
CSC4130

Introduction to Human-Computer Interaction

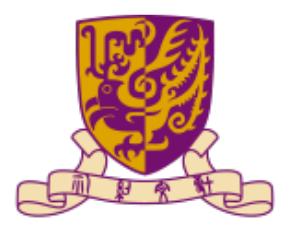
Lecture 5

Interaction



香港中文大學(深圳)

The Chinese University of Hong Kong, Shenzhen



Outline

- Interaction models
- Ergonomics
- Interaction styles
- Elements of the WIMP interface
- Interactivity
- Experience, engagement, and fun

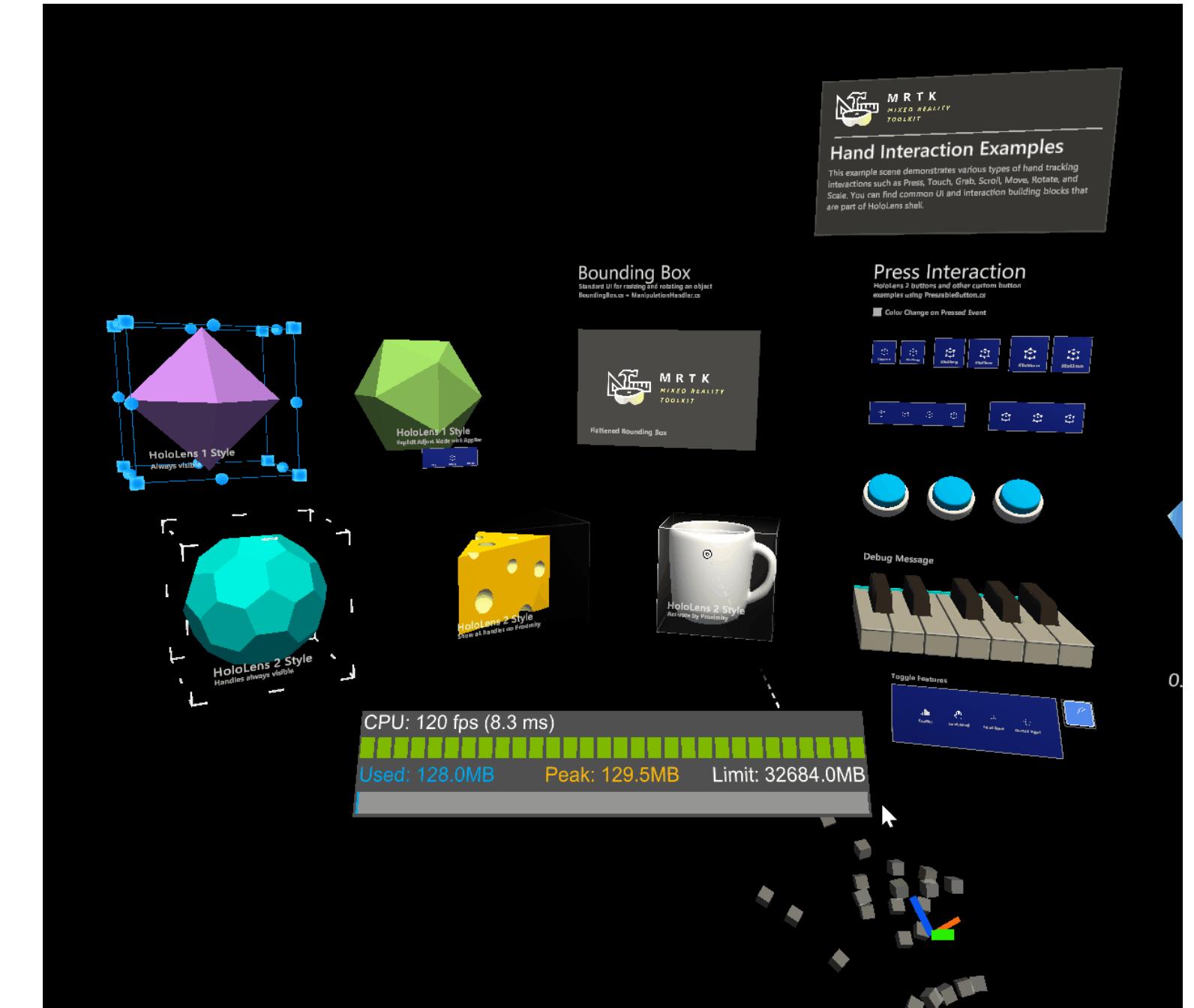
Outline

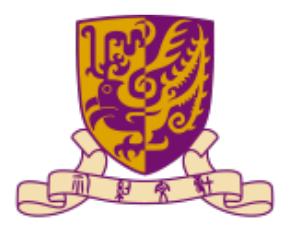
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What is interaction

- Communication
- A kind of action that occurs as two or more objects have an effect upon one another

user ←→ computer



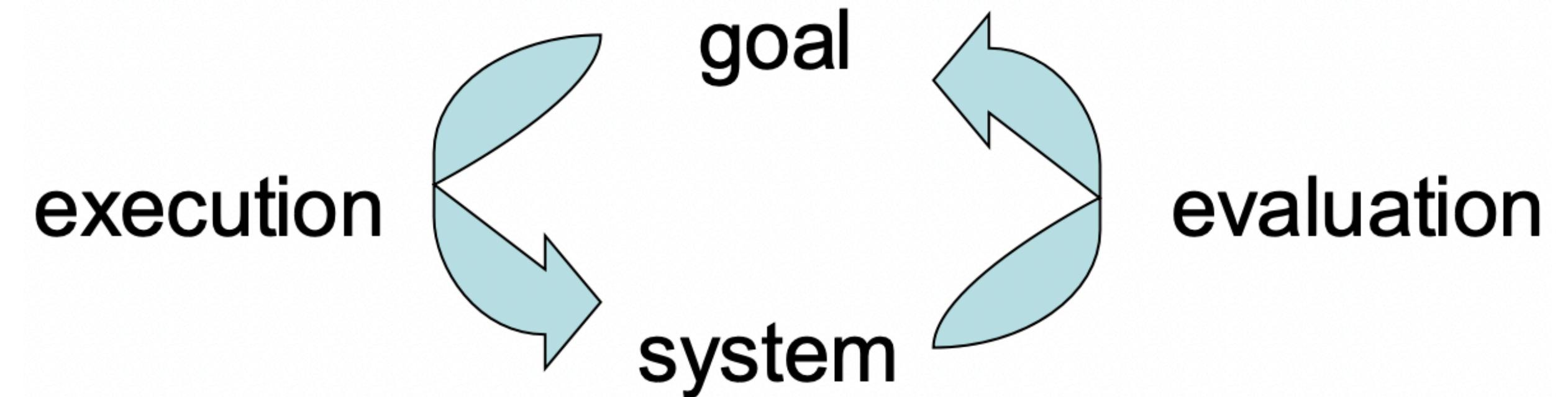


Interaction terms

- Domain
 - The area of work under study e.g., graphics design
- Goal
 - What you want to achieve, e.g., draw a solid circle
- Task
 - How you go about doing it, e.g., select color to fill

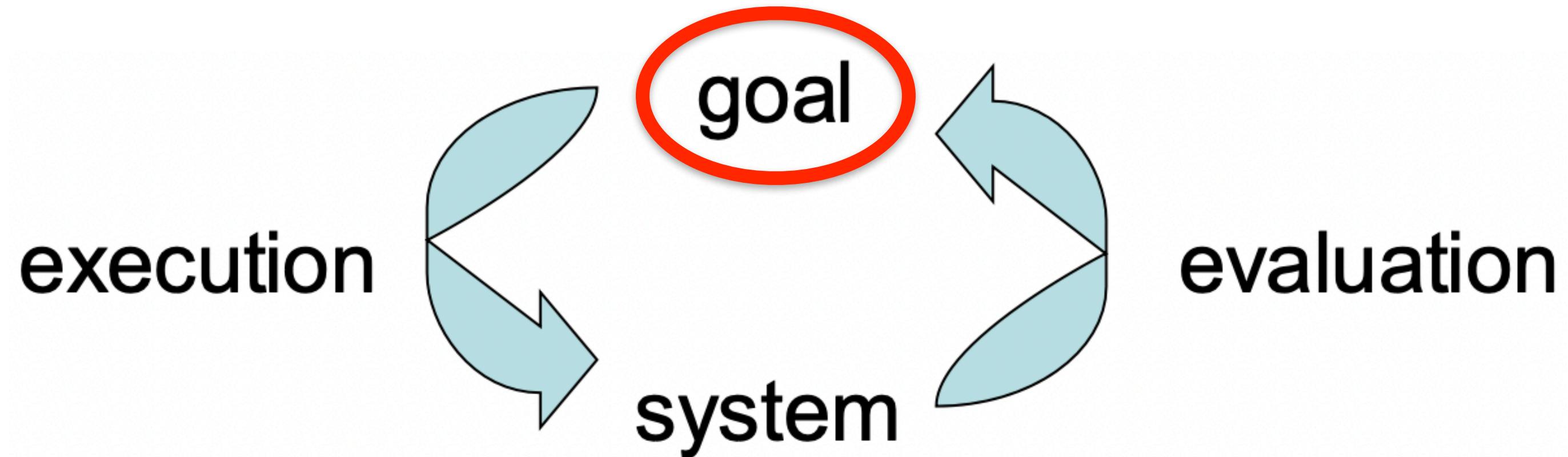
Donald Norman's model

- Seven stages
 - Establish the goal
 - Formulate interaction
 - Specify actions at interface
 - Execute action
 - Perceive system state
 - Interpret system state
 - Evaluate system with respect to the goal
- This model concentrates on the user's view of interface



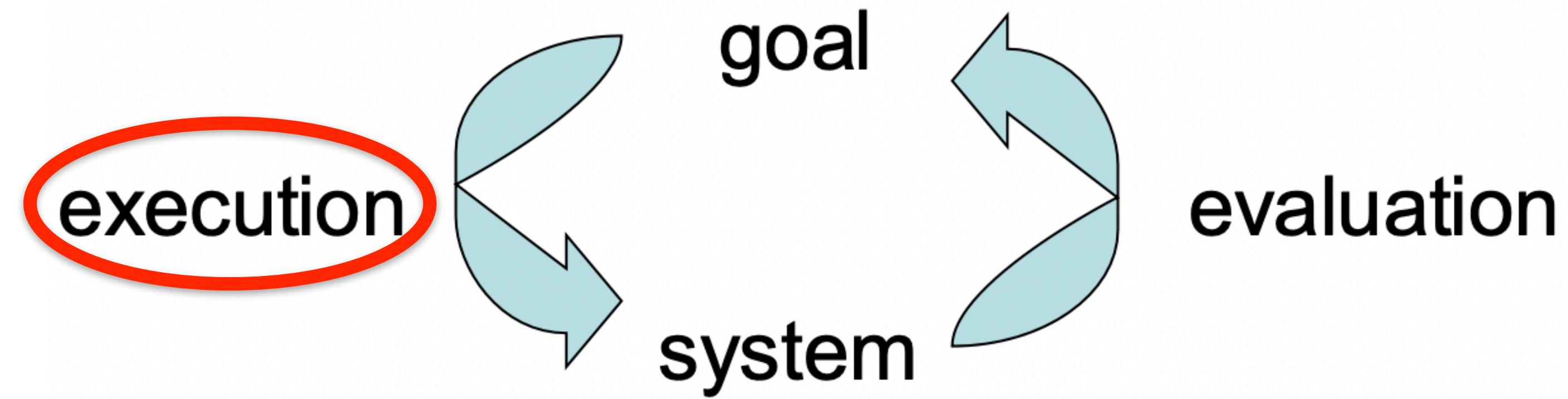
Execution/evaluation loop

- Establish the goal
- Formulate interaction
- Specify actions at interface
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- Evaluate system with respect to the goal



