

Week 8-2

Memory

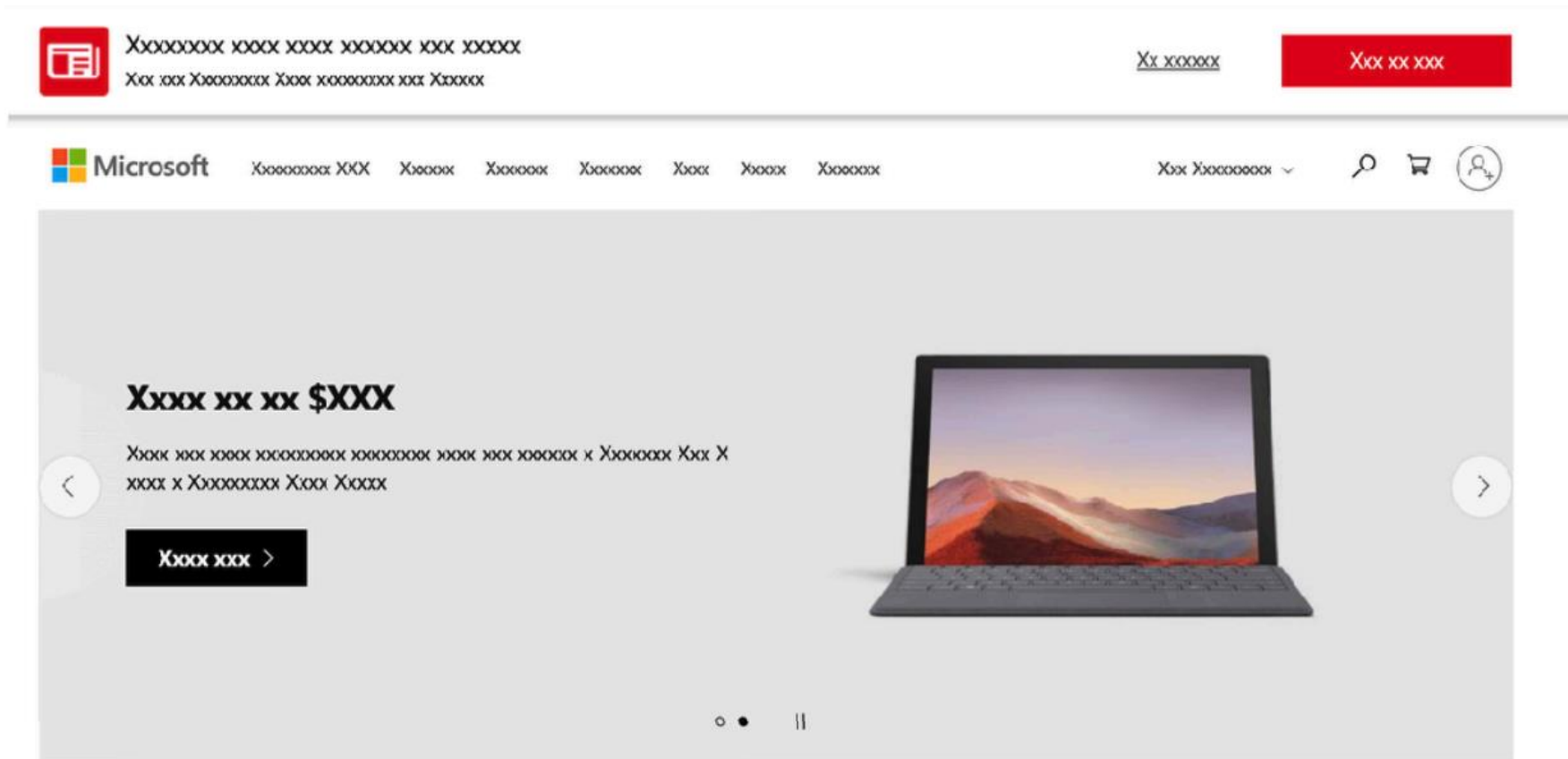
SFWRENG 4HC3/6HC3 Human Computer Interfaces

** Slides adapted from previous instructors of COMPSCI/SFWRENG 4HC3/6HC3*

Gestalt: Review

- **Proximity:** place items that are related close to one another (use whitespace)
- **Similarity:** use similar visual design for similar items to help with grouping and comprehension
- **Continuity:** lay related items in lines or continuous curves to show that they are related
- **Closure:** expect the brain to “fill in the gaps”, e.g., you can use dotted lines or overlay panels
- **Area:** smaller shapes on larger ones become grouped on the larger shape
- **Symmetry:** lay out items in the same fashion to leverage clear grouping and relationship

Gestalt: Review



- Proximity
- Similarity
- Continuity
- Closure
- Area
- Symmetry

The Human

A **simplified view** of “the human” involves:

- **Input/output** (vision, auditory, haptic; movement, voice)
- **Memory** (short term, long term, sensory)
- **Processing** (cognition, problem solving, learning, etc...)

