

C-D 001

Introduction to Human-Computer Interaction

Class 3

Course matters

Assignment 1 returned

Sandeep's talk - feedback?

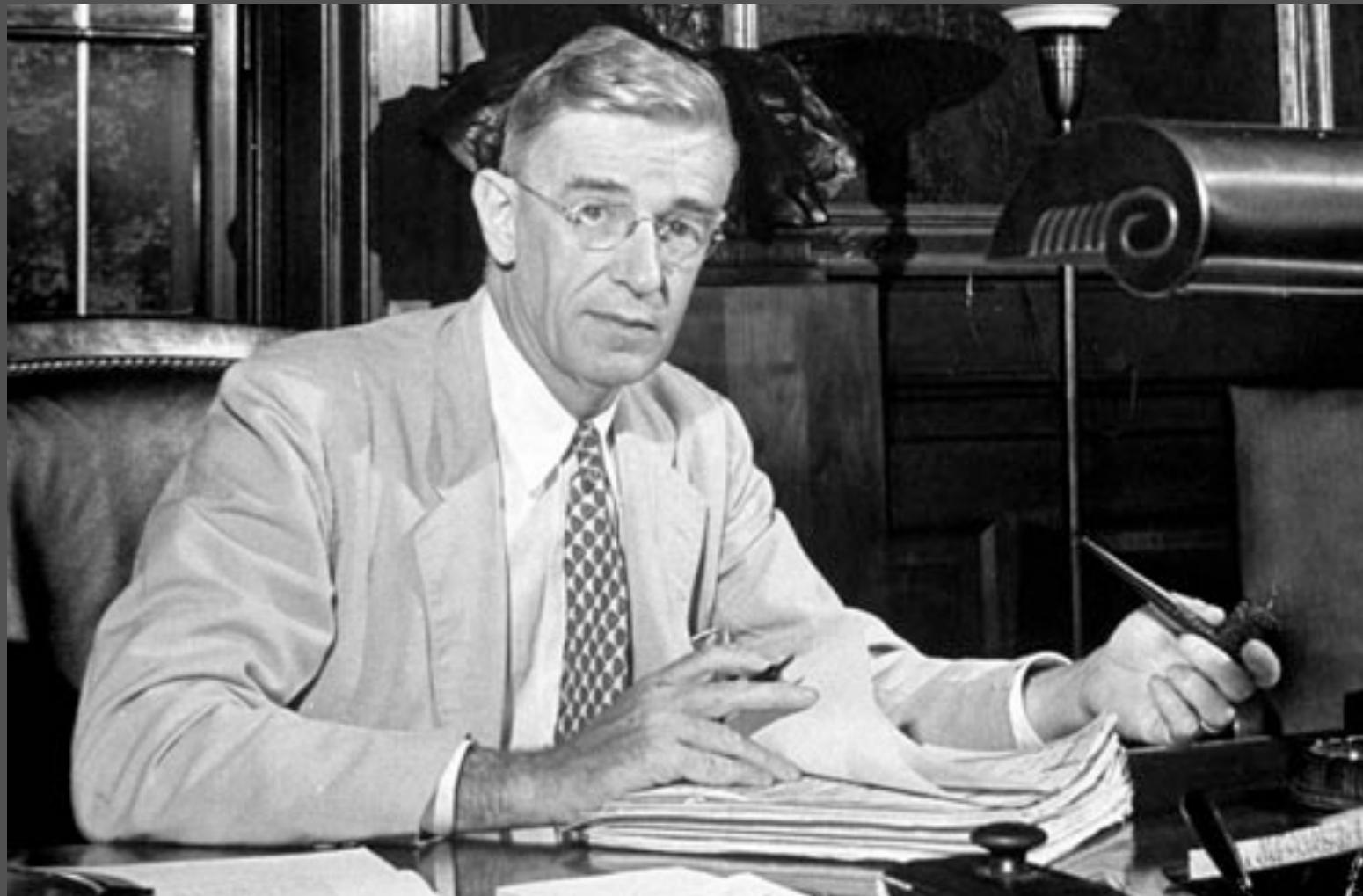
Assignment 2 due before this class

Assignment 3 due Friday midnight

Balsamiq tutorial this week

How are the idea logs going?

As we may think



As we may think

Written in 1945, after 50-60 years of tech. inventions
(Electricity distribution, automobiles, airplanes, movies,
TV, telephone, atomic bomb...)

"[Man] has built a civilization so complex that he needs to mechanize his records more fully if he is to push his experiment to its logical conclusion and not merely become bogged down part way there by overtaxing his limited memory."

Memex

"... for we can enormously extend the record; yet even in its present bulk we can hardly consult it"

"A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory."