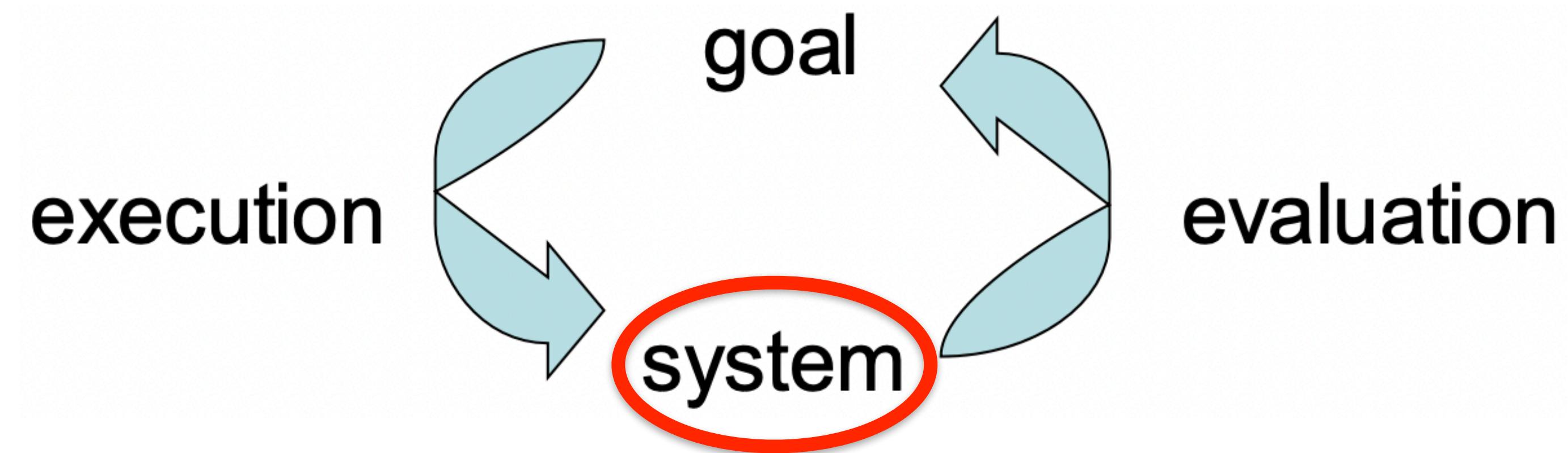
Execution/evaluation loop

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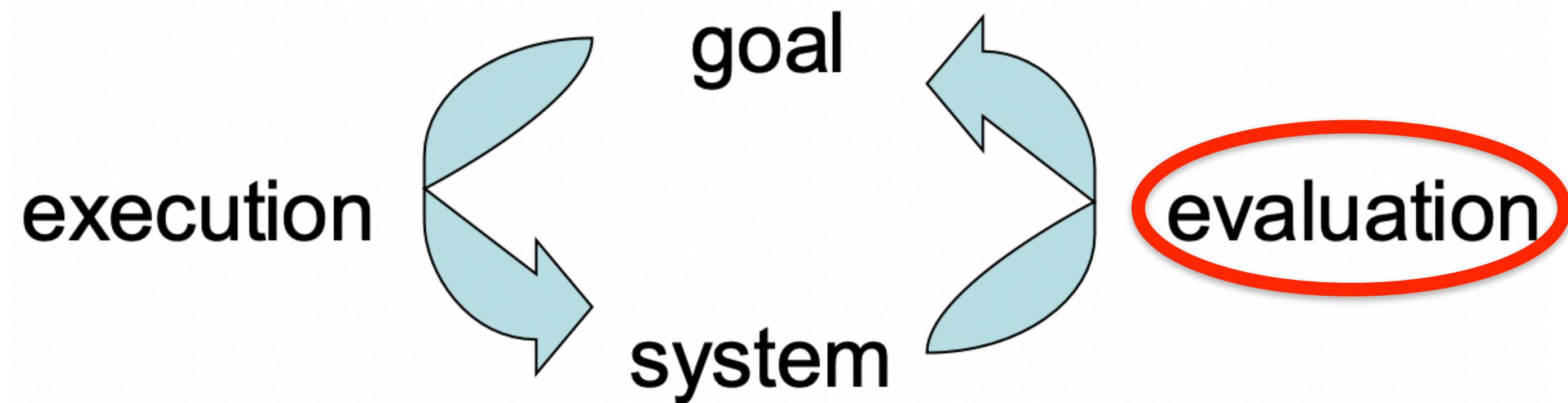
Execution/evaluation loop

- Establish the goal
- Formulate interaction
- Specify actions at interface
- Execute action
- **Perceive system state**
- **Interpret system state**
- **Evaluate system with respect to the goal**



Execution/evaluation loop

- Establish the goal
- Formulate interaction
- Specify actions at interface
- Execute action
- Perceive system state
- Interpret system state
- **Evaluate system with respect to the goal**



Norman's model

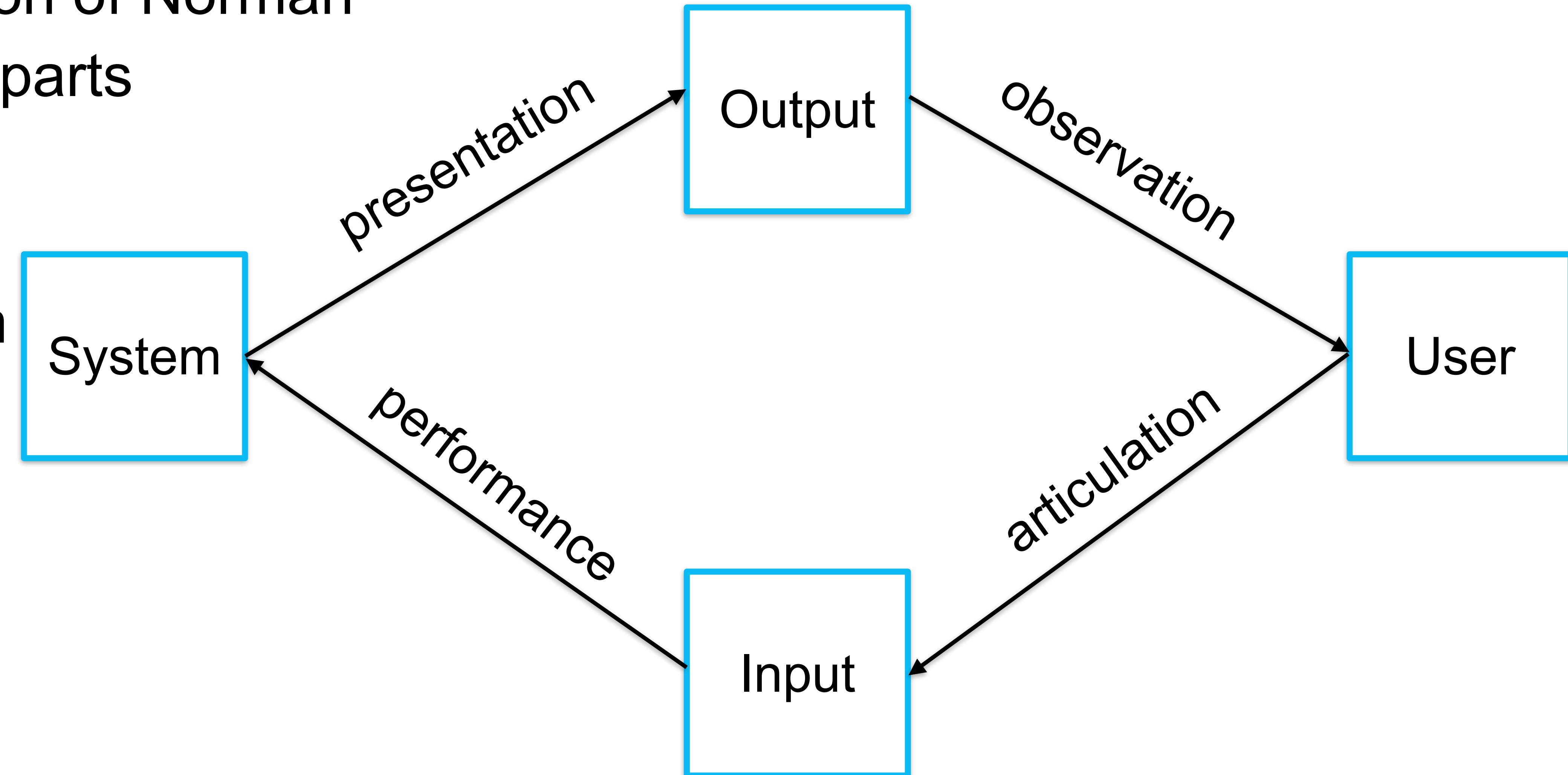
- Some systems are harder to use than others
- Gulf of execution
 - User's formulation of actions is not equal to actions allowed by the system
- Gulf of evaluation
 - User's expectation of changed system state is not equal to actual presentation of this state

Abowd and Beale framework

- Extension of Norman

- Have 4 parts

- User
- Input
- System
- Output



Using Abowd and Beale's model

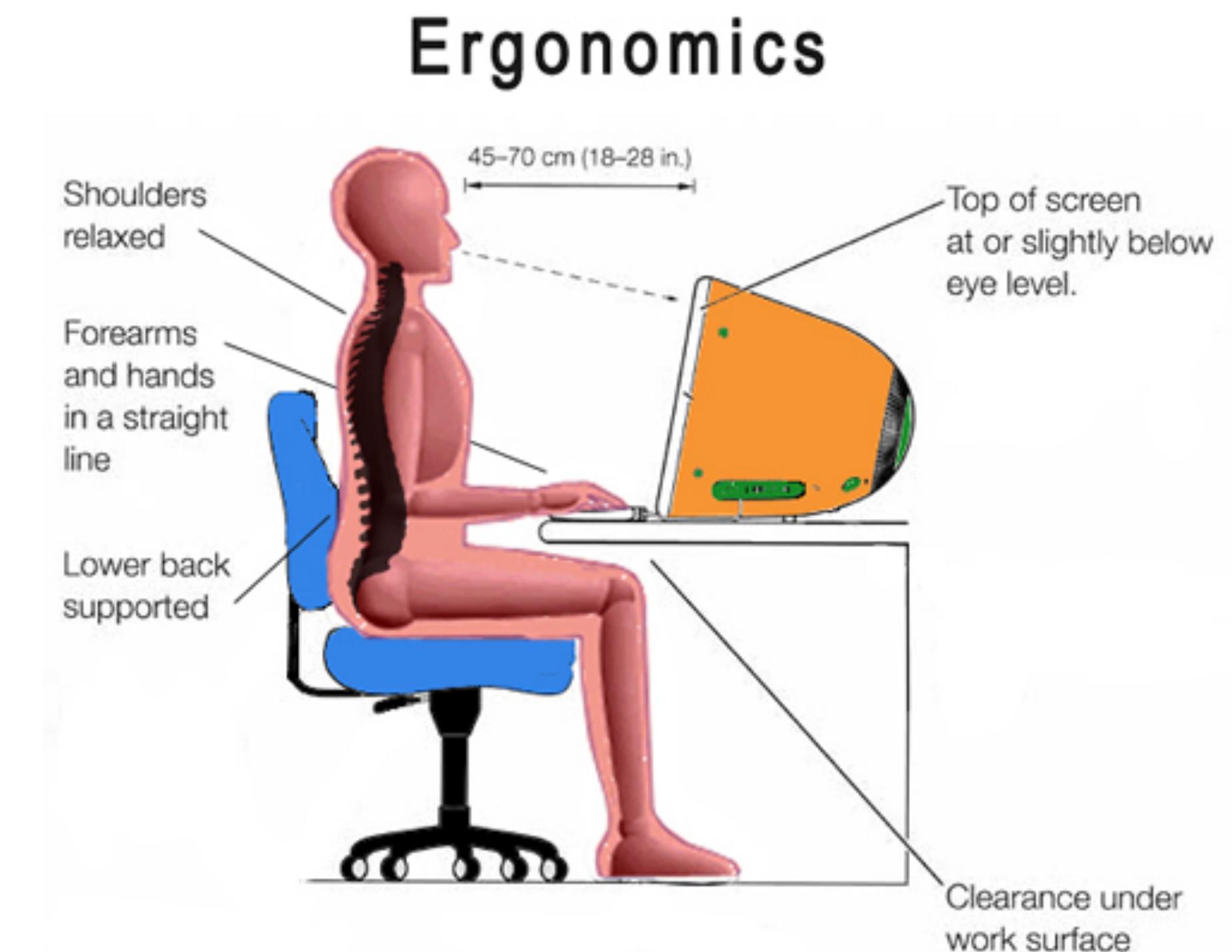
- User intentions
 - Translated into actions at the interface
 - Translated into alterations of system state
 - Reflected in the output display
 - Interpreted by the user
- General framework for understanding interaction
 - Not restricted to electronic computer systems
 - Identify all major components involved in the interaction
 - Allow comparative assessment of systems

