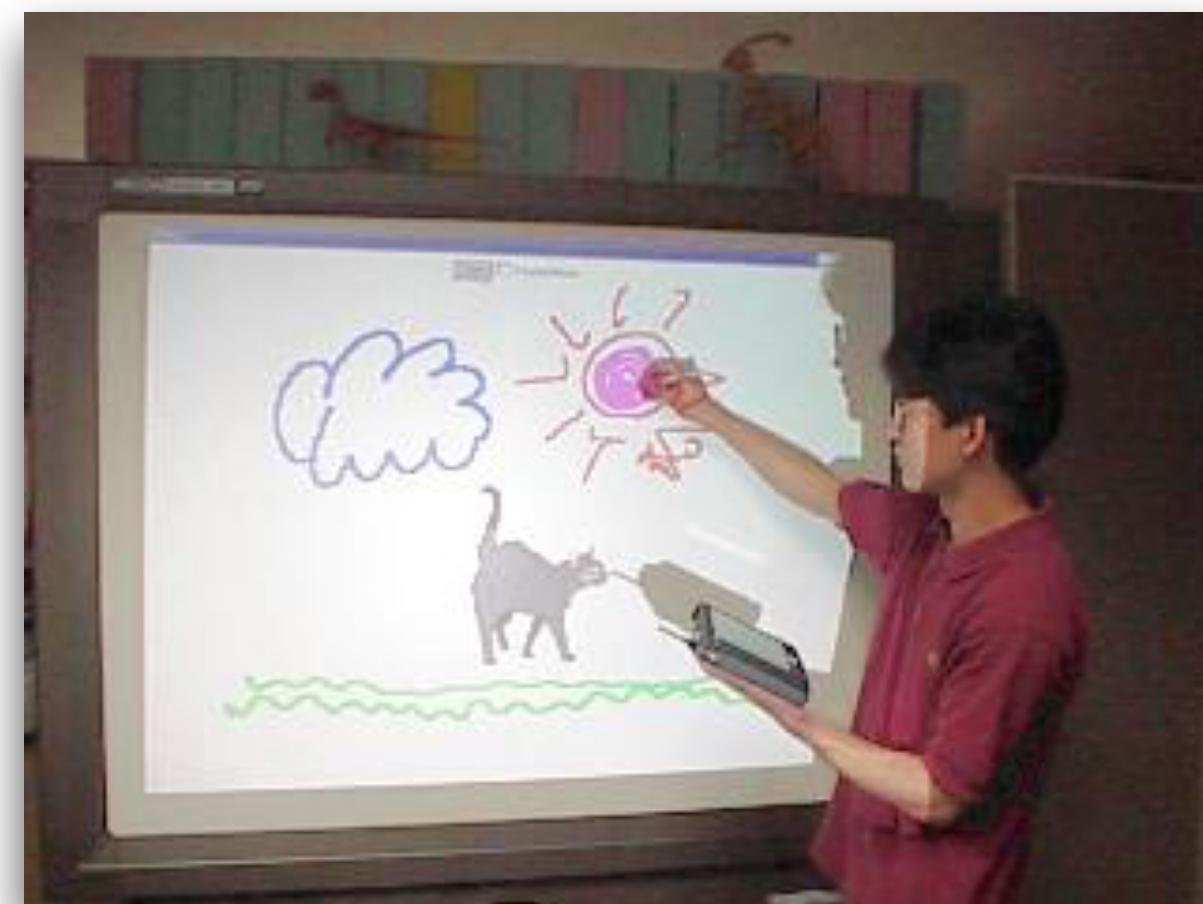
- Print the **status** of all **processes** of all **users** currently running on the sys
- pipe the **output** to a **sort** program
- re-direct the sorted list from the screen to a **file** (ps.txt).
- do all this in the **background**
- **alert** the user when the task has finished

# Interface Types

## Direct Manipulation

Users can directly manipulate objects at the interface using a pointing device such as a mouse, stylus or fingers.