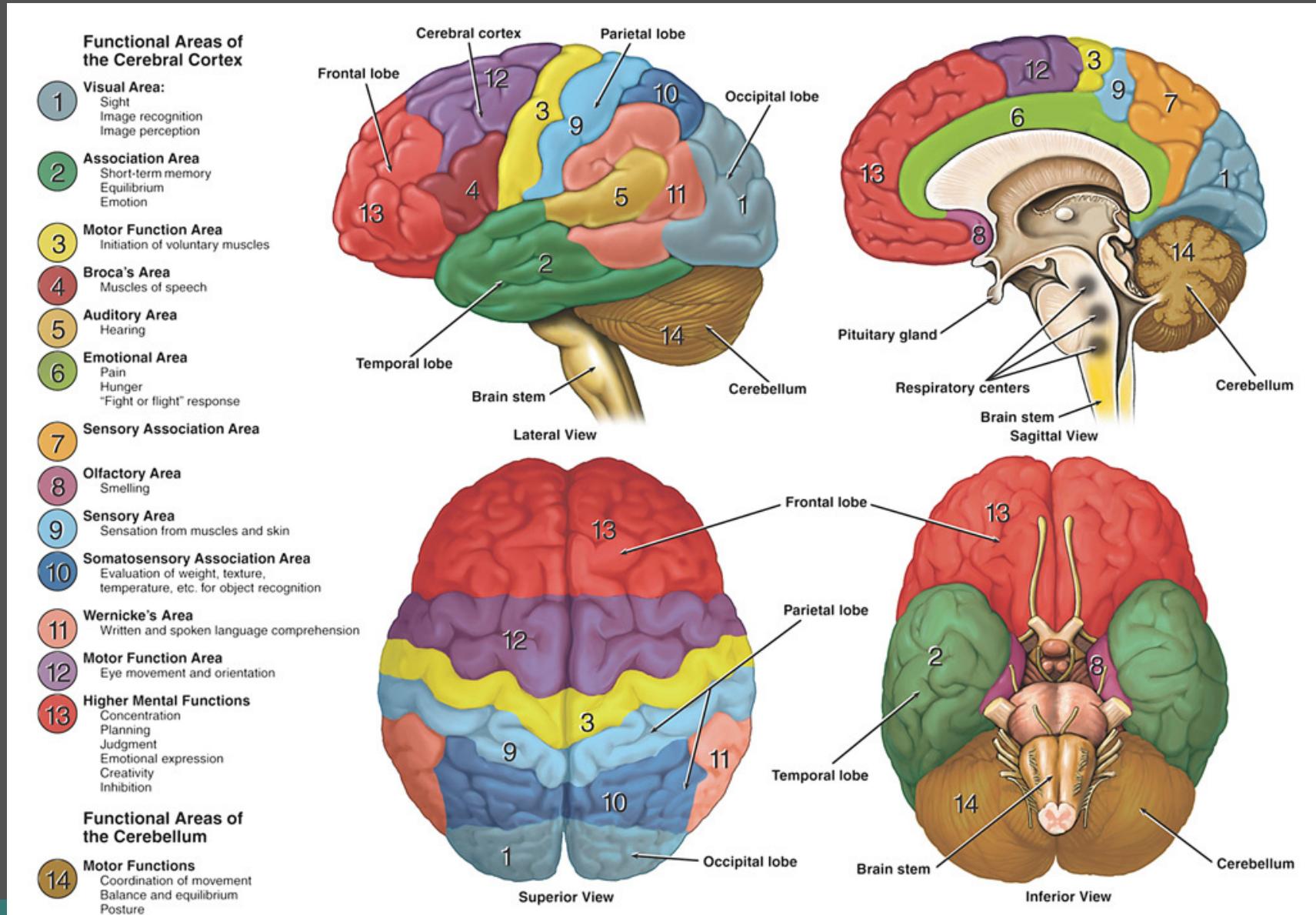
Memex #001



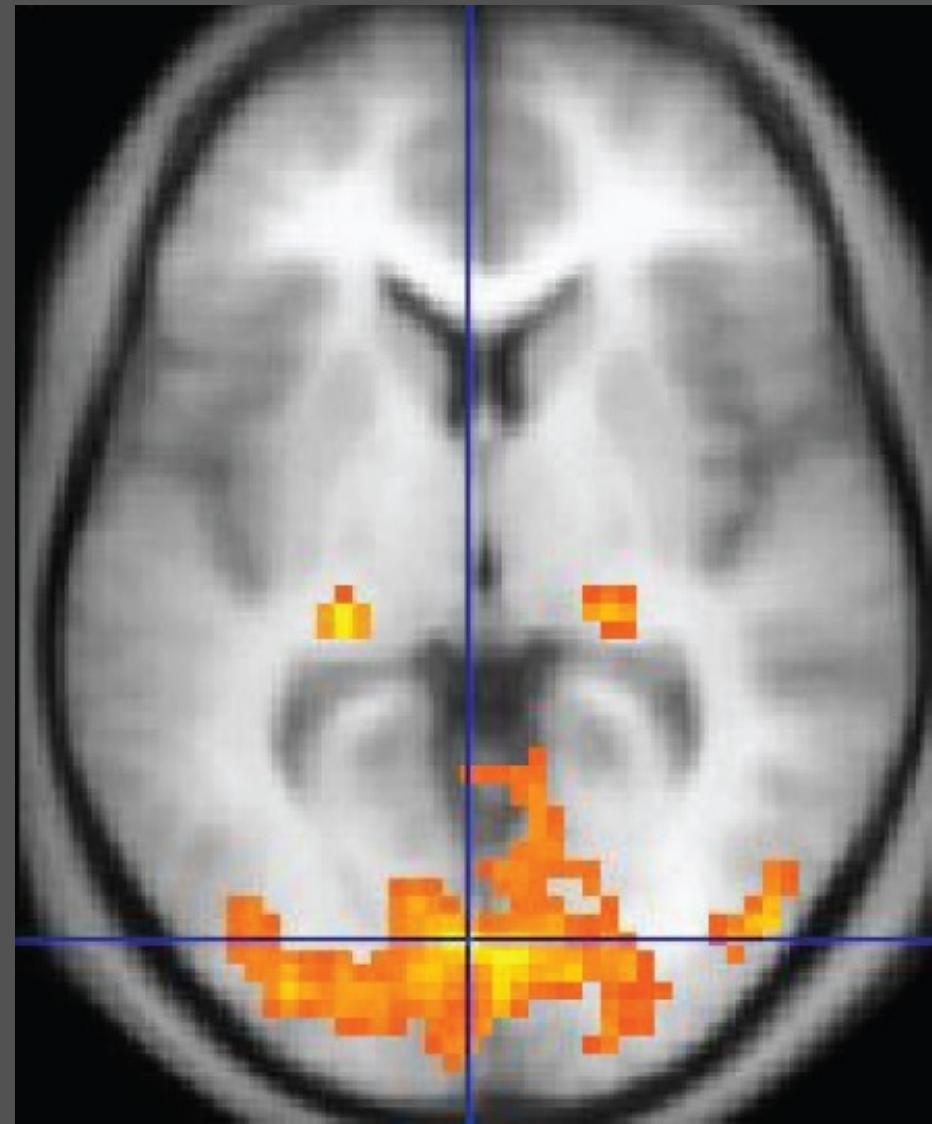
Designed in 1945, Constructed in 2014



Areas of the brain



fMRI



Interaction Models

High-level interaction models

Given an interface, can we predict user performance on some task using a high-level cognitive model?