Each person is **different** in these aspects!

Week 8 Overview

- **Monday**
 - ~~Perceptions: Gestalt~~
- **Wednesday**
 - **Memory**
- **Friday**
 - **Cognition**

Memory, Cognition, and Learning

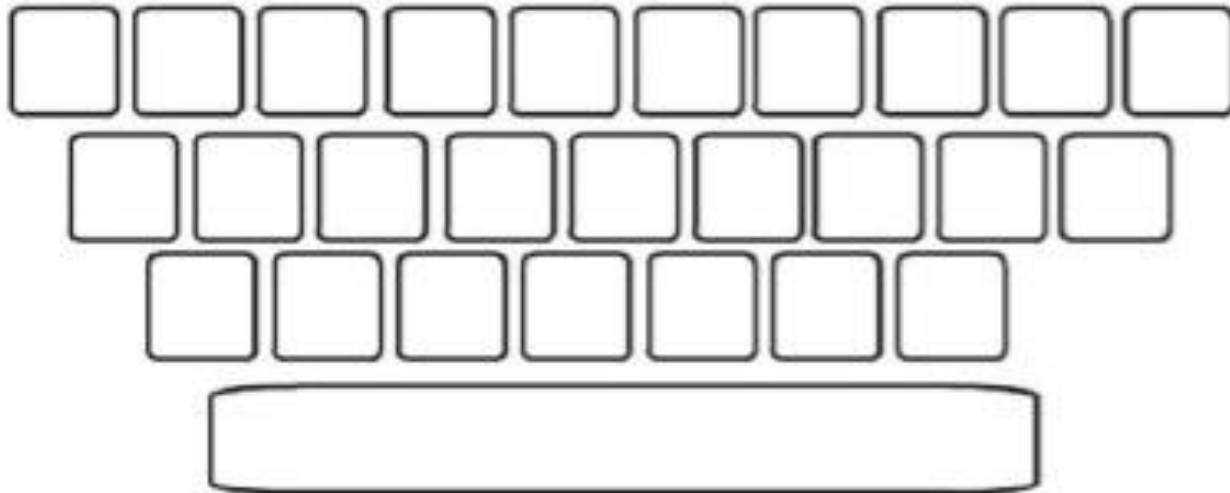
Interacting with technology is **cognitive process**

Need to take into account **cognitive theories** in HCI
and **cognitive limitations of users**

- Provide insight into what users can and cannot be expected to do
- Help identify and explain the nature and causes of problems users encounter

Keyboard Layout

Team-member Name: _____



Completion Time (s): _____

Key Placement Errors (count): _____

Phrase Entry Time (s): _____

Typing Style: *Touch-typing* or *Hunt-and-peck*

Typing Speed (wpm): _____

Number of Typos (count): _____

Memory

- Involves **storing & recalling** knowledge and acting appropriately
- **We don't remember everything** – need to filter and process
- Designers need basic understanding of memory to make good design choices



Memory

There are 3 types of memory:

- Sensory
- Short-term
- Long-term

Sensory Memory

Small buffers for stimuli:

- Iconic memory for visual (~0.25 sec)
- Echoic memory for aural (3-4 sec)
- Haptic memory for touch (2 sec)

Retains some information after stimulus over, but **very temporary**

- Information constantly **over-written/destroyed**

Attention

Information is passed from sensory memory to short-term memory **through attention**

Which stimuli we attend to depends on:

- Arousal
- Need
- Interest

Short-Term Memory

- a.k.a. **Working memory**
- Acts as **temporary “scratch pad”** for recall
- Rapid access (~70ms), rapid decay (~200 ms) – **very effective**
- **Interference** often causes **disturbances** in short-term memory retention
 - This accounts for the desire to complete the tasks held in short-term memory as soon as possible

