

Lecture 33:

HUMAN-COMPUTER INTERACTION

CSC111: Introduction to CS through Programming

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A quick recap...

- Week 0: what is computer science?
- Week 1: hardware, python basics, `input(...)`
- Week 2: numbers (`floats` & `ints`), math, `if` statements
- Week 3: `strings`, `main()`, debugging
- Week 4: `for` and `while` loops, `random`, documentation
- Week 5: functions
- Week 6: `lists`, `dictionaries`, ethical code reuse

A quick recap...

- Week 7: recursion*, cloud computing*, ongoing research*
- Week 8: text adventure games*, MIDTERM
- Week 9: **classes**, inheritance, and OOP
- Week 10: **graphics**, animation, interactive games
- Week 11: prototyping
- Week 12: files, algorithmic thinking, handling **Exceptions**

What's left?

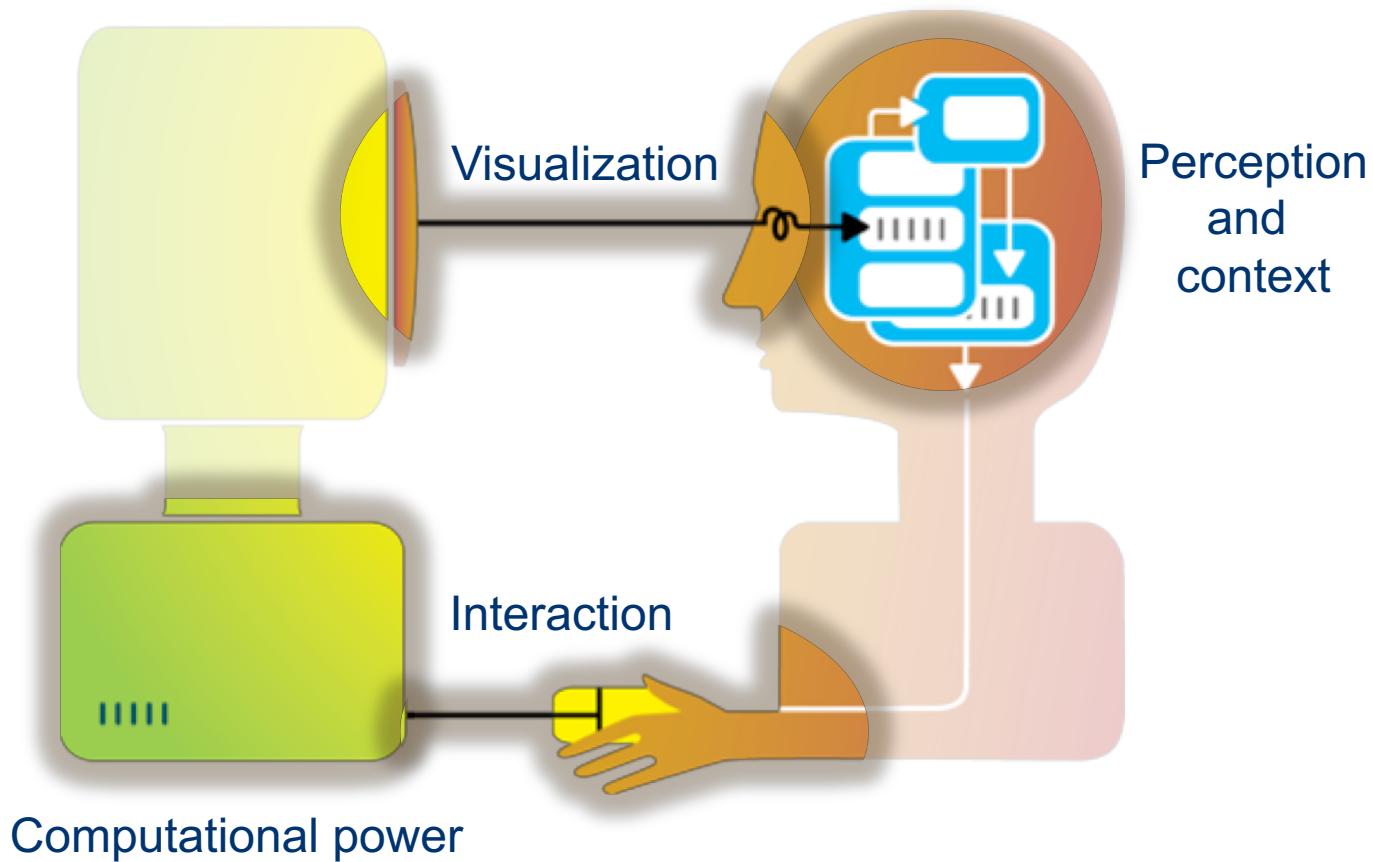
- 12/3: Advanced Topic: Human-Computer Interaction (HCI)
- 12/5: Final Project Workshop
- 12/7: Advanced Topic: TBD
- 12/10: Last Day of Class: Final Project Demonstrations
- 12/12: (class cancelled)