Design to replace the need to enter command via keyboard

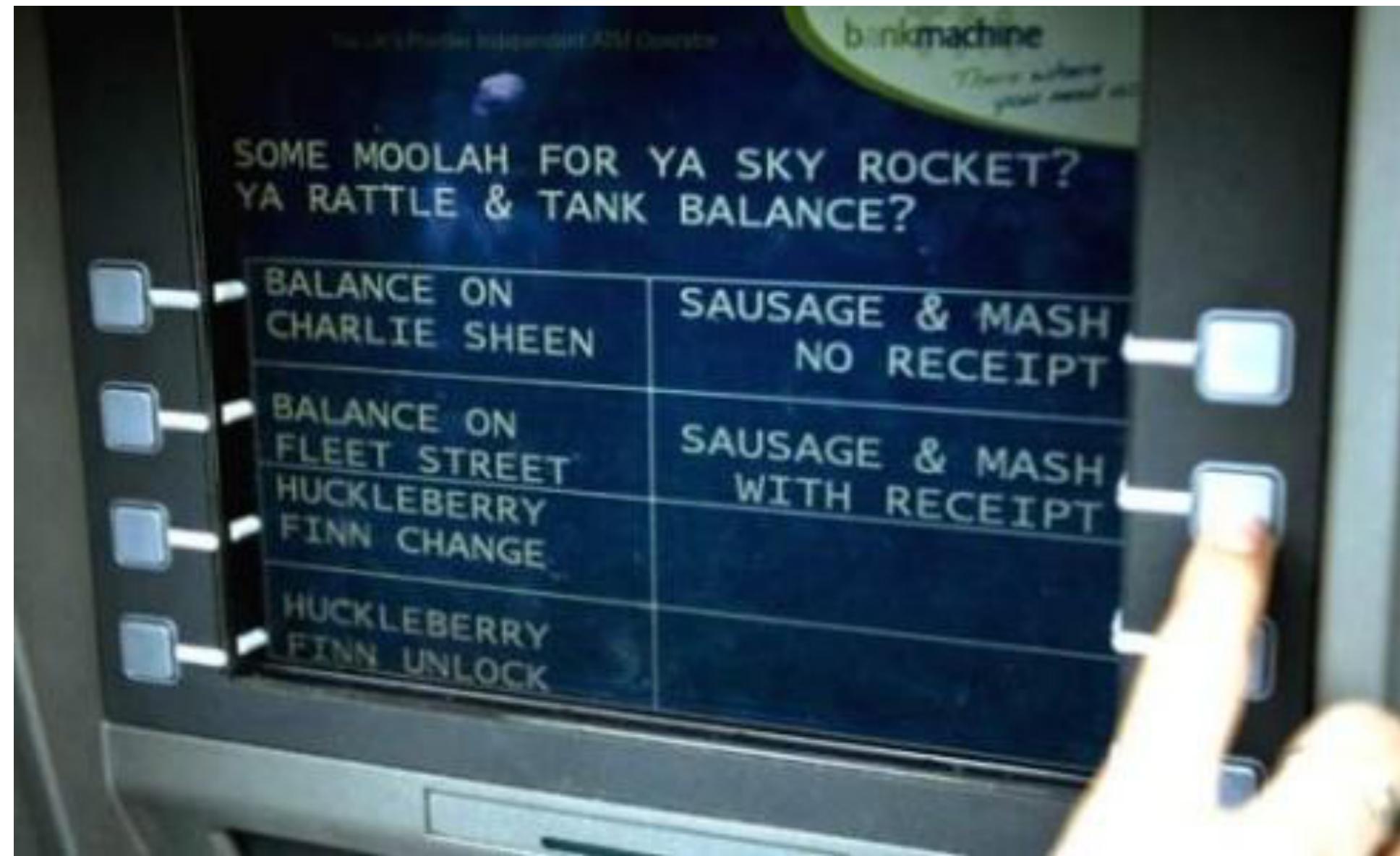


- Advantages
  - Users can immediately see if their action is furthering their goal, if they are not, can simply change the direction of their activity
  - Visibility of the system state, actions are easily reversible (so, less anxiety)
- Disadvantages
  - Not all actions can be done directly e.g. spell checking
  - May require graphics display and pointing devices (mouse, stylus, data glove) ( how about visual impaired user?)
  - Slow in handling repetitive tasks compare to CLI.

# Interface Types

## Menu

- List of **OPTIONS** from which user selects the desired choice
- Advantages:
  - Options visible
    - less recall - easier to use
    - rely on recognition so names should be meaningful.
  - ENHANCEMENTS ARE VISIBLE:
    - If we **add new functions** into the system, they will **appear** on the screen



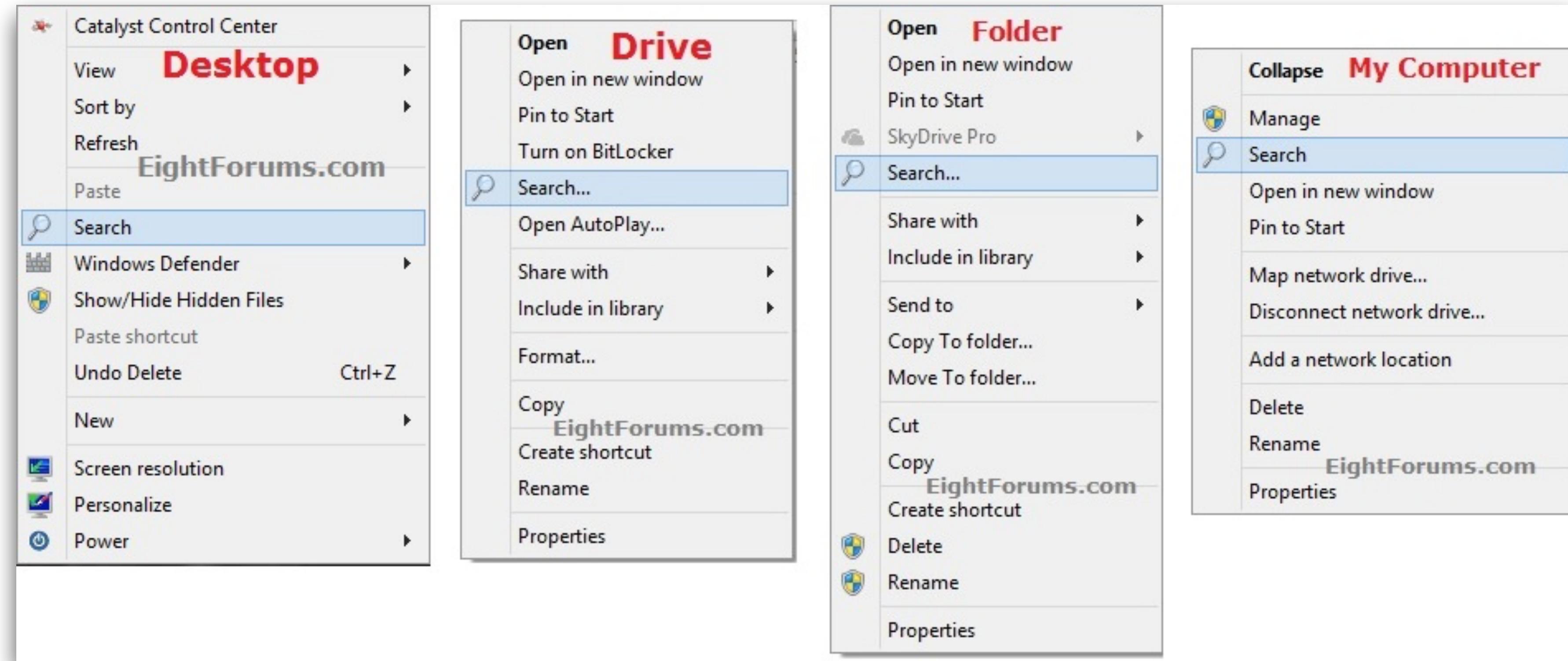
CSS+ Menu	Swimbi	Lightweight	Cross platform	SEO friendly
	No plugins required			
	Friendly GUI		Ready-to-use styles	
	Fully customizable		No programming skills required	
	Patters, effects		Keep your own configs	
	And more...		Meet all your needs	