Short-Term Memory

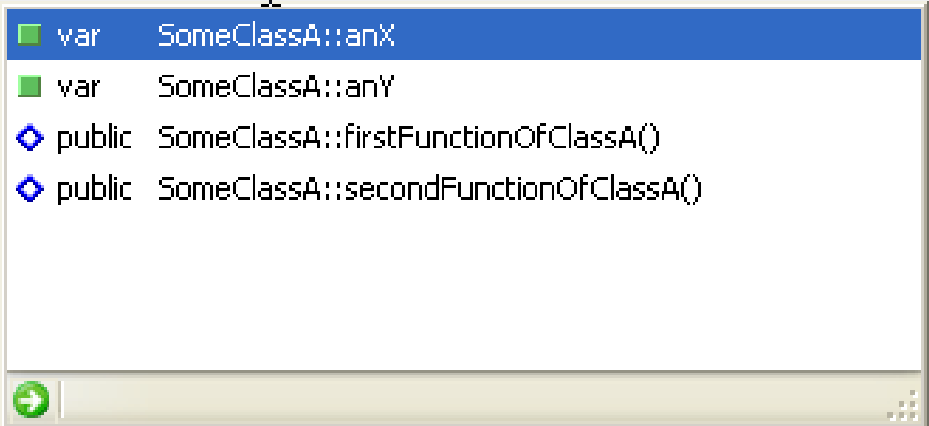
- Limited capacity
- 7+-2 **chunks** (Miller, 1956)
 - Chunk: meaningful combination of items
- **“Chunking” of data helps memory**
- With good chunking, short-term memory is essentially unlimited
 - CAT DOG PIG CLOCK (n=4 chunks)
 - ATD OGP IGC LOCKC (n=14 chunks)

Short-Term Memory

For design, we want to **minimize how many things** your user needs to keep in memory as they work

- you just made a new variable and scrolled down.. what exactly was the name again?

```
/**/  
function function1($bA, $bB) {  
    $bA->  
}  
  
// ph  
function  
    $bB->  
  
// php5 syntax is also supported:
```



Short-Term Memory

Inappropriate use of the 7+-2 rule

- Present only 7 options on a menu
- Display only 7 icons on a tool bar
- Have no more than 7 bullets in a list
- Place only 7 items on a pull-down menu
- Place only 7 tabs on the top of a website page

These are not things that need to be stored in memory!!

Short-Term Memory

Short-term memory **not enough?**

Vi has 50+ “basic commands,” how can you learn them?

Long-Term Memory

- Long-term store of **facts, experiential knowledge, procedures**
- Unlimited (?) capacity
- Slow access time ($> \sim 0.1$ second)
- Slow or **no decay**
- Information moves from short- to long-term memory through **rehearsal**
- Research also suggests that learning time is most effective if it is distributed over time

Don't expect your users to learn things right away, know that it takes time!!

Long-Term Memory

Episodic memory

- Memory of events and experiences in **a serial form**
- From this we can reconstruct events

Semantic memory

- Structured record of **facts and concepts**
- Can be derived from episodic memory: we can learn new facts or concepts from our experiences

People remember **processes** they have done **repeatedly**, in the **order** they did it

People can also remember **facts** such as program commands, but it's **harder** and **derives from processes**

Long-Term Memory

In addition to practice, what else helps us **remember**?

- **Meaning** – understanding how and why
 - New information can be added to existing memory structures
- **Categories** – grouping and chunking!
- **Pictures** – visual memory as well as factual
- **Cues to assist with recall** should be provided during the phase of encoding (creating memory)
- **Recognition** much easier than **recall**
- Research also suggests that learning time is most effective if it **is distributed over time**

Long-Term Memory

What can cause us to “**forget**”?

- Debatable whether we actually ever forget anything or whether it becomes increasingly difficult to access certain items from memory

Interference

- When things to be memorized are similar, they overlap, e.g., learning bash, csh, and dos
- Learning hotkeys in programs – what is copy and paste?

Interference: Two Directions

Retroactive Interference

- Learning a new thing interferes with the old
- Get a new phone number or postal code, hard to remember the old one

Proactive Interference

- Old information leaks through (inhibits new memory)
- New lock combination, usually remember old one first

Long-Term Memory

Where is long-term memory important in HCI?

Scenarios:

- Remembering procedures?
- Websites visited?
- Files?

Reducing Memory Load

Users sometimes have to employ **workarounds** to reduce memory load

e.g., **externalizing information**

Failure of interface or crutch?

Reducing Memory Load

Don't reinvent the wheel!