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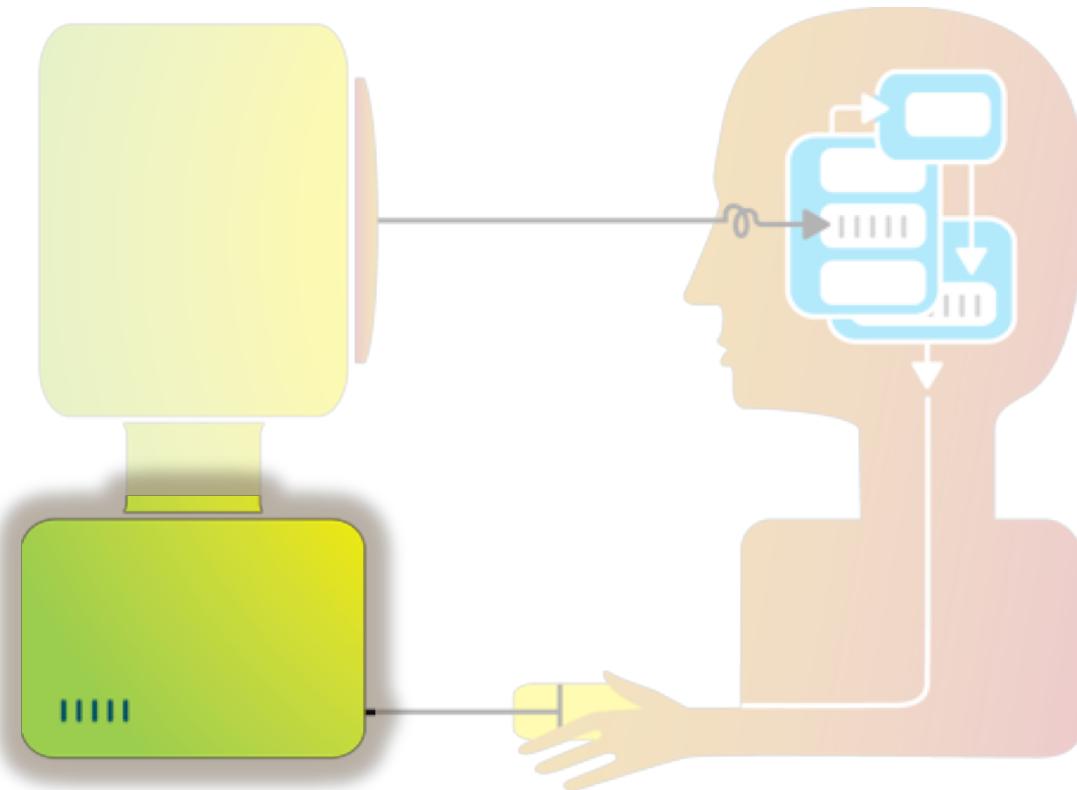
Recap: big idea behind my research