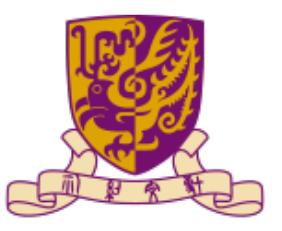
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Ergonomics

- Study of the physical characteristics of interaction
- Also known as human factors
- Good at defining standards and guidelines for constraining the way we design certain aspects of systems





Ergonomics - examples

- Arrangement of controls and displays
 - Controls grouped according to function or frequency of use
- Surrounding environment
 - Seating arrangements adaptable to cope with all sizes of user
- Health issues
 - Physical position, environmental conditions (e.g., temperature), lighting
- Use of color
 - Use red for warning, green for ok

Outline

- Interaction models
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- **Interaction styles**
- Elements of the WIMP interface
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Common interaction style

- Command line interface
- Menus
- Natural language
- Question answer and query
- Form-fills and spreadsheets
- WIMP
- Point and click
- Three-dimensional interfaces

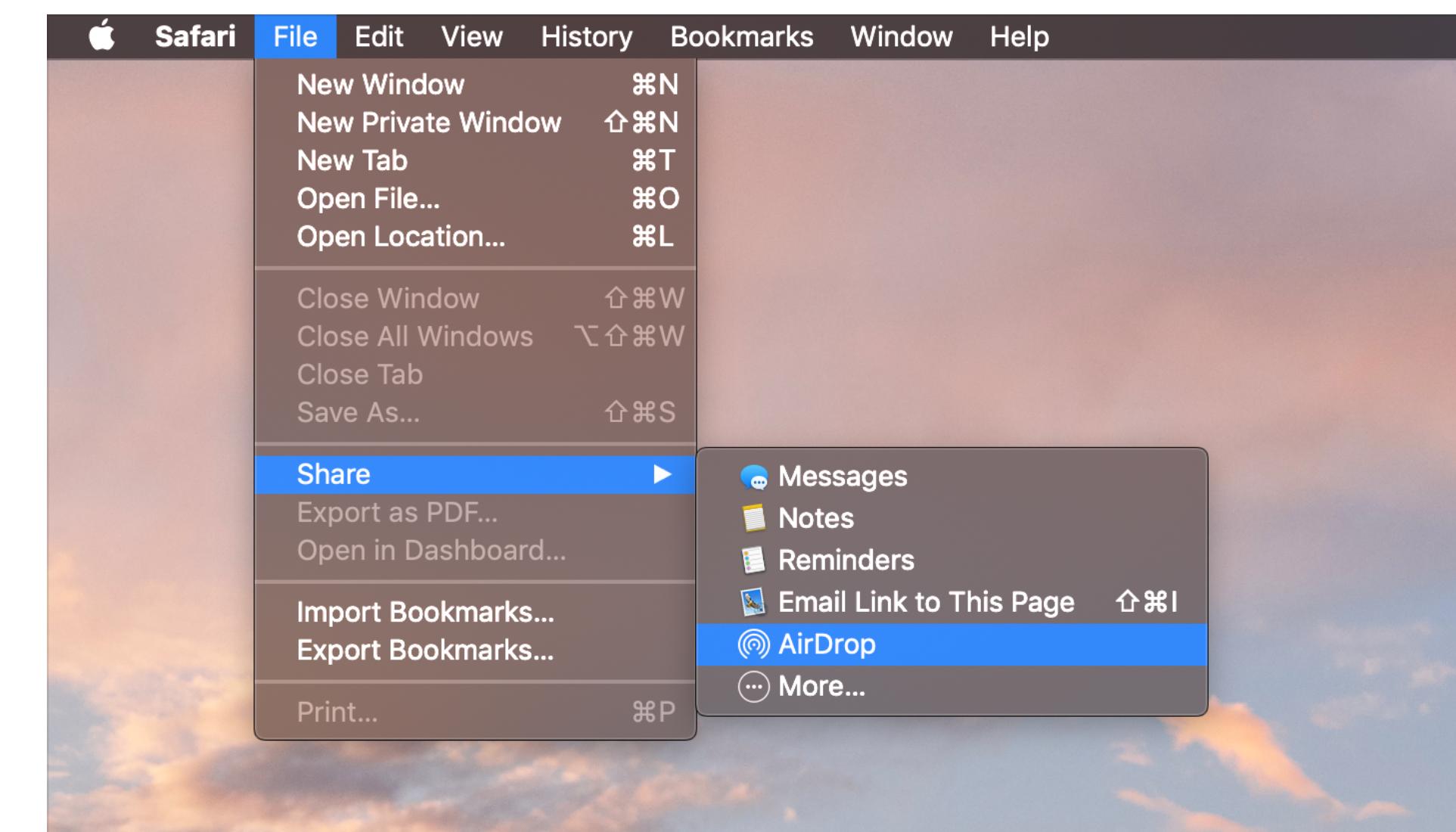
Common line interface

- Way of expressing instructions to the computer directly
- Suitable for repetitive tasks
- Better for expert users than novices
- Offer direct access to system functionality
- Command names/abbreviations should be meaningful

```
[root@localhost ~]# ping -q fa.wikipedia.org
PING text.pmta.wikimedia.org (208.80.152.2) 56(84) bytes of data.
^C
--- text.pmta.wikimedia.org ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 540.528/540.528/540.528/0.000 ms
[root@localhost ~]# pwd
/root
[root@localhost ~]# cd /var
[root@localhost var]# ls -la
total 72
drwxr-xr-x. 18 root root 4096 Jul 30 22:43 .
drwxr-xr-x. 23 root root 4096 Sep 14 20:42 ..
drwxr-xr-x. 2 root root 4096 May 14 00:15 account
drwxr-xr-x. 11 root root 4096 Jul 31 22:26 cache
drwxr-xr-x. 3 root root 4096 May 18 16:03 db
drwxr-xr-x. 3 root root 4096 May 18 16:03 empty
drwxr-xr-x. 2 root root 4096 May 18 16:03 games
drwxrwx--T. 2 root gdm 4096 Jun 2 18:39 gdm
drwxr-xr-x. 38 root root 4096 May 18 16:03 lib
drwxr-xr-x. 2 root root 4096 May 18 16:03 local
lrwxrwxrwx. 1 root root 11 May 14 00:12 lock -> ../run/lock
drwxr-xr-x. 14 root root 4096 Sep 14 20:42 log
lrwxrwxrwx. 1 root root 10 Jul 30 22:43 mail -> spool/mail
drwxr-xr-x. 2 root root 4096 May 18 16:03 nis
drwxr-xr-x. 2 root root 4096 May 18 16:03 opt
drwxr-xr-x. 2 root root 4096 May 18 16:03 preserve
drwxr-xr-x. 2 root root 4096 Jul 1 22:11 report
lrwxrwxrwx. 1 root root 6 May 14 00:12 run -> ../run
drwxr-xr-x. 14 root root 4096 May 18 16:03 spool
drwxrwxrwt. 4 root root 4096 Sep 12 23:50 tmp
drwxr-xr-x. 2 root root 4096 May 18 16:03 yp
[root@localhost var]# yum search wiki
Loaded plugins: langpacks, presto, refresh-packagekit, remove-with-leaves
rpmfusion-free-updates | 2.7 kB 00:00
rpmfusion-free-updates/primary_db | 206 kB 00:04
rpmfusion-nonfree-updates | 2.7 kB 00:00
updates/metalink | 5.9 kB 00:00
updates | 4.7 kB 00:00
updates/primary_db 73% [=====] 62 kB/s | 2.6 MB 00:15 ETA
```

Menus

- Set of options displayed on the screen
- Options visible
 - Rely on recognition so names should be meaningful
- Selection by
 - Numbers, letters, arrow keys, and mouse
- Often options hierarchically grouped
- Sensible grouping is needed
- Restricted form of full WIMP system



Natural language

- Familiar to user
- Speech recognition or typed natural language
- Problems
 - Vague
 - Ambiguous
 - Hard to do well
- Solutions
 - Pick on key words
 - Build dictionary

How does amazon Alexa work?



Natural language

Skype

Don.Anton

...
nlsql

People, groups & messages

Chats Calls Contacts Notifications

ALL

16:07 Show me stock of MZ-TG-Y200 on Plant 1 US

nlsql, 16:07 Material MZ-TG-Y200 on Plant 1 US unrestricted stock is 0 item(s), also Blocked Stock - 0, Stock in Quality Inspection - 0, Stock in transfer - 0, based on SAP test records.

16:07 Graph me payments of USCU_S01

nlsql, 16:07 Customer(s) USCU_S01 payments in 2016-2017

USD\$

2016 2017

1 2 3 4 5 6 7 8 9 10 11 12

16:07 Show me balance of CUST group |

No new notifications

Check back to see new @ mentions, reactions, quotes and much more.

11:07

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
 - Require understanding of database structure and language syntax

Query Interface

Protein Name	E90A
Protein Type	Membrane Protein
Invention Date	January <input checked="" type="checkbox"/> 1900 <input checked="" type="checkbox"/>

Form-fills

- Primarily for data entry or data retrieval
- Screen like paper form
- Data put in relevant place
- Require
 - Good design
 - Obvious correction facilities

Hello!

Name
Jane Smith

Select your city
London

What apps do you use frequently?

- WhatsApp
- Instagram
- Snapchat
- Twitter

NEXT →

Your full name
Jane Smith

Question about a few options

<input checked="" type="checkbox"/>	Option 1
<input type="checkbox"/>	Option 2
<input checked="" type="checkbox"/>	Option 3
<input type="checkbox"/>	Option 4

Radio buttons

<input type="radio"/>	Option 1
<input checked="" type="radio"/>	Option 2
<input type="radio"/>	Option 3
<input type="radio"/>	Option 4