This may tell us which interface might be better at a task without having to build its details

How to Organize Your Kitchen Like a Professional Chef

The kitchen-wear entrepreneur Ellen Bennett shares tips for keeping food labeled, spices sorted and drawers in perfect order.



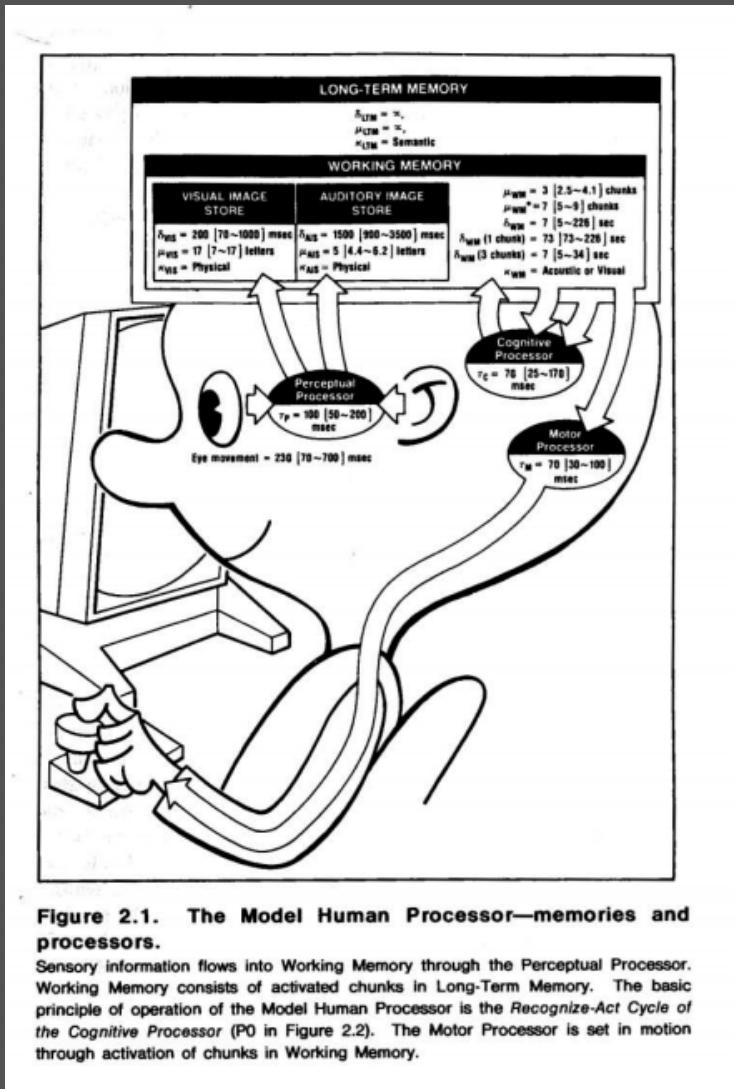
High-level interaction models

Useful for “back-of-the-envelope” comparison...