Disadvantage:

Inflexible: Menu **force** a user through set sequences of steps



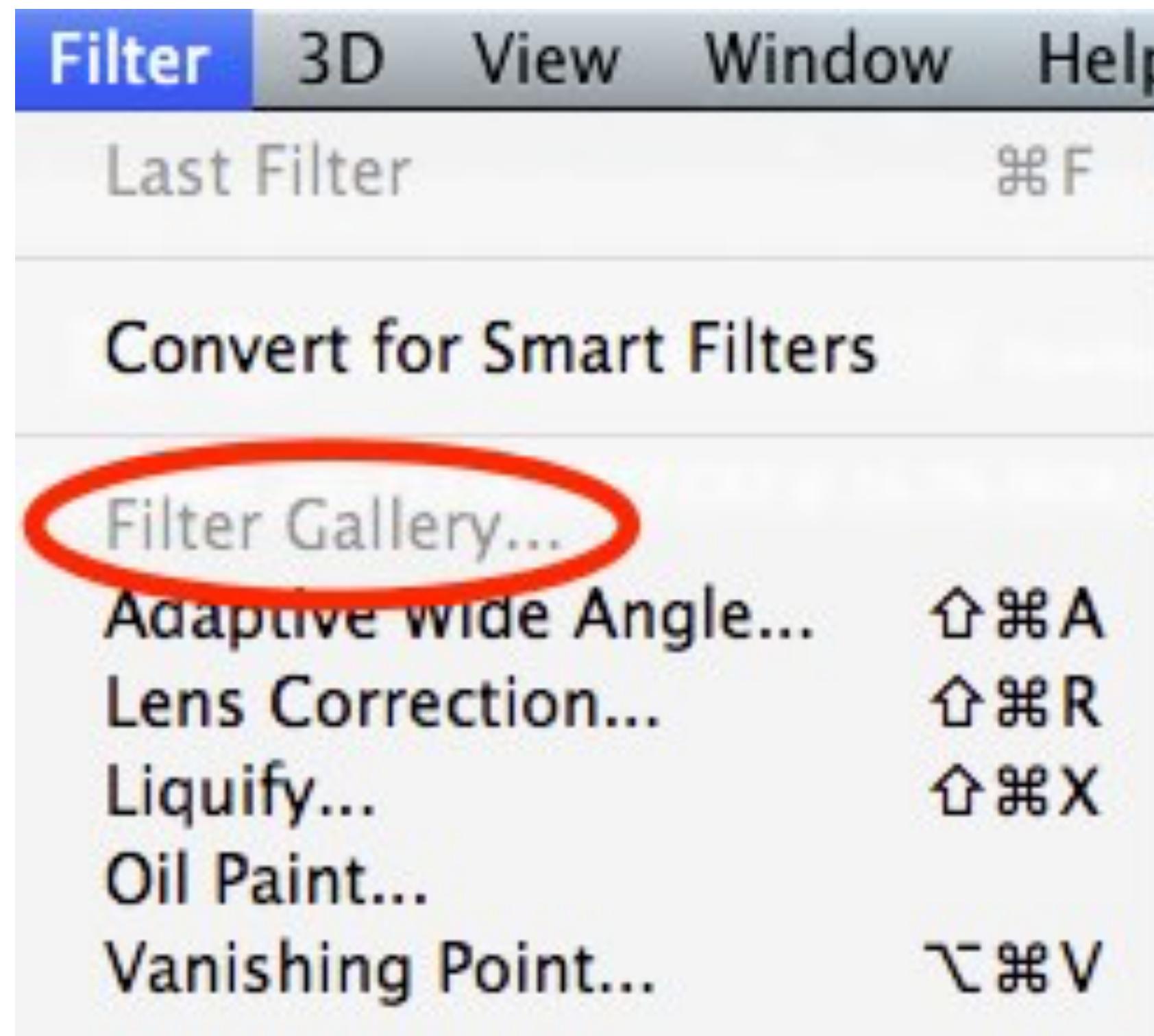
- Types of menus
- Menu Bar at top of screen (normally), menu drop down
  - mouse click
  - mouse over
- Contextual menu appears where you are
  - pop-up menus - shows available actions for selected object
  - pie menus - arranged in a circle
    - easier to select item (larger target area)
    - quicker (same distance to any option)
      - ... but not widely used!