Humans and machines have **complimentary strengths**



This course so far

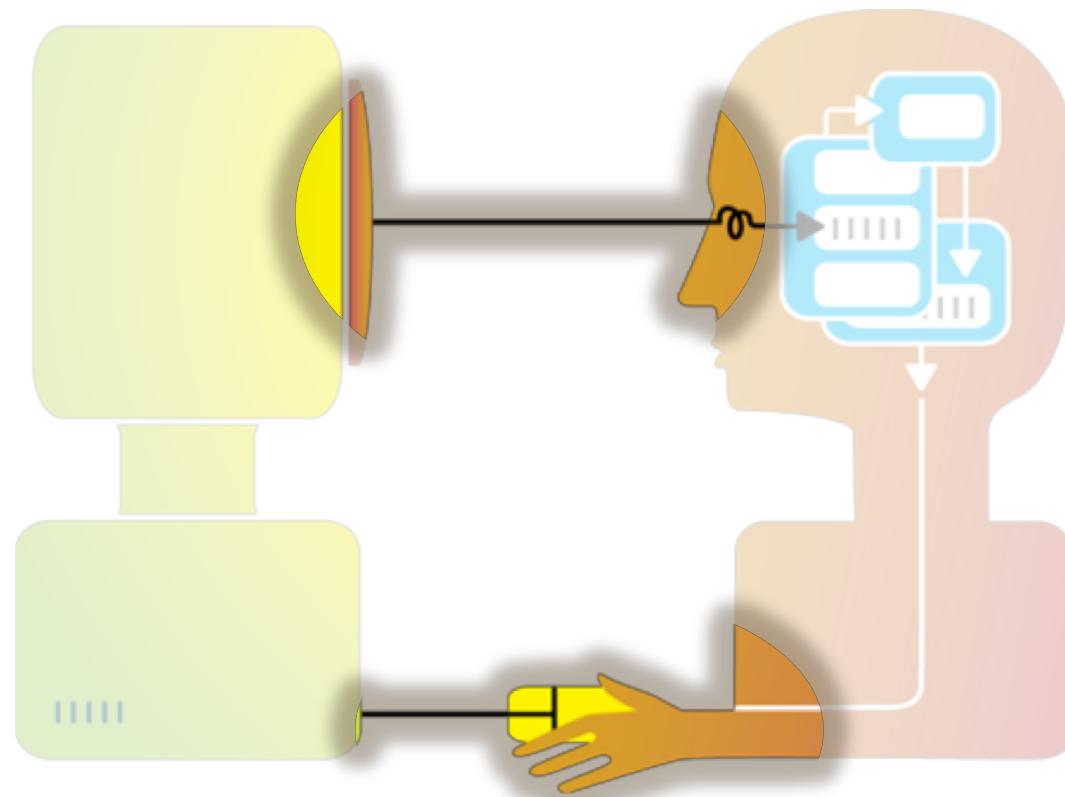
How does this part **work**,
and how do we get it to **do what we want**?



Computational power

Today

How do we **design** ways for humans and machines
to **interact** with one another?



“Human-Computer Interaction” (def.)

“a discipline concerned with the **design, evaluation and implementation of interactive computing systems for human use** and with the study of major phenomena surrounding them.”

ACM SIGCHI Curricula for HCI (Hewett et al. 1992)

<http://sigchi.org/cdg/cdg2.html>

Discussion

Why do we **care**?



Recap: Interaction (def.)

- Ways for the user to affect change in what's happening in the program
- **Low level:** between human and interface
 - the set of operations available
 - happens between the human and the physical computer
- **High level:** between human and problem space
 - a cognitive act enabled by the interface
 - happens between the human and the digital objects

Input devices

How many ways can you think of to get information from the **human** to the **computer**?



Keyboard

- Most common text input device
- Allows rapid entry of text by experienced users
- Keypress closes connection, causing a char code to be sent
- Usually connected by cable, but can be wireless



HUMAN-COMPUTER
INTERACTION

THIRD
EDITION



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FINLAY
ABOWD
BEALE

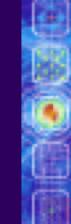
Mouse

- Handheld pointing device
 - very common
 - easy to use
- Two characteristics
 - planar movement
 - buttons used for making a selection, indicating an option, etc.



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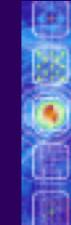
Touchpad

- Small touch-sensitive surface
- Used mainly in laptops
- ‘Acceleration’ is important
 - Fast stroke
 - lots of pixels per inch moved
 - initial movement to the target
 - Slow stroke
 - fewer pixels per inch moved
 - more accurate positioning



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Touchscreen

- Larger, touch-sensitive surface
- Advantages:
 - fast, no specialised pointer
 - good for menu selection
 - easy to clean
- Disadvantages:
 - finger can mark screen
 - imprecise
 - lifting arm can be tiring



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