May have to be calibrated for specific operations
(generally by expert users)

Evaluated on target task(s)

Model Human Processor



μ , the storage capacity in items,
 δ , the decay time of an item, and
 κ , the main code type (physical, acoustic, visual, semantic).

Fitt's Law

$$Time \text{ to acquire target} \propto \log\left(\frac{A}{W} + 1\right)$$

A = Amplitude (distance to target)

W = width of target

Try it at <http://simonwallner.at/ext/fitts/>

High-level interaction models

GOMS:

- Goals
- Operators
- Methods
- Selectors

Keystroke Level Model:

- (K) Keypress, (P) Point,
- (H) Home to keyboard,
- (D) Draw line

```
GOAL COPY-AND-PASTE-TEXT
GOAL COPY-TEXT
GOAL HIGHLIGHT-TEXT
    Operator MOVE-CURSOR-TO-BEGINNING
    Operator CLICK-MOUSE-BUTTON
    Operator MOVE-CURSOR-TO-END
    Operator SHIFT-CLICK-MOUSE-BUTTON
    Operator VERIFY-HIGHLIGHT
GOAL ISSUE-COPY-COMMAND
Select*:
    GOAL USE-MOUSE
        Operator MOVE-CURSOR-TO-EDIT-MENU
        Operator PRESS-MOUSE-BUTTON
        Operator MOVE-CURSOR-TO-COPY-ITEM
        Operator VERIFY-HIGHLIGHT
        Operator RELEASE-MOUSE-BUTTON
    GOAL USE-KEYBOARD
        Operator PRESS-KEY-STRG
        Operator PRESS-KEY-C
        Operator RELEASE-KEYS
    GOAL PASTE-TEXT[...]
*Selection rule for GOAL ISSUE-COPY-COMMAND
If HANDS-ARE-ON-KEYBOARD then
    select GOAL USE-KEYBOARD
else
    select GOAL USE-MOUSE
```

GOMS principle is intuitive

Mental math: compute

$$354 + 988$$

$$280 * 0.5$$

Different computation methods have different cognitive costs/time

The GOMS method forces us to assign costs and evaluate options systematically

Sudoku puzzle

5	1		3	4	6		8	
8						2	4	
	4			1				
2	3	4	9				6	
9	6	8		2			3	
5	8			3		7		
	2		5	3	1		4	
7	1				2			
8				9				

No 199

6 is the only entry that can go in **this cell.** 

Accept

Sudoku puzzles

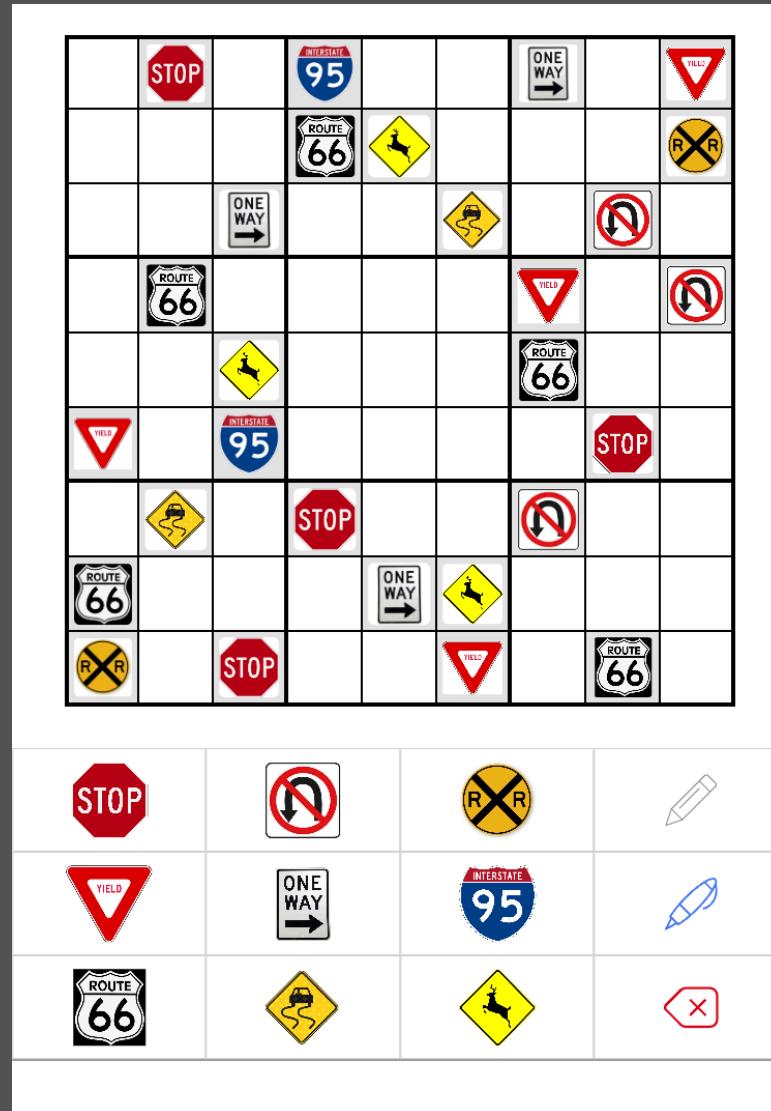
Spot a missing number in

12347895

VS.