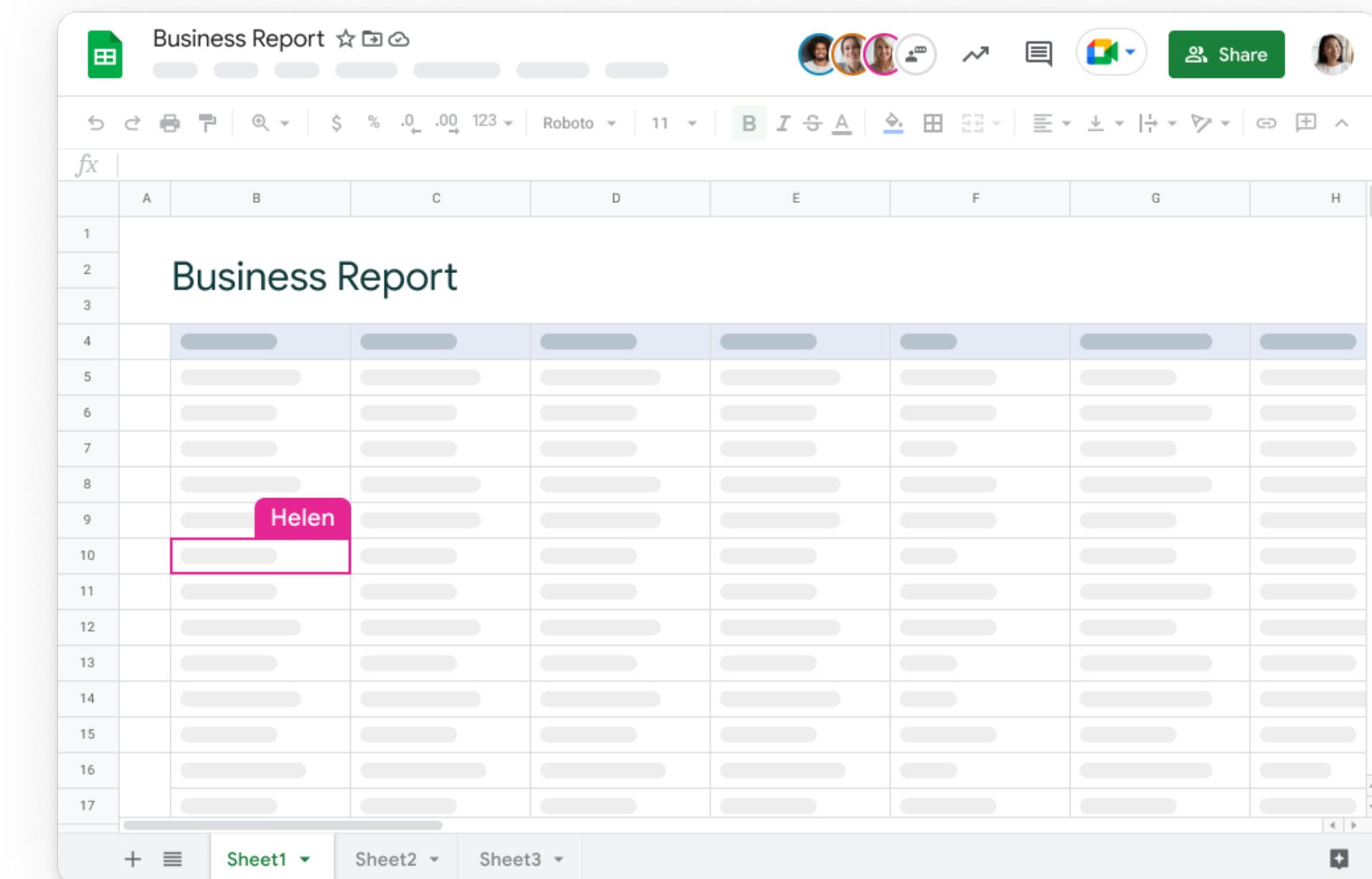
Select one option

London

New York
 Sidney
 Ottawa
 Wellington

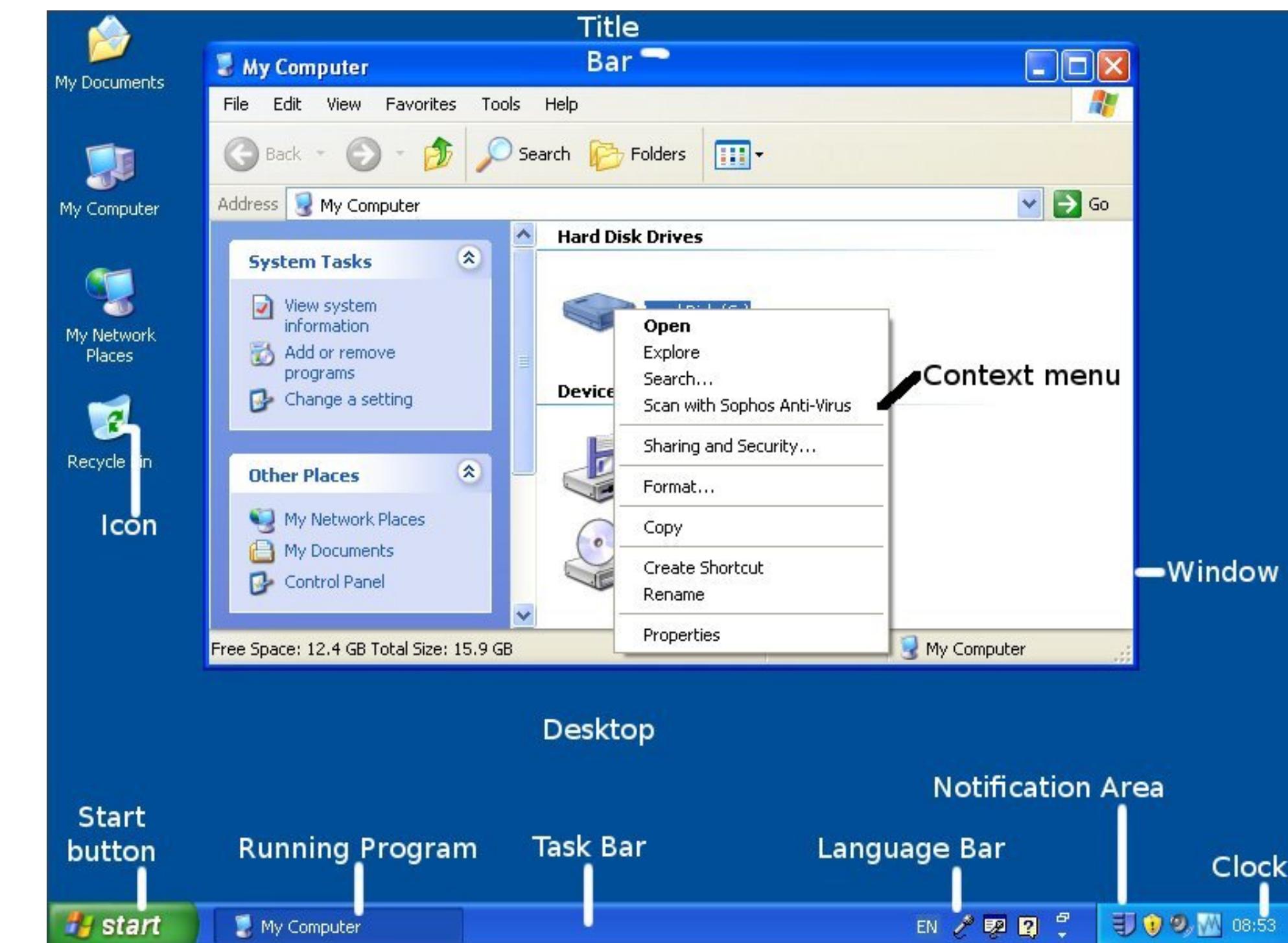
Spreadsheets

- First spreadsheet VISICALC, followed by Lotus 1-2-3
- Sophisticated variation of form-filling
 - Grid of cells contain a value or a formula
 - Formula can involve values of other cells
 - User can enter and alter data spreadsheet maintain consistency



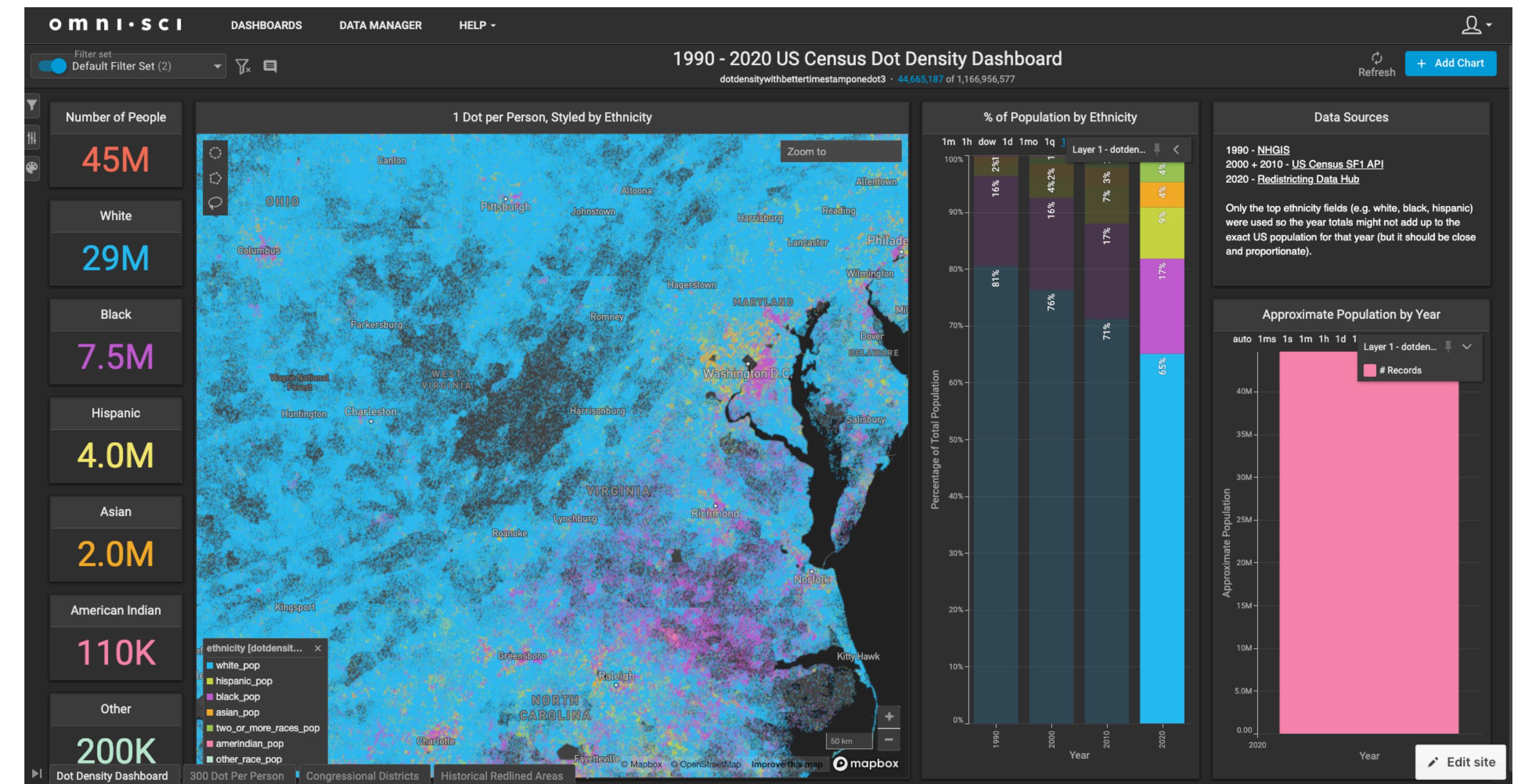
WIMP interface

- 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



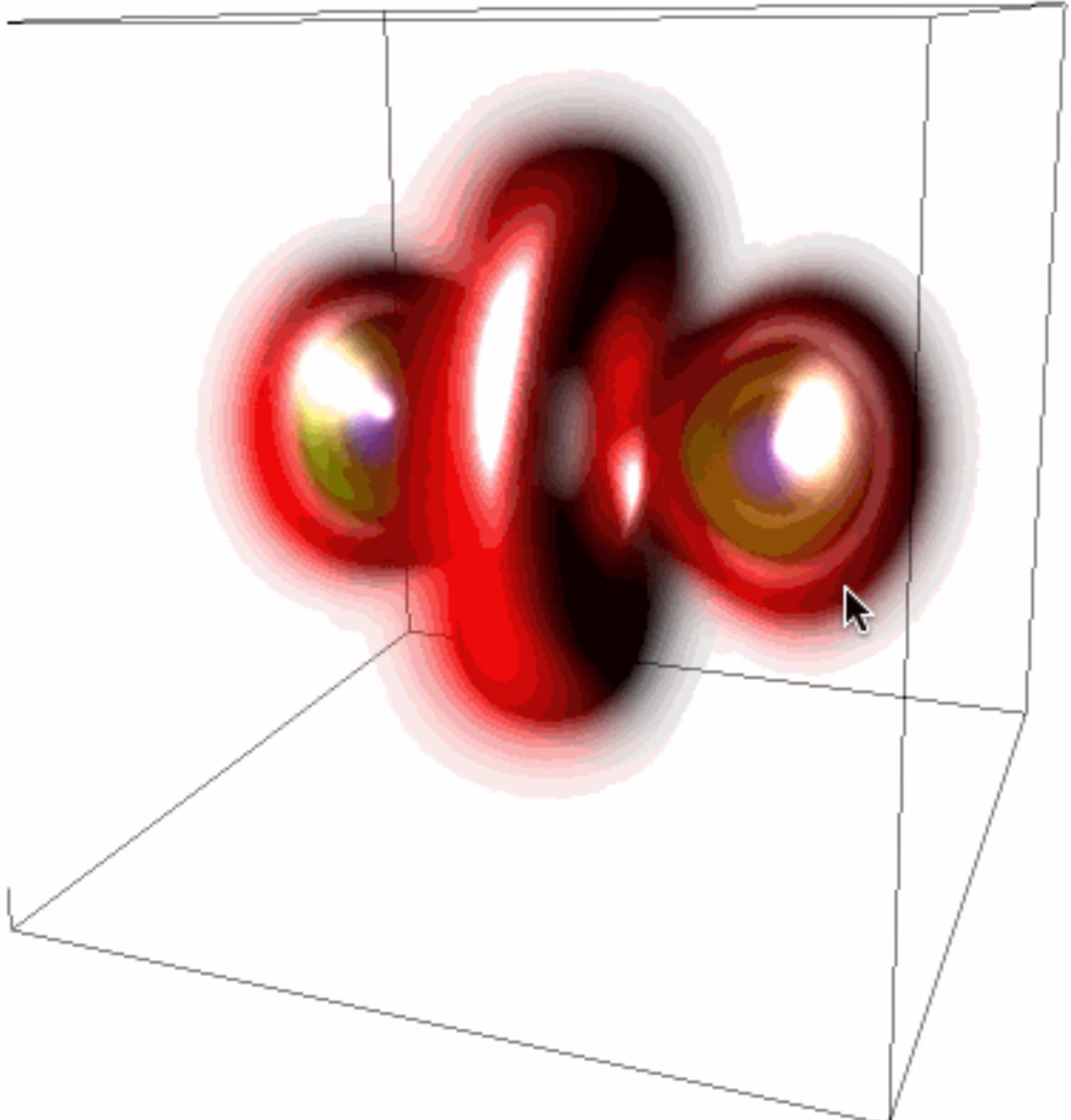
Point and click interface

- Used in multimedia, web browsers, and hypertext
- Just click something, e.g., icons, text links or location on map
- Minimal typing