## Contextual menus

# Menu Design Guidelines

- Consider **GRAYING OUT** of inactive menu items



- Use familiar terminology, but ensure that **items are DISTINCT** from one another.
- Choice of ordering menu items
  - Alphabetical: choices are simply listed in alphabetic order
  - Categorical: choices are grouped according to semantic property
  - Conventional: choices are neither in alphabetical order nor categorical order but can have a temporal order – such as months of the year, days of the week, numbers, sizes
  - Frequency of use: choices are listed in order of expected frequency of use

# Accot-Zhai Steering Law

An extension to Fitts's Law. Models the movement time of a pointer through a 2D tunnel.

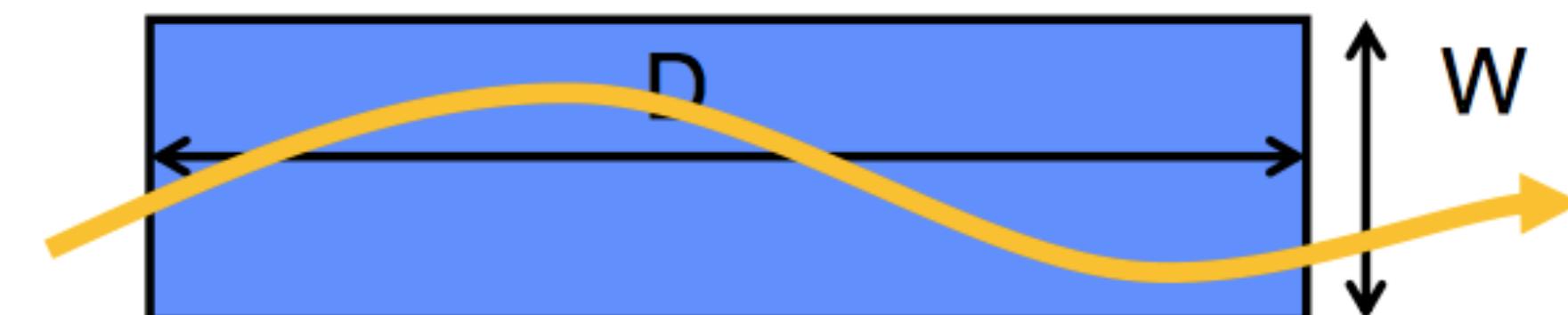
$$T = a + b \int_C \frac{ds}{W(s)}$$

T - average time to navigate through path.