14395278

Picdoku puzzle



Augmenting cognition

Scanning a web page

The New York Times – Breaking News, World News & Multimedia

The New York Times – Breaking... www.nytimes.com

Muse Login Muse search CSEs Slant Google Marker port Bookmarks

World »

- As European Union Beckons, Allure Fades for Wary Croatia
- Rescue Effort Suspended as Cruise Ship Shifts on Rocks
- Ship Salvage Workers Roll Up Their Sleeves

Business Day »

- Protest on Web Uses Shutdown to Take On Two Piracy Bills
- In Tech, Starting Up by Failing
- DealBook: Another Bitter Divorce for Perelman

Opinion »

- Op-Ed Columnist: Trust, but Verify
- Editorial: Preaching Division in South Carolina
- Op-Ed Columnist: Hunting, Dear Sir? Delighted!

DINING & WINE »

Sorcerer's Apprentice Hosts a Dinner

Melissa Clark brings the avant-garde recipes of the cookbook "Modernist Cuisine" to her home kitchen.

MELISSA CLARK

U.S. »

- Young, in Love and Sharing Everything, Including a Password
- Few Cities Have Regained Jobs They Lost, Report Finds
- Affirmative-Action Foe Is Facing Allegations of Financial Misdeeds

Technology »

- Protest on Web Uses Shutdown to Take On Two Piracy Bills
- Jerry Yang, 'Chief Yahoo,' Steps Down From Board
- Young, in Love and Sharing Everything, Including a Password

Arts »

- Movie Review | 'Crazy Horse': The Agony Behind an Erotic Club's Ecstasy
- Technology Helps Sundance Films Capture the Moment
- 'Spider-Man' Producers Sue Taymor for Breach

REAL ESTATE AUTOS JOBS ALL CLASSIFIEDS

LIVING IN | ESSEX FELLS, N.J.

Holding Fast to Old-Fashioned Ways

With 2,113 residents nestled into 1.3 square miles of hilly, tree-lined terrain, Essex Fells is the smallest community in Essex County and also one of its most desirable.

FIND PROPERTIES

- Go to Real Estate Section
- Search for Properties
- Download the Real Estate App
- Commercial Real Estate
- Video Showcase: Real Estate
- Post an Ad

Sports »

- In Year of Hut, Hut, Hut, the 49ers Hit, Hit
- The Fifth Down: Pining for Sideshow Rex and His Bickering Jets
- Mets Owners Can Look Forward

Movies »

- Technology Helps Sundance Films Capture the Moment
- Movie Review | 'Crazy Horse': The Agony Behind an Erotic Club's Ecstasy
- Movie Review | 'The City Dark':

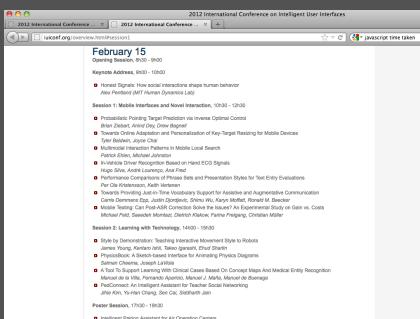
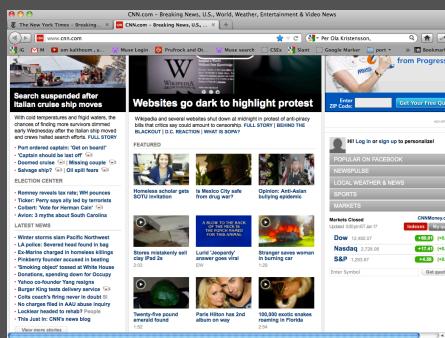
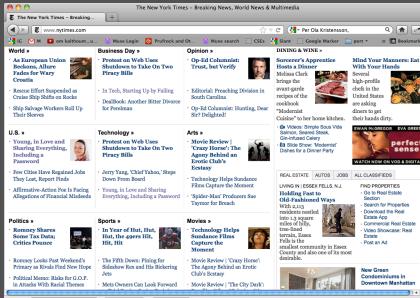
New Green Condominiums in Downtown Manhattan