Three dimensional interfaces

- Virtual reality
- Ordinary window systems
 - Highlighting
 - Visual affordance
- 3D workspaces
 - Use for extra virtual space
 - Light and occlusion give depth
 - Distance effects

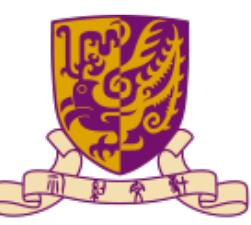


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Windows

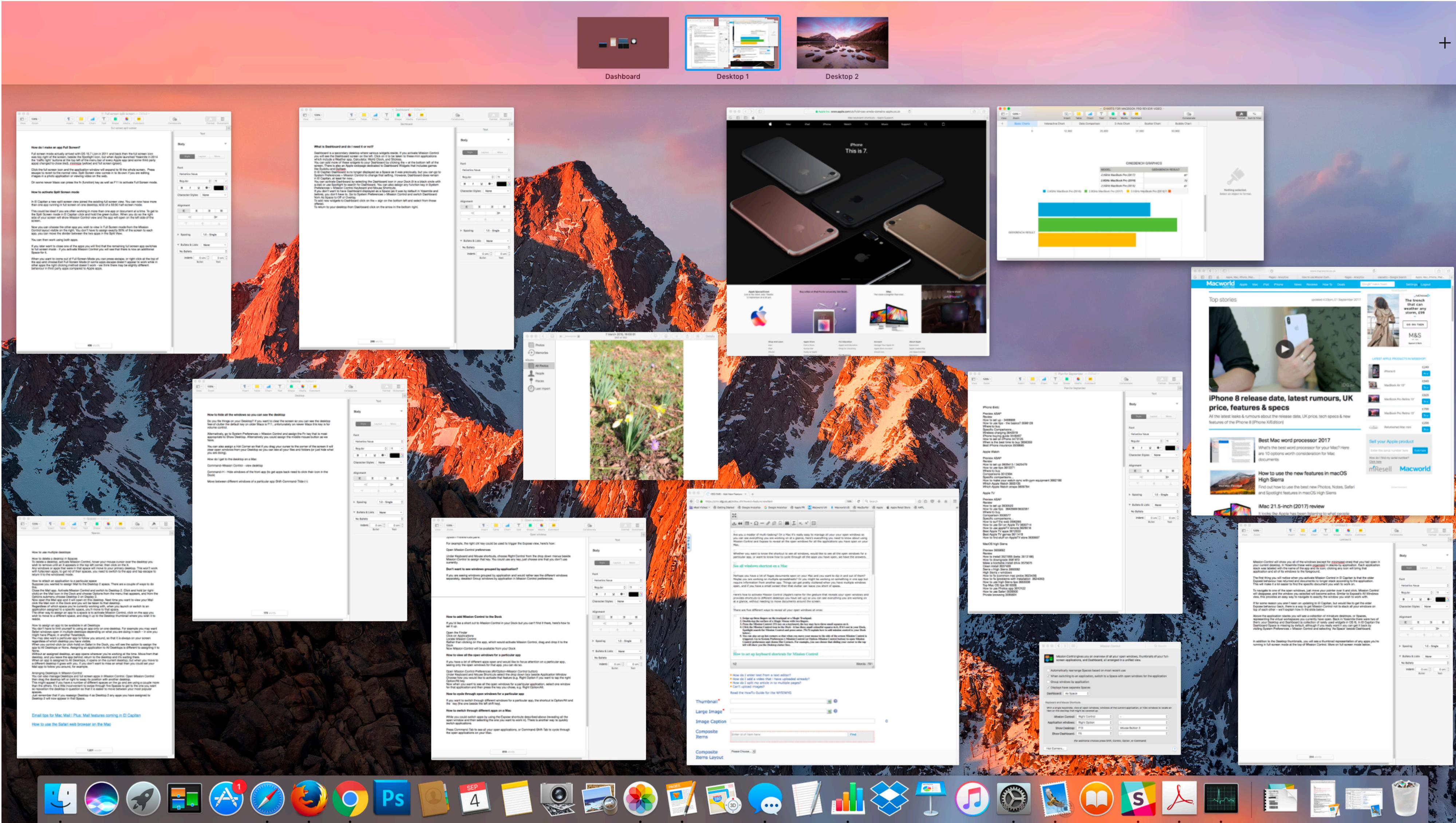
- Areas of the screen
 - Can contain text or graphics
 - Can be moved or resized
 - Can overlap and obscure each other, or can be laid out next to one another
- Scrollbars
 - Allow the user to move the contents of the window up and down or from side to side
- Title bars
 - Describe the name of window



Windows

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Icons

- Small picture or image
 - Represent some object in the interface
- Often a window or action
- Windows can be closed down
- Can be many and various
 - Highly stylized
 - Realistic representations



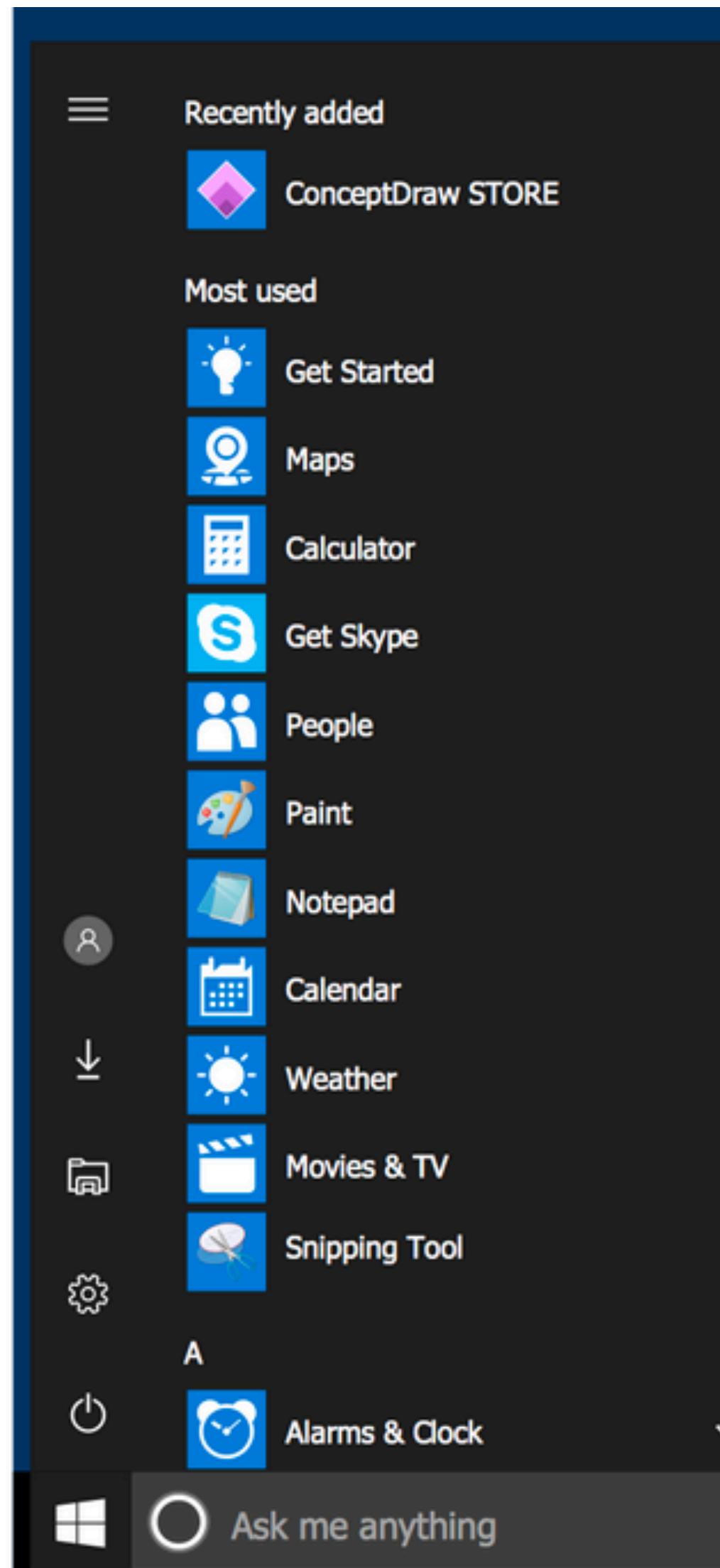
Pointers

- Important component
 - WIMP style relies on pointing and selecting items
- Use mouse, trackpad, joystick, trackball, cursor keys, or keyboard shortcuts
- Wide variety of graphical images