a, b – constants depending on context

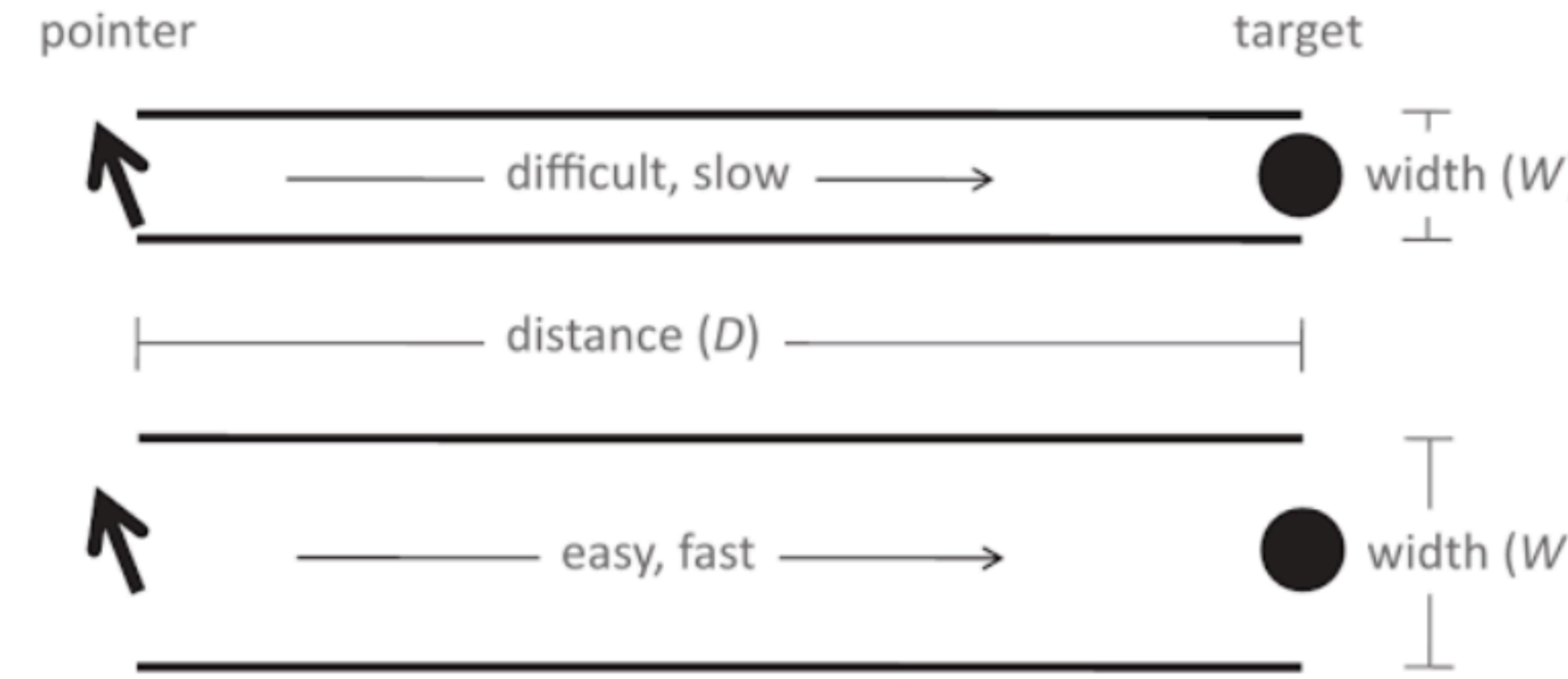
C – path parameterized by s

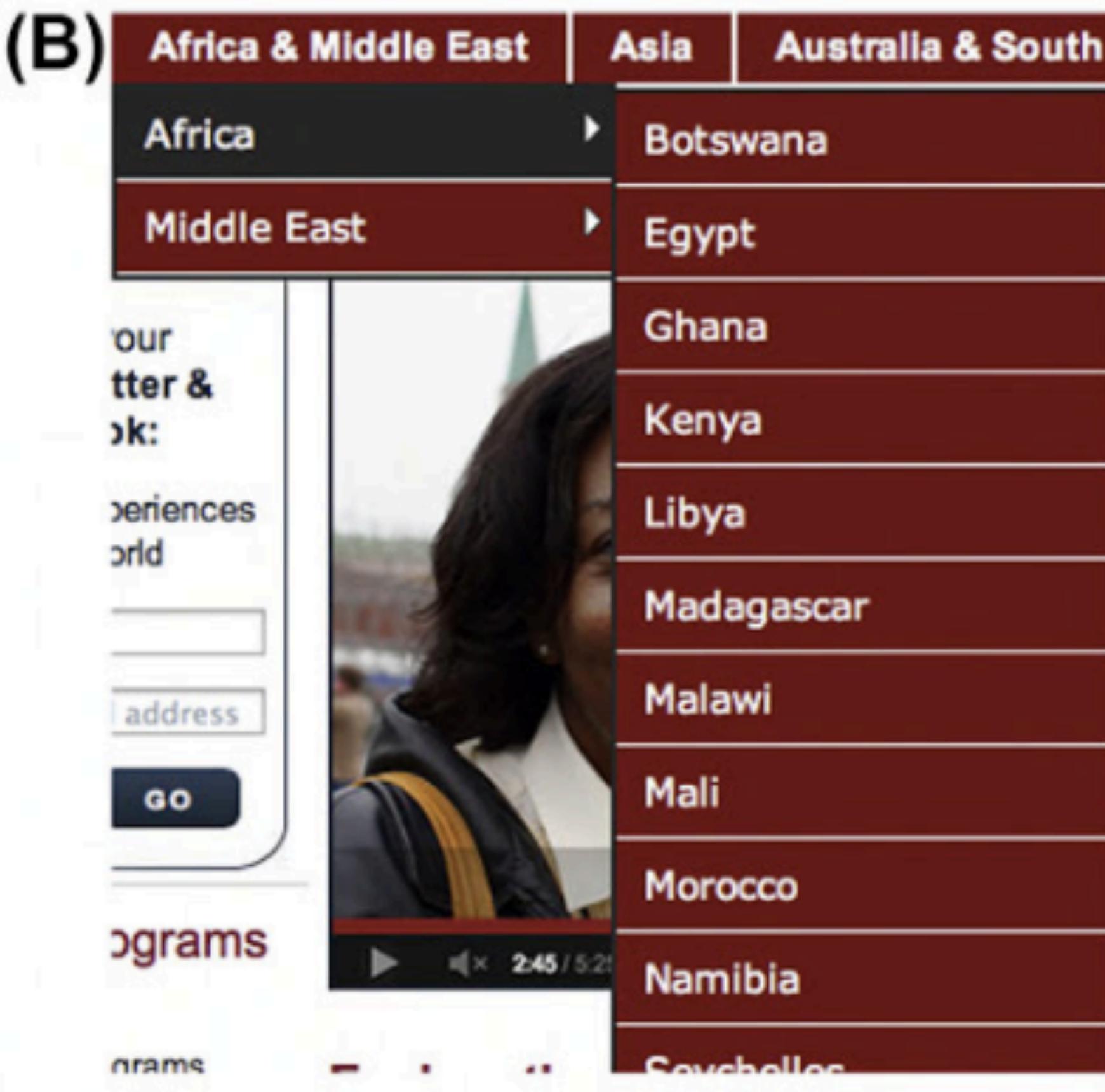
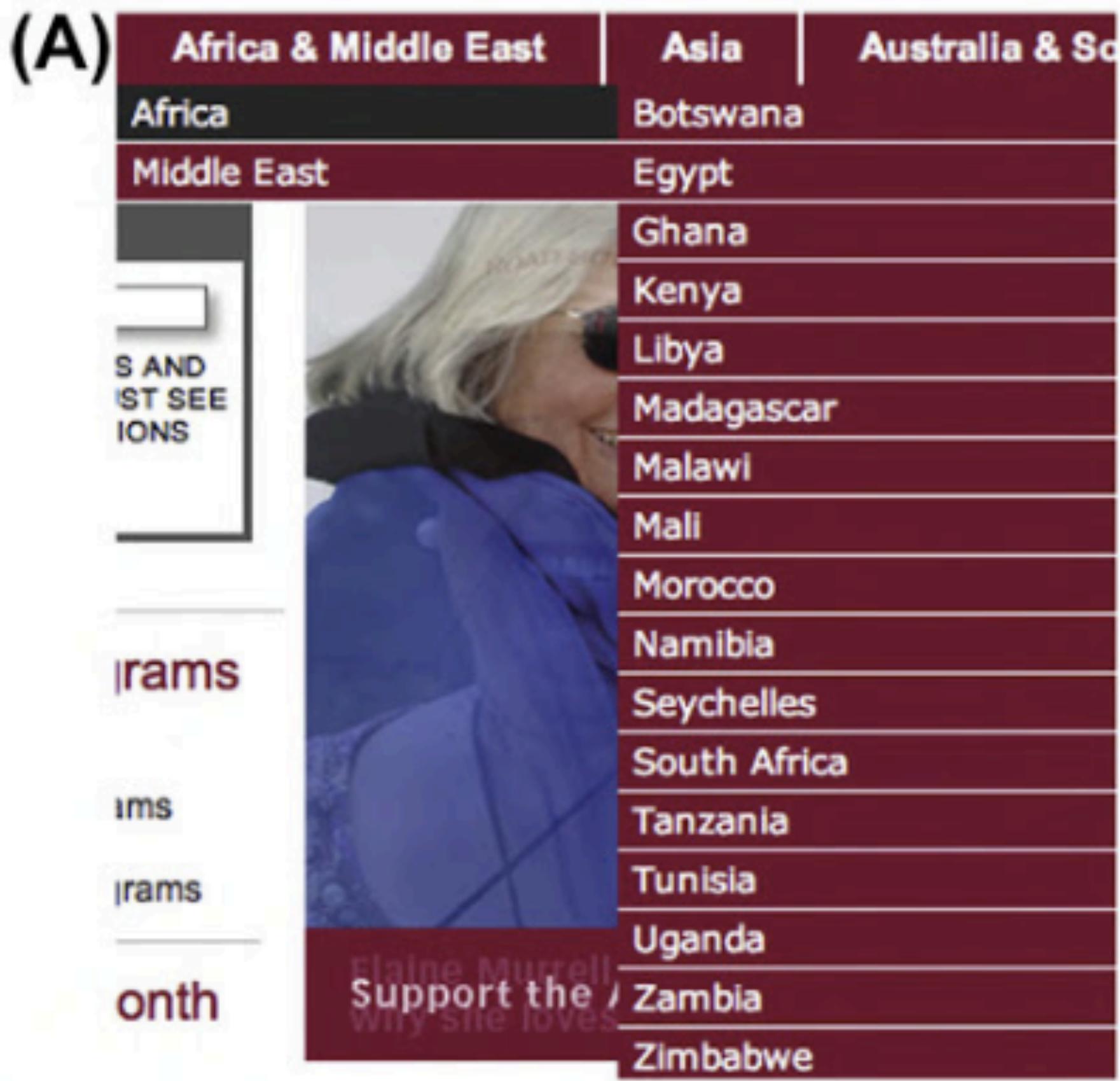
W(s) – width of the path at s