Using personal history

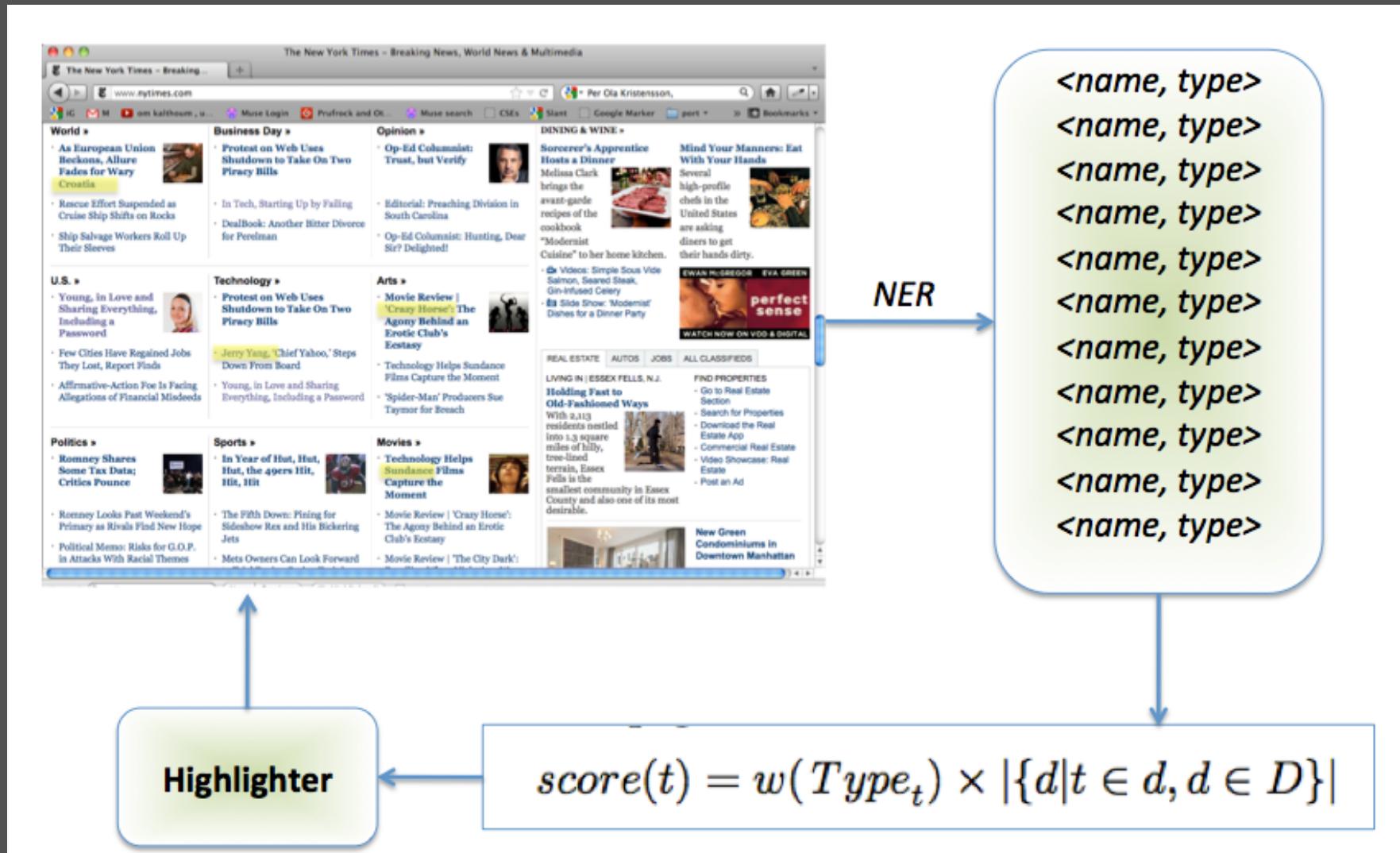


Email history

101010
011010
100101
010101
011101
010100
101010
101010
101010
010101
010101
001010
010010
100101
0000



Experience-infused browser



Cognition: wrap-up

Recap

Elements of cognition: Attention, perception, memory, learning, decision-making, language

Perception fixation (resistance to change)

Incongruities impose a cognitive burden

Experiments in cognition

Modeling design choices/user interfaces through step-by-step operations

Cognitive biases

Important tool for critical thinking

Critical for objective decision-making

Used extensively by intelligence agencies (CIA)

Be aware of your own biases and those of others

Judgment under Uncertainty: Heuristics and Biases

Biases in judgments reveal some heuristics of thinking under uncertainty.

Amos Tversky and Daniel Kahneman

Many decisions are based on beliefs concerning the likelihood of uncertain events such as the outcome of an election, the guilt of a defendant, or the future value of the dollar. These beliefs are usually expressed in statements such as "I think that . . . , " "chances are . . . , " "it is unlikely that . . . , " and so forth. Occasionally, beliefs concerning uncertain events are expressed in numerical form as odds or subjective probabilities. What determines such beliefs? How do people assess the probability of an uncertain event or the

mated when visibility is good because the objects are seen sharply. Thus, the reliance on clarity as an indication of distance leads to common biases. Such biases are also found in the intuitive judgment of probability. This article describes three heuristics that are employed to assess probabilities and to predict values. Biases to which these heuristics lead are enumerated, and the applied and theoretical implications of these observations are discussed.

occupation from a list of possibilities (for example, farmer, salesman, airline pilot, librarian, or physician)? How do people order these occupations from most to least likely? In the representativeness heuristic, the probability that Steve is a librarian, for example, is assessed by the degree to which he is representative of, or similar to, the stereotype of a librarian. Indeed, research with problems of this type has shown that people order the occupations by probability and by similarity in exactly the same way (1). This approach to the judgment of probability leads to serious errors, because similarity, or representativeness, is not influenced by several factors that should affect judgments of probability.