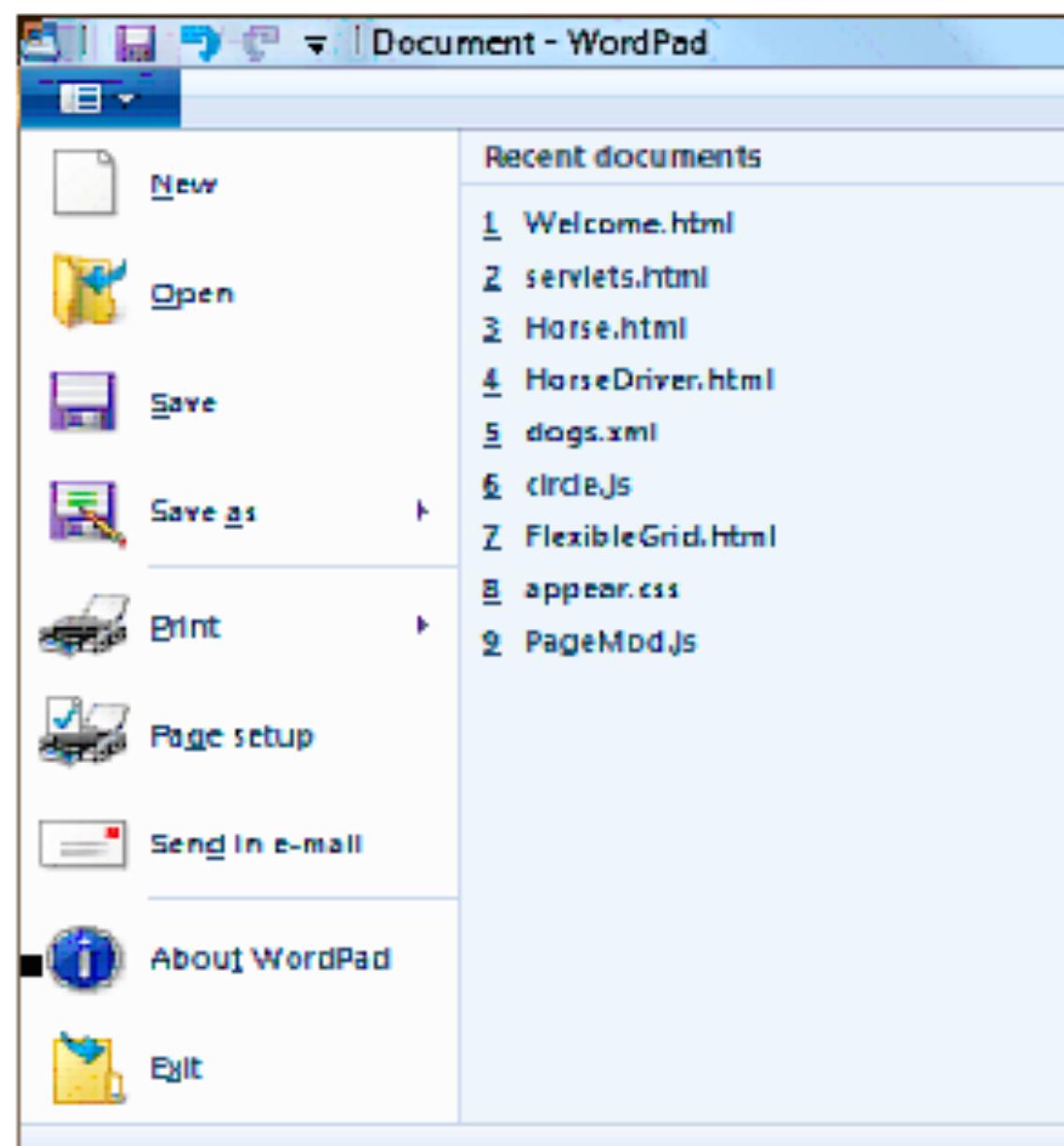
Menus

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

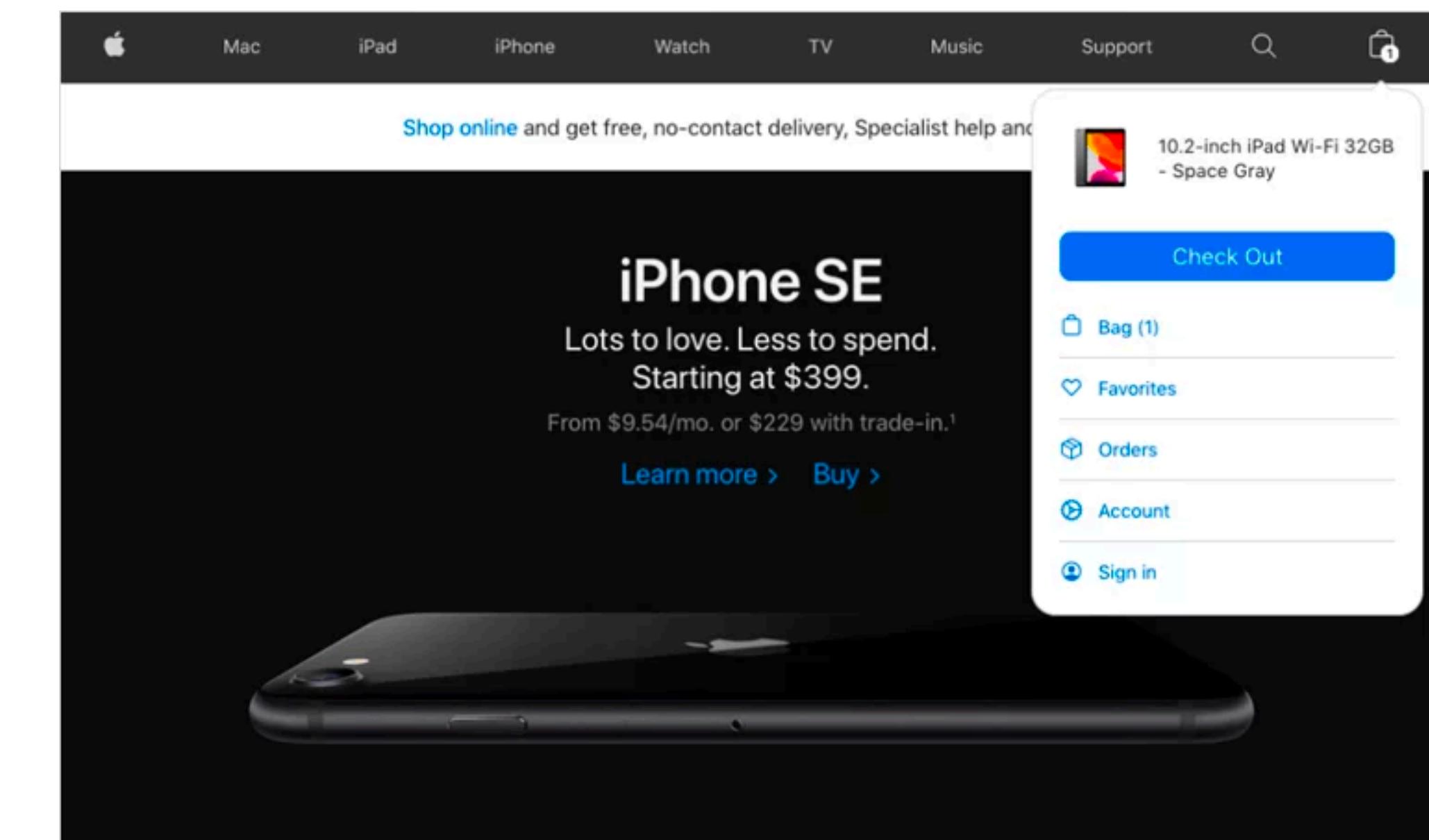


Kinds of menus

- Menu bar at top of screen, menu drags down
 - Pull-down menu - mouse hold and drag down menu
 - Drop-down menu - mouse click reveals menu



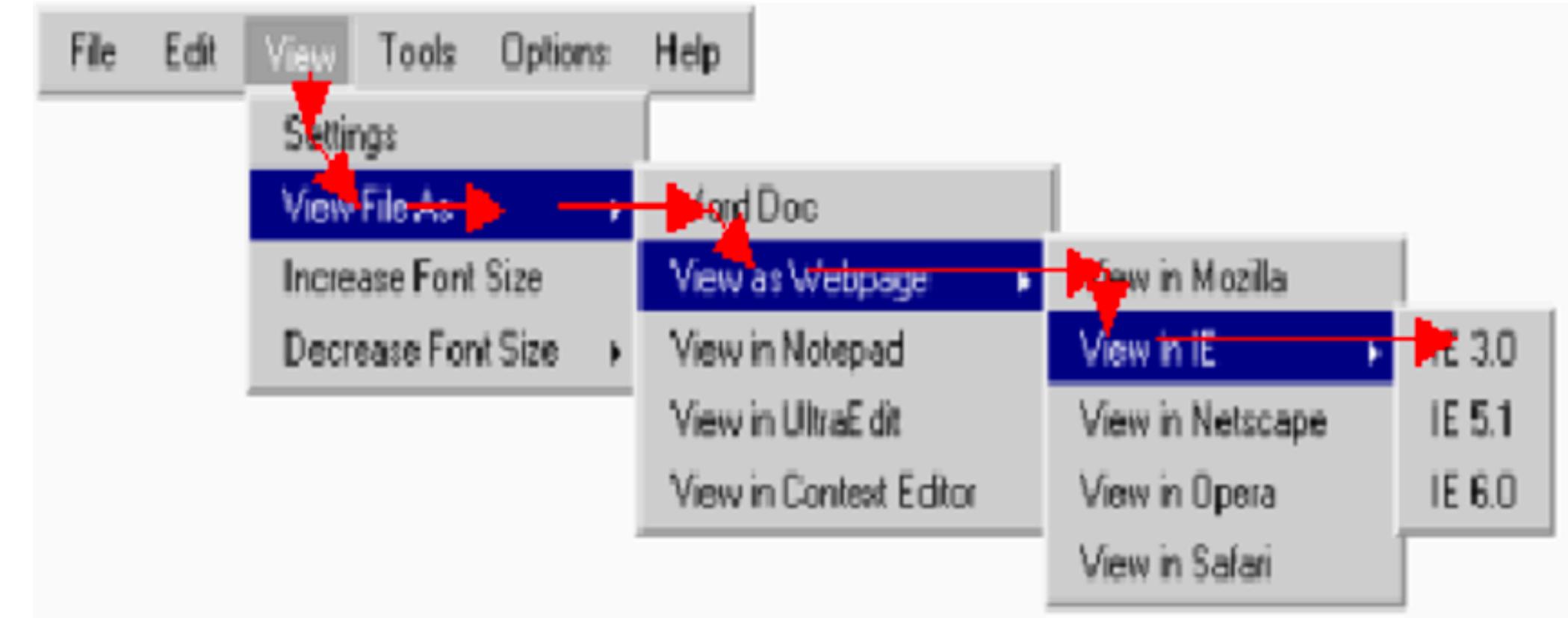
pull-down



drop-down

Menus extras

- Cascading menus
 - Hierarchical menu structure
 - Menu selection opens new menu
- Keyboard accelerators
 - Key combinations - same effect as menu item
 - Active when menu open - usually first letter
 - Active when menu close - usually Ctrl + letter



Menus design issues

- Which kind to use
- What to include the menu at all
- Words to use (actions or descriptions)
- How to group items
- Choice of keyboard accelerators

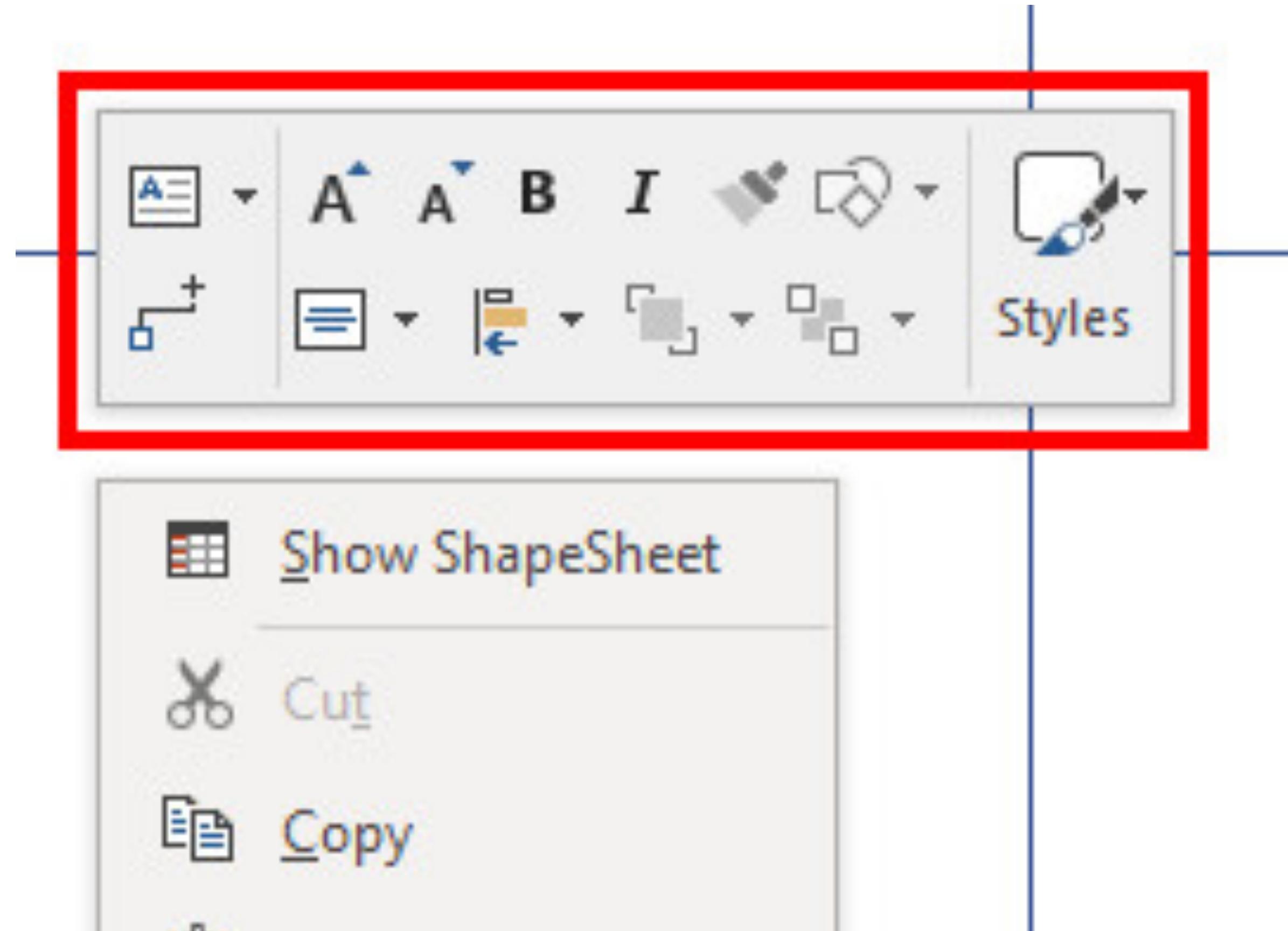
Buttons

- Individual and isolated regions with 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