## Conclusions:

- A narrow and long path increases selection time.
- Conversely, a wider and short path reduces selection time.





A) Narrow menu items B) wider menus items

# Interface Types

## Fill-in Form

- **Screen** like paper form
- Contain a number of **FIELDS** in which user is expected to type in data
- Each field has a **LABEL** (aka **caption**)
- Fill-in form is useful for **data entry application**

First Name:	Terry
Last Name:	Lin
Your Email:	www.podiy.com@gmail.com
Re-enter Email:	www.podiy.com@gmail.com
New Password:	*****
I am:	Male
Birthday:	Mar 27 1980
Why do I need to provide this?	
<b>Sign Up</b>	

## Advantages:

- Efficient use of screen real estate – i.e. can ask many questions on one screen
- Provide context: because there are many fields on a single screen
- Enhancements are visible

## Disadvantages:

- Assume typing skill
- More user errors (How to improve?)
- Assume knowledge of special keys: e.g. “Tab”, “Cursor key”, “Enter”, “Backspace”

# Fill-in Form Design Guidelines

Some guidelines in designing Fill-in Form:

- Organisation & layout
- Caption & field design
- Input formats
- Error handling
- Completion signal to support user control

- Organisation & layout

- Organize the form to **support task** : If the fill-in form is an online version of the paper form **both layouts should be similar**, such as credit card application form .
- Utilise spaces to create **symmetry and balance.**

**COURSE OFFERINGS**

QUARTER COLLEGE  
SPRING 86 ALL

SEQUENCE 02	PROFESSOR ALL		
COURSE NUMBER	COURSE NAME	NUMBER CREDITS	PROFESSOR
COM1200	DATASTRUCT	04	SMITH
PSY0001	INTRODUCT	04	JONES
BIO0032	GENETICS	04	RUBIN
COM0987	FORTRANLA	01	MICHEALS

**COURSE OFFERINGS**

QUARTER: Spring COLLEGE: All  
SEQUENCE: 2 PROFESSOR: All

NUMBER	NAME	CREDITS	PROFESSOR
COM 987	Fortranla	1	Michaels
COM 1200	Datastruc	4	Smith
BIO 32	Genetics	4	Rubin
PSY 1	Introduct	1	Jones

Press ARROW KEYS to scroll      Press < RETURN > to go back

- Separate logical groups by spaces, lines, color or other visual cues
- Reduce the gap between label and the field

The image displays two side-by-side screenshots of user interface forms, each featuring a red dashed line to highlight specific design elements.