Insensitivity to prior probability of outcomes. One of the factors that have no effect on representativeness but should have a major effect on probability is the prior probability, or base-rate frequency, of the outcomes. In the case of Steve, for example, the fact that there are many more farmers than librarians in the population should enter into any reasonable estimate of the probability that Steve is a librarian rather than a farmer. Considerations of base-rate frequency, however, do not affect the similarity of Steve to the

Assignment

Read Kahneman and Tversky, Judgement Under Uncertainty, Heuristics and Biases

Identify at least 3 biases from real life, and the (main) type. Do not just summarise the paper.

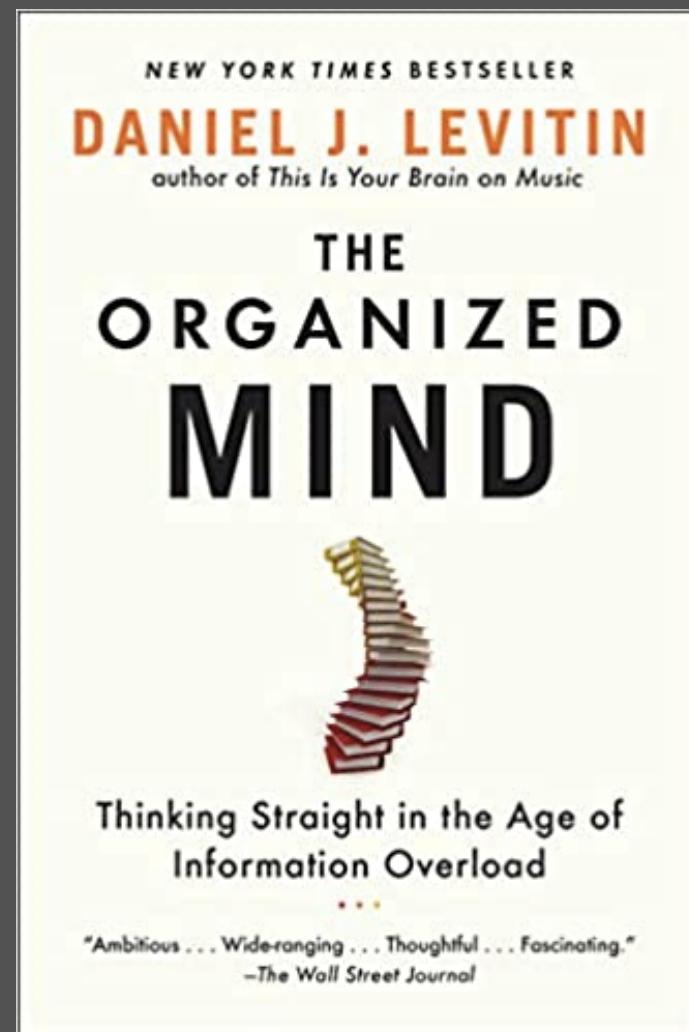
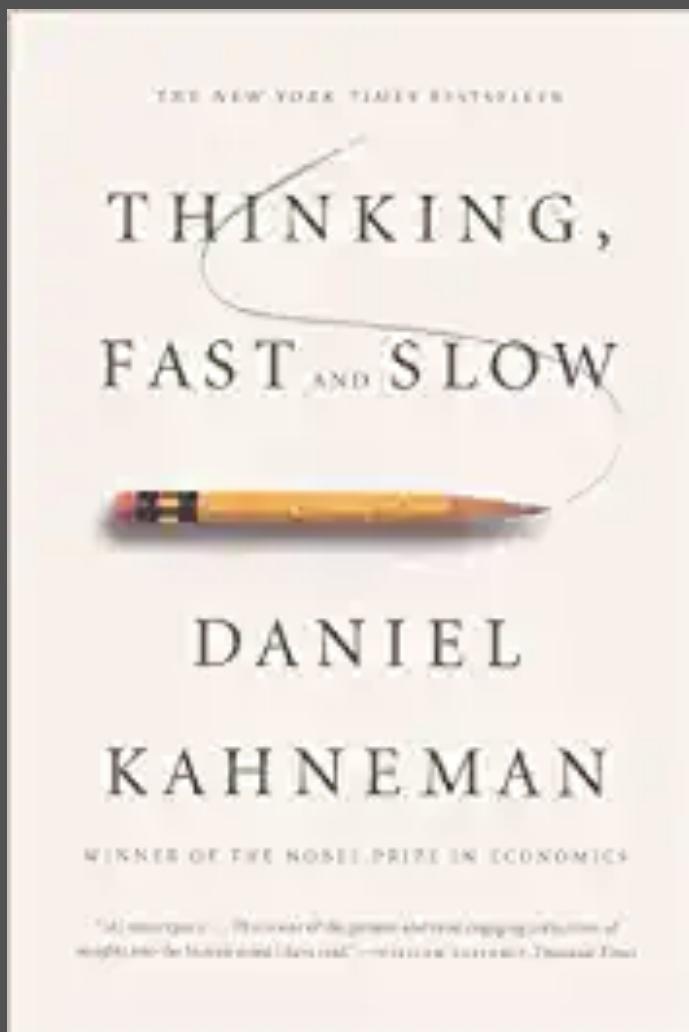
Could be from personal life, surrounding environment, news, etc. Your own bias, or others'.