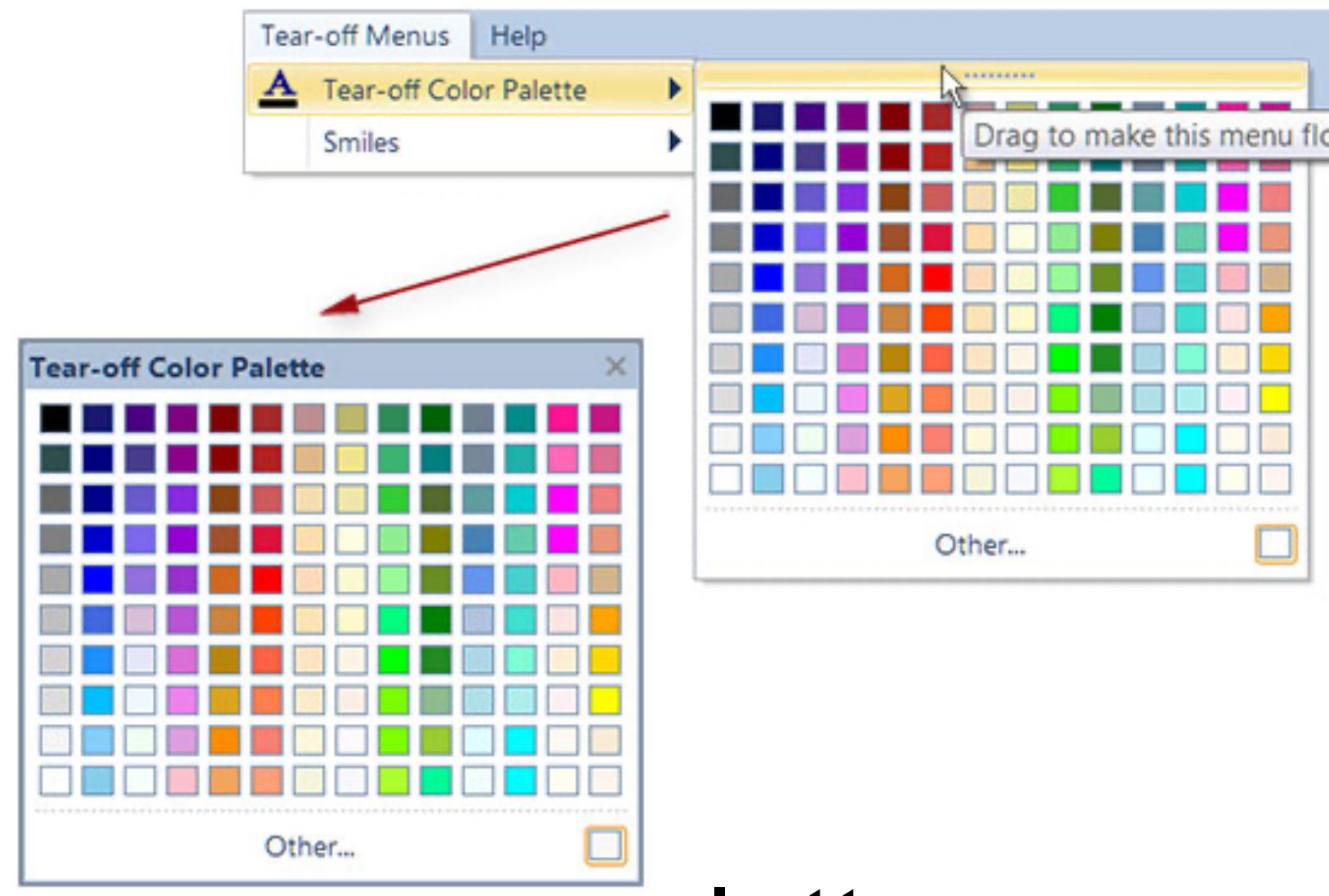
Toolbars

- Long lines of icons
- Fast access to common actions
- Often customizable
 - Choose which toolbars to see
 - Choose what options are on it

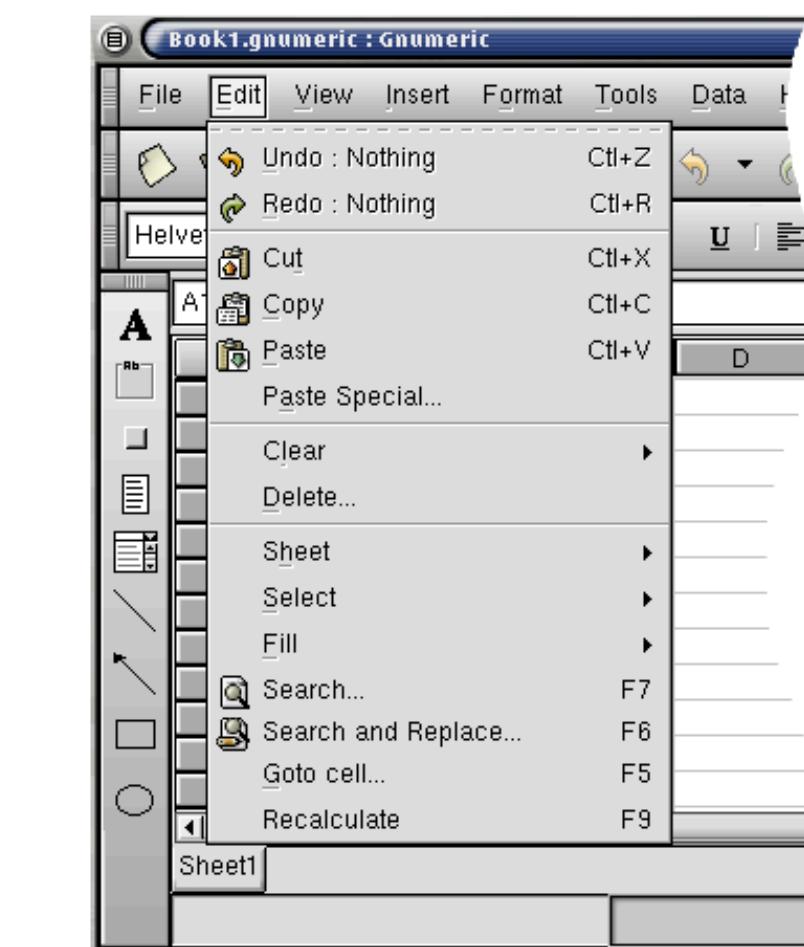


Palettes and tear-off menus

- Problem
 - Menu not there when you want it
- Solution
 - Palettes - little windows of action
 - Tear-off and pin-up menus - menu tears off to become palette



palette

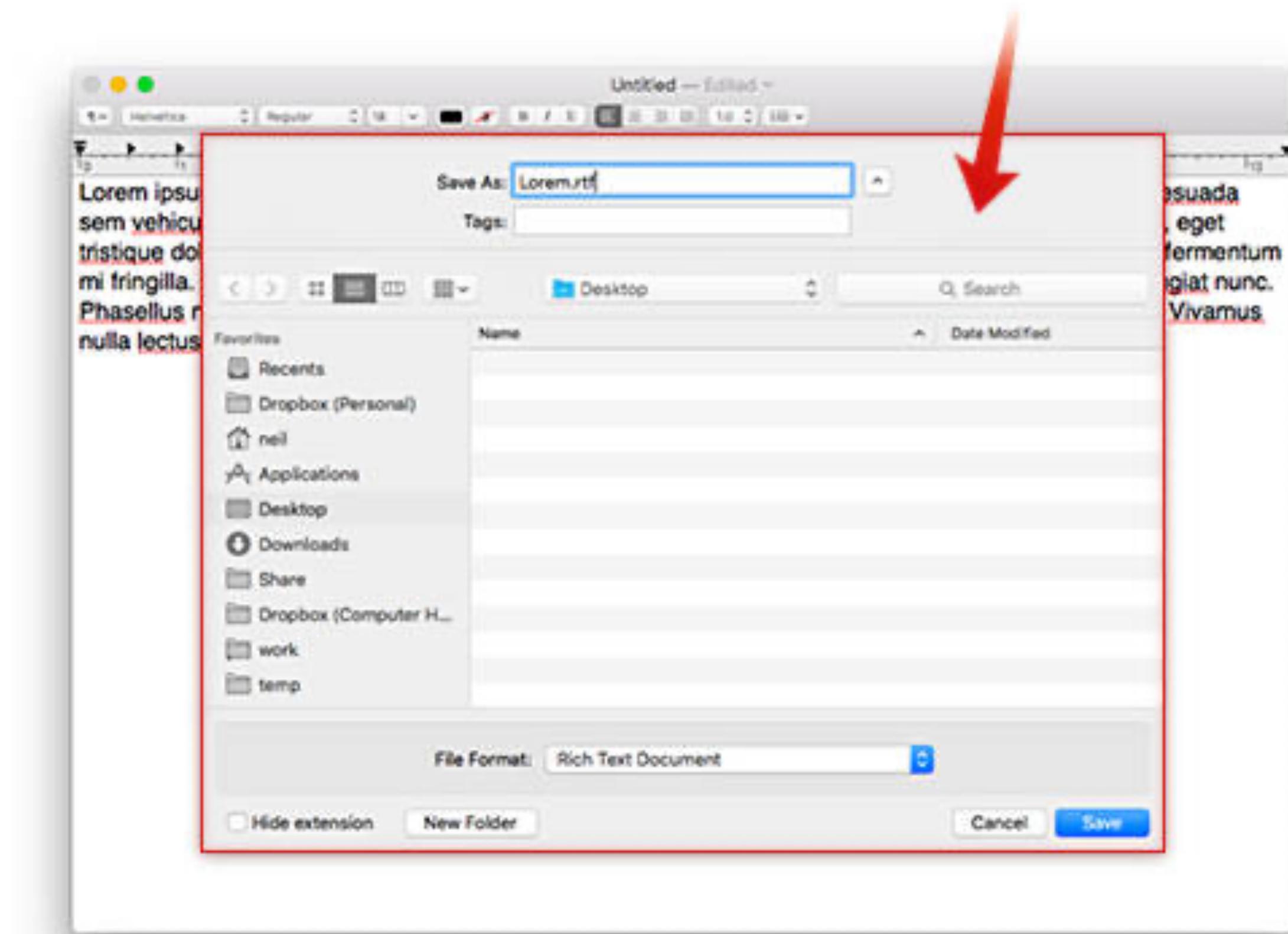


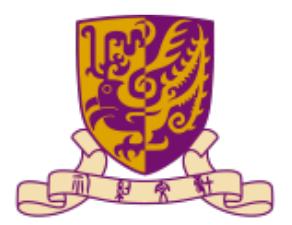
tear-off menu



Dialogue boxes

- Information windows that pop up to inform of an important event or request information
 - 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