**Left Screenshot (Profile Name Form):**

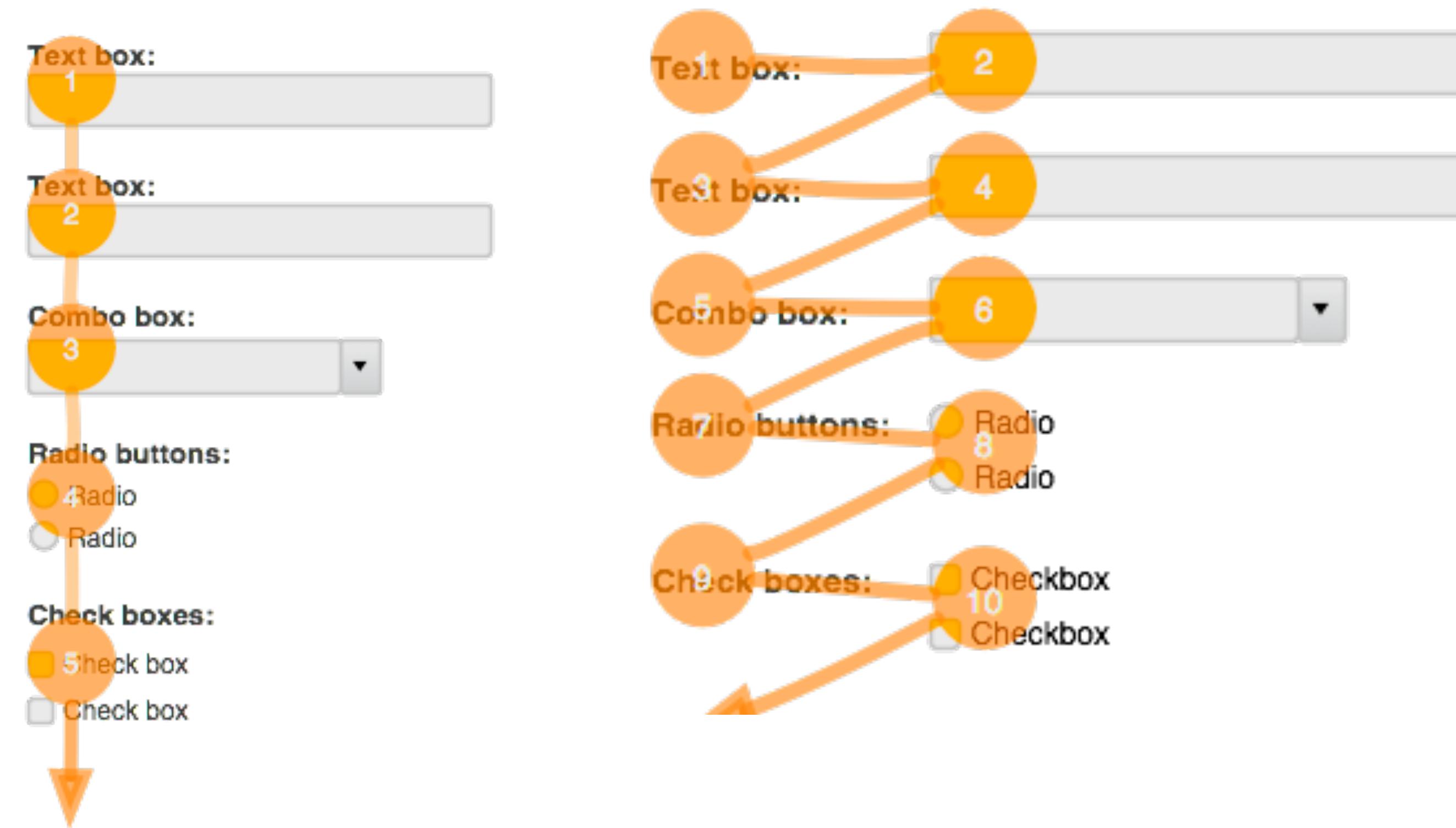
- Header:** Profile Name (with a red dashed line connecting it to the input field), Personal Information (selected tab), Contact Information, Credit Card Info.
- Fields:** Title (Mr.), First Name (Test), Middle Name, Last Name (User), Username (puser), Gender (Male), Birthday (1/1/1970), Social Security Number (123456789).
- Buttons:** Edit Form, Delete, Require Password Reprompt (checkbox).

**Right Screenshot (Sign Up Form):**

- Fields:** First Name (Terry), Last Name (Lin), Your Email (www.podiy.com@gmail.com), Re-enter Email (www.podiy.com@gmail.com), New Password (\*\*\*\*\*), I am (Male), Birthday (Mar 27 1980).
- Text:** Why do I need to provide this?
- Buttons:** Sign Up.

- Caption & field design

- Label position—Placing a label above an input field works better in most cases, because users aren't forced to look separately at the label and the input field.