More points for more concrete and personalized examples.

Write up in about 400 words with an explanation of the type

Due Friday before midnight

Recommended books



THE NEW YORK TIMES BESTSELLER

MOONWALKING



WITH



EINSTEIN

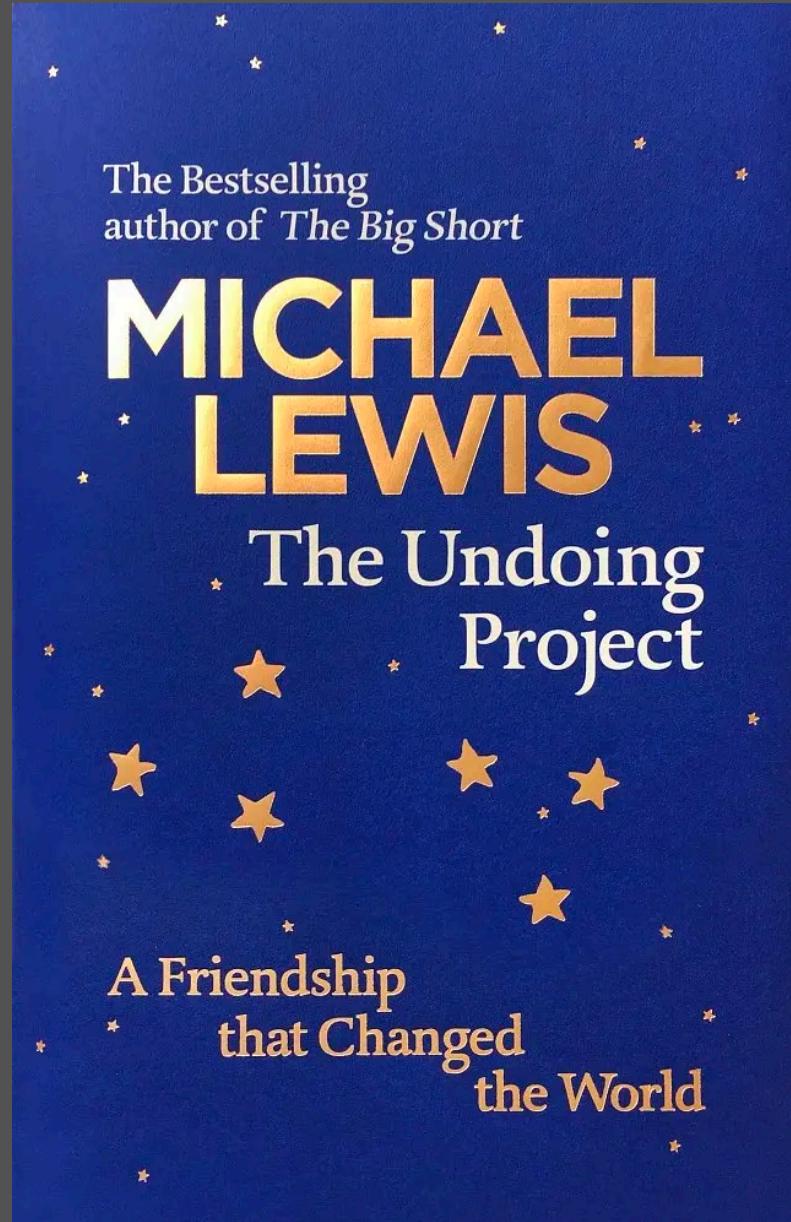


The Art and Science of Remembering Everything

JOSHUA FOER



A very good book



Cognition: Final thoughts

Clever experimental methods

Much still remains to be explored

Intersection of CS + cognitive science

How technology is affecting cognition

Reference: Online course: The Brain and Technology: Brain Science in Interface Design

Human-centered design

Human-centered design

Human needs, capabilities and behaviors are put first, and then a product is designed to support them

1. Understand user
2. Build prototypes
3. Test

Avoid specifying the exact problem too early to avoid narrow framing

Human-centered design...

NOT

What might be some examples?

Other foci:

cost, bureaucracy, lack of interest/awareness, lack of users, lack of time, manufacturing constraints, keeping people “occupied”, supposedly well-understood users,

...

First: ethical issues

Human-subjects experiments

Most “human-subjects” experiments need to be explicitly approved, monitored and reviewed by an Institutional Review Board (IRB)

Approval must be obtained *before* the research takes place

General need to undergo a training program

Strong policies on informed consent, deception, etc.

Stanford prison experiment



Prof. Philip Zimbardo conducted an (in)famous experiment in 1971: 12 students acting as guards and 12 as prisoners for 2 weeks

Other troublesome experiments

Tuskegee syphilis experiment (1932-1972)

Milgram's "Obedience to Authority" experiment (1961)

Facebook's emotional contagion (2014)