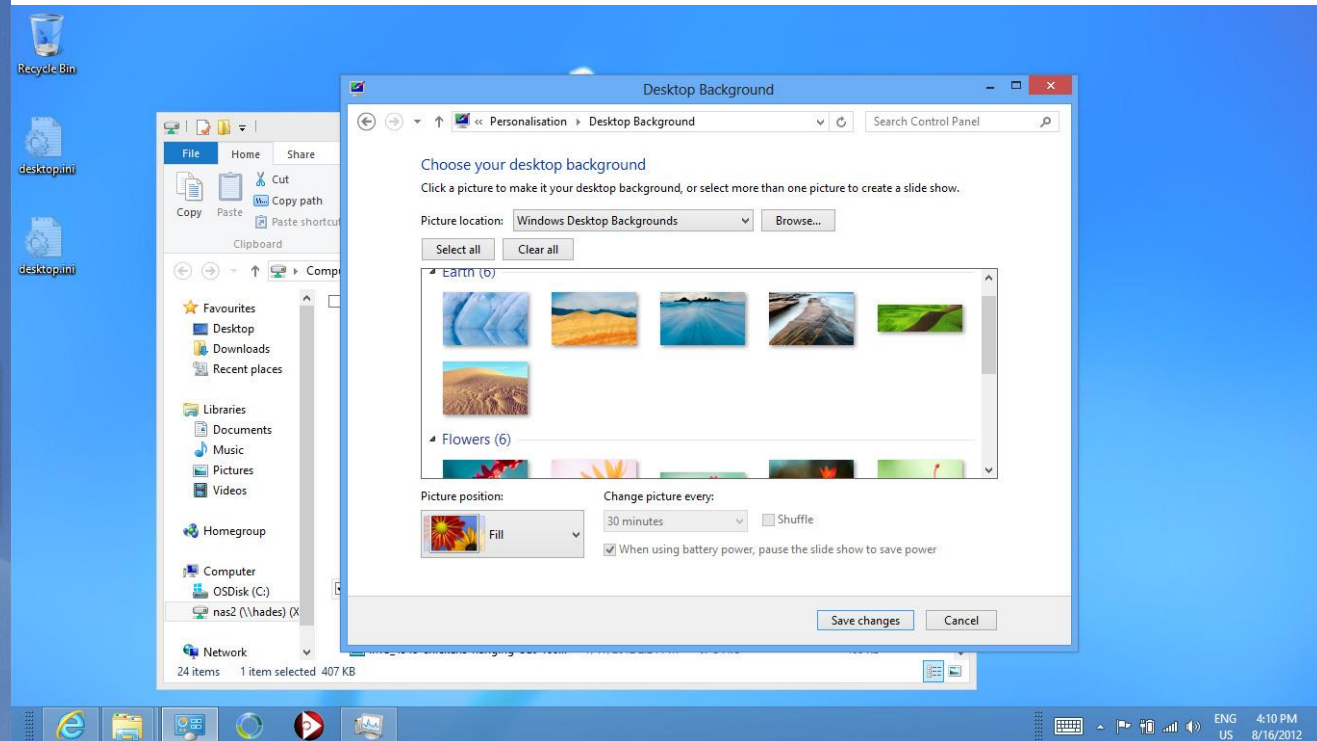
- **Leverage existing memories** to your own benefit – **stick to the norms**
- **Don't change** hotkeys, keywords, etc. between versions
- Use **metaphors** to piggyback on existing memories

Make things memorable

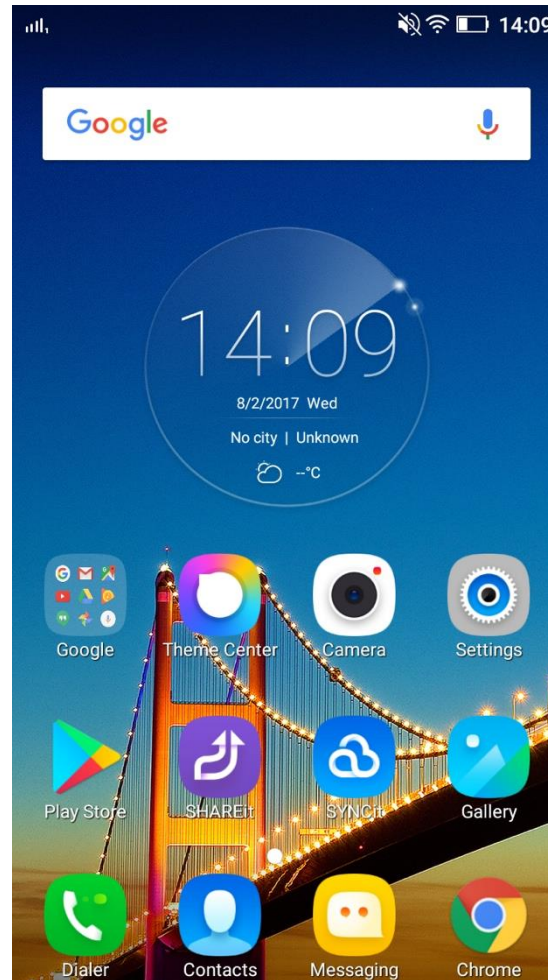
- Use visual memory / icons
- Make new items unique to avoid interference / overlap (e.g., print properties, printer properties, printer settings)

Why c-like languages are very common?

Example: Desktop Metaphor



Example: App Model



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