- Provide distinctive section headings in complex form

Name:	<input type="text"/>	Major:	<input type="text"/>	Year:	<input type="text"/>	Status:	<input type="text"/>
ID:	<input type="text"/>	Co-op Track:	<input type="text"/>		<input type="text"/>		<input type="text"/>
Number	Title	Section	Sequence				
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							

Poor

**Improved:**

STUDENT REGISTRATION							
STUDENT				COURSES			
Name:	<input type="text"/>	*Major:	<input type="text"/>	Year:	<input type="text"/>	Status:	<input type="text"/>
ID:	<input type="text"/>	Track:	<input type="text"/>		<th></th> <td> </td>		
Number	*Title	Section	Sequence				
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							
<input type="text"/>							

Improved

- Indicate which fields are **optional** or indicate which fields are **mandatory (\*)**.
- **AVOID HEAVY USE OF ALL UPPERCASE LETTERS**
  - Conventional upper & lower case can be read about **13% faster** than text in all upper case
  - Use all upper case only if you want to highlight something

- For display of fields:
  - **Numeric fields** may be left justified on entry but then become **right justified** on display
  - **Numeric fields with decimal points** should line up on the decimal points

Poor:	Improved:
10 100 1,000 10,00	10 100 1,000 10,000
100.00 25.2563 5,432.48 1.45491	5,432 .48 1.45491 100 .00 25 .2563
6173954686 028405554 1234567890 135792468	617-395-4686 028-40-5554 1,234,567,890 135 792 468

## Error Handling

- **Error messages** for unacceptable values and indicate the errors.

# Sign Up

It's free and always will be.

What's your name? First name Last name 

Mobile number or email 

Re-enter mobile number or email 

New password 

Birthday Month ▾ Day ▾ Year ▾  Why do I need to provide my birthday?

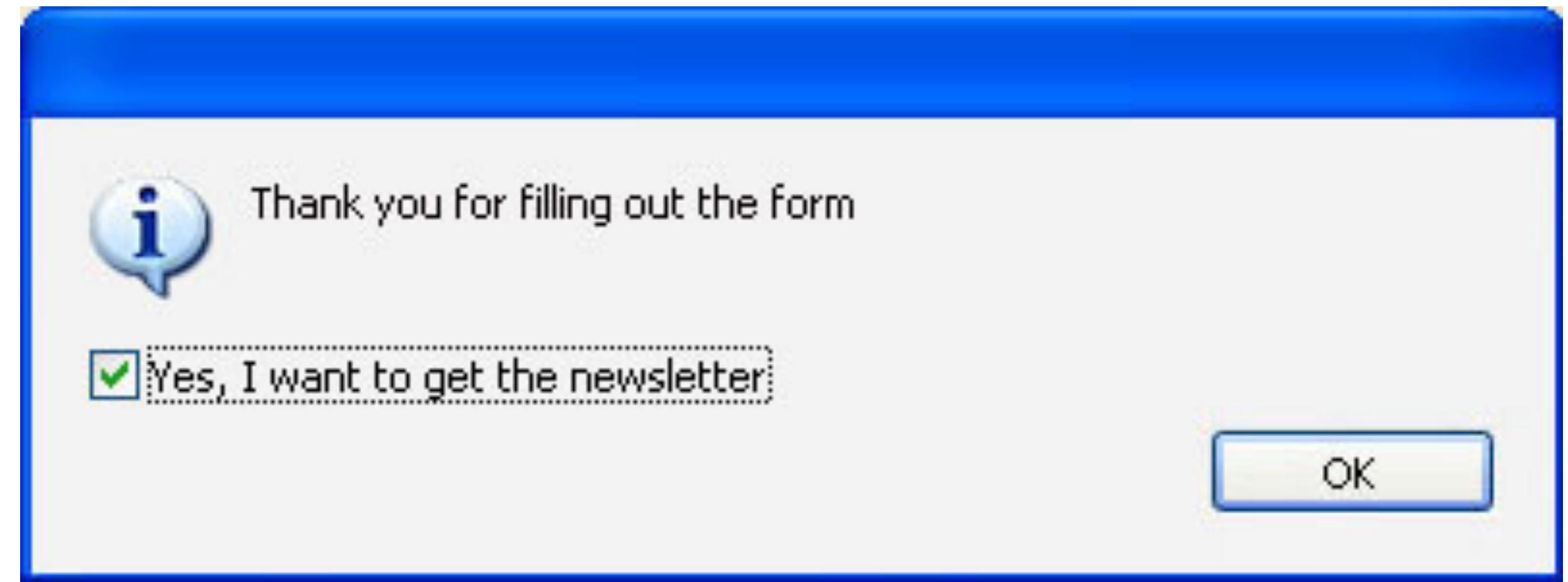
Female  Male 

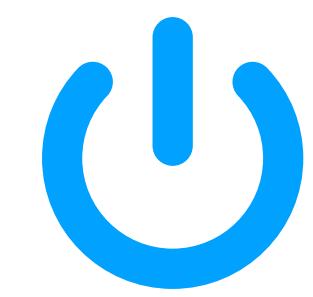
By clicking Sign Up, you agree to our [Terms](#) and that you have read our [Data Policy](#), including our [Cookie Use](#).

**Sign Up**

## Completion signal to support user control

- **It should be clear to the users** what they must do when they finished filling the form.



 **Thank you**