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Speech-driven interfaces

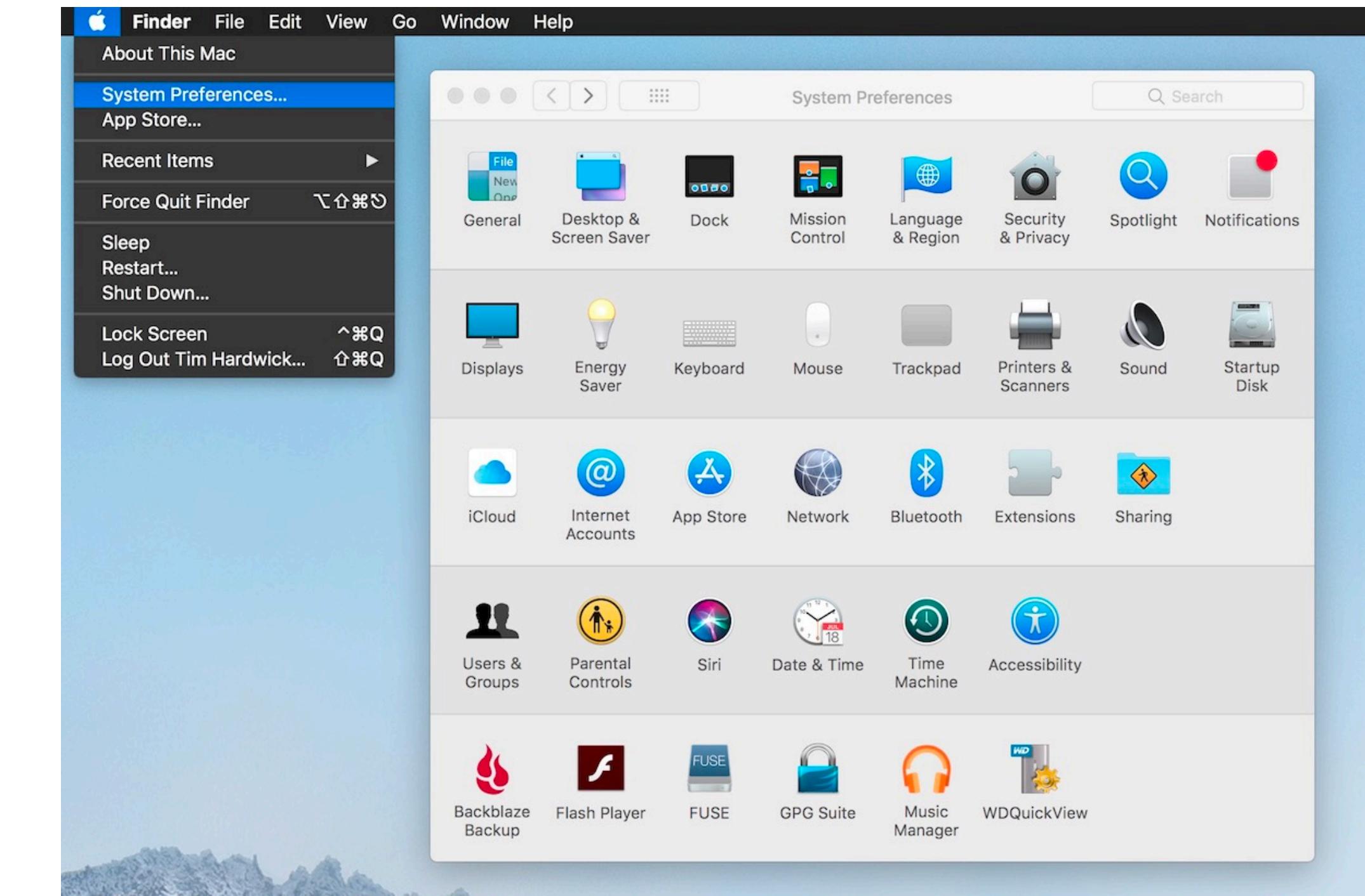
- Rapidly improving but still inaccurate
- How to have a robust dialogue
 - Airline reservation: reliable “yes” and “no” + system reflects back its understanding “you want a ticket from New York to Boston?”



Look and feel

- WIMP systems have the same elements
- But different window systems, behave differently
 - Windows vs. MacOS

appearance + behavior = look and feel



Error and repair

- Can't always avoid errors, but we can put them right
- Make it easy to detect errors, then user can repair them

hello, this is the Go Faster booking system what would you like?

(user) *I want to fly from New York to London*

you want a ticket from New York to Boston

(user) no

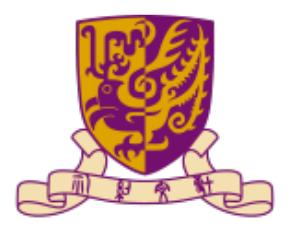
sorry, please confirm one at a time do you want to fly from New York

(user) yes

.....

Context

- Interaction affected by social and organizational context
 - Other people - desire to impress, competition, fear of failure
 - Motivation - fear, allegiance, ambition, self-satisfaction
 - Inadequate systems - cause frustration and lack of motivation



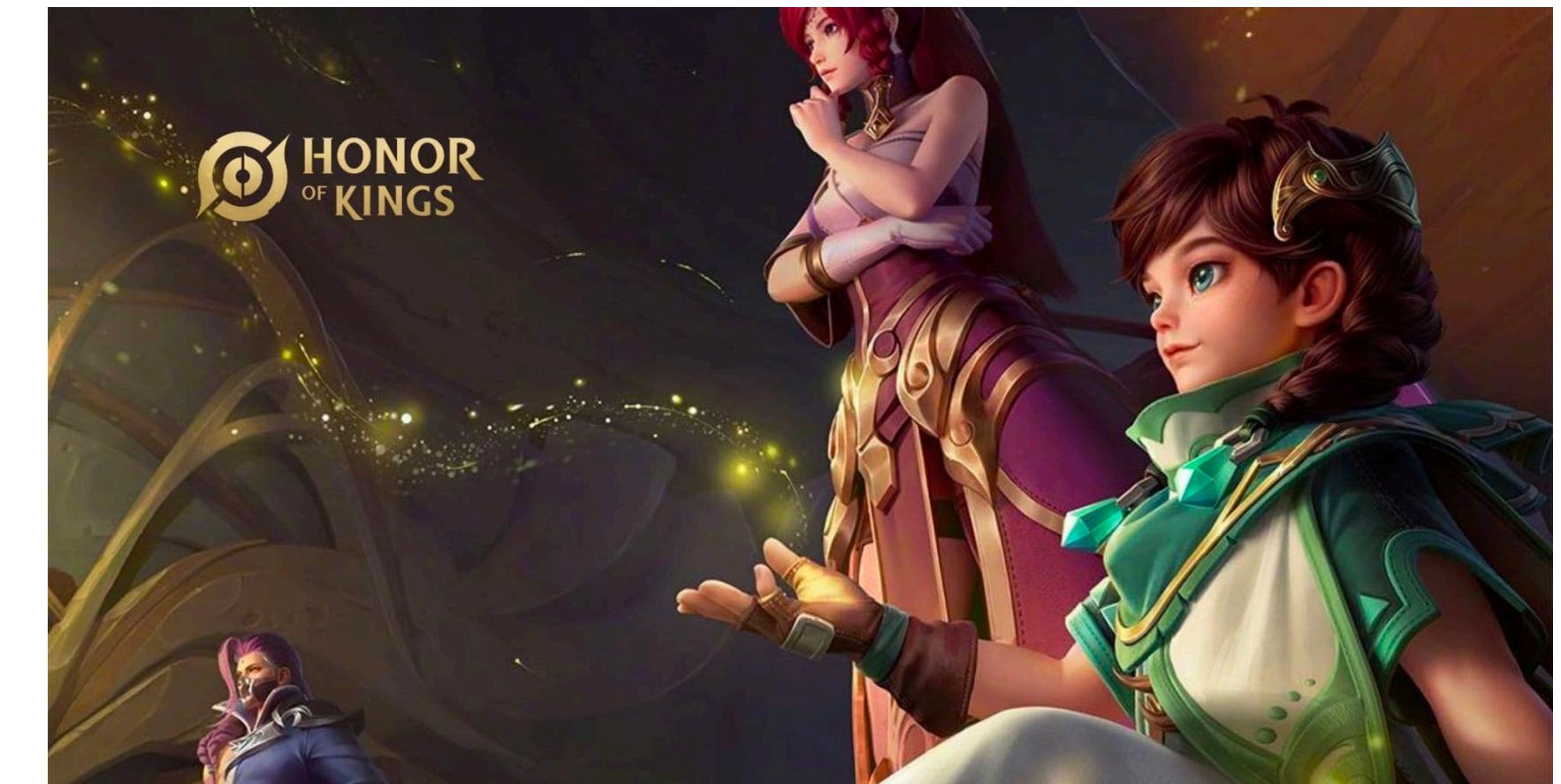
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Experience

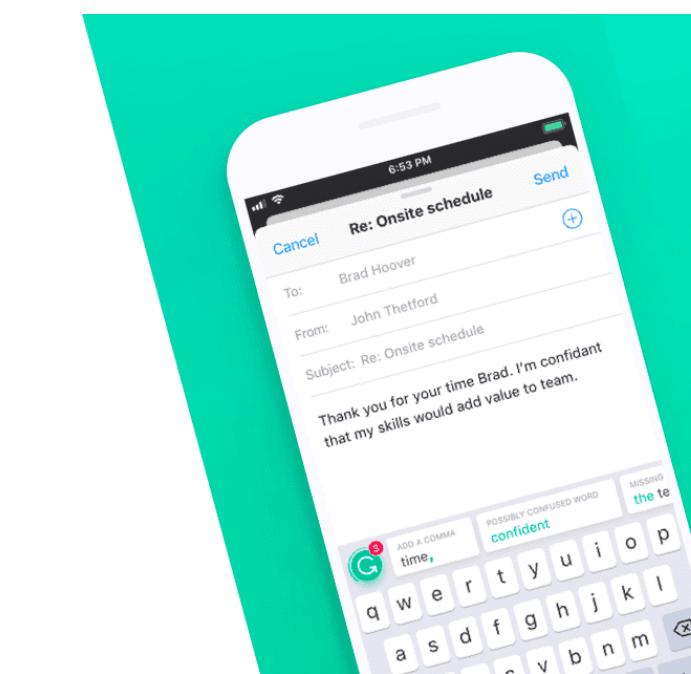
- Home, entertainment, shopping
 - Not enough that can use a system
 - They must want to use it
- Psychology of experience
 - Flow
 - Balance between anxiety and boredom
- Education
 - Zone of proximal development
 - Thing you can do with help

淘宝
Taobao



grammarly

Your writing,
at its best.



Physical design

- Many constraints
 - Ergonomic - minimum button size
 - Physical - high-voltage switches are big
 - Legal and safety - high cooker controls
 - Context and environment - easy to clean
 - Aesthetic - look good
 - Economic - not cost too much

Design trade-offs

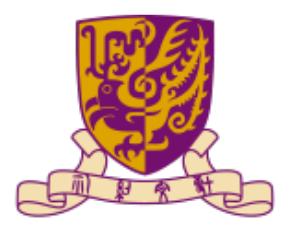
- Constraints are contradictor ... need trade-offs
- Within categories
 - Safety - cooker controls
 - Front panel - safer for adult
 - Rear panel - safer for child
- Between categories
- Ergonomics vs. physical - MP3
 - Ergonomics - controls need to be bigger
 - Physical - few space
 - Solution - multifunction controls and reduced functionality



Physical layout

- Controls
- Logical relationship ~ spatial grouping





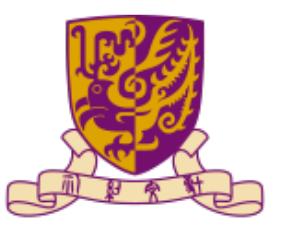
Managing value

- People use something ONLY IF it has perceived value AND value exceeds cost
- But note
 - Exception e.g., habit
 - Value NOT necessarily personal gain or money

Weighing up value

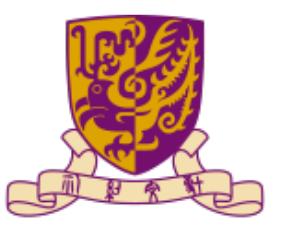
- Value
 - Help me get work done
 - Fun
 - Good for others
- Cost
 - Download time
 - Learning curve
 - Money





Discounted future

- In life, people heavily discount
 - Future value and future cost
 - Resistance to learning
 - Need low barriers and high perceived present value



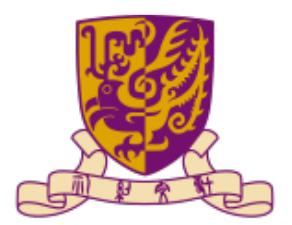
Value and organizational design

- Coercion
 - Tell people what to do
 - Value = keep your job
- Enculturation
 - Explain corporate values
 - Establish support
- Emergence
 - Design process so that individual value -> organizational value

General lesson for design

- If you want someone to do something
 - Make it easy for them
 - Understand their values





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Thank Prof. Alan Dix for many of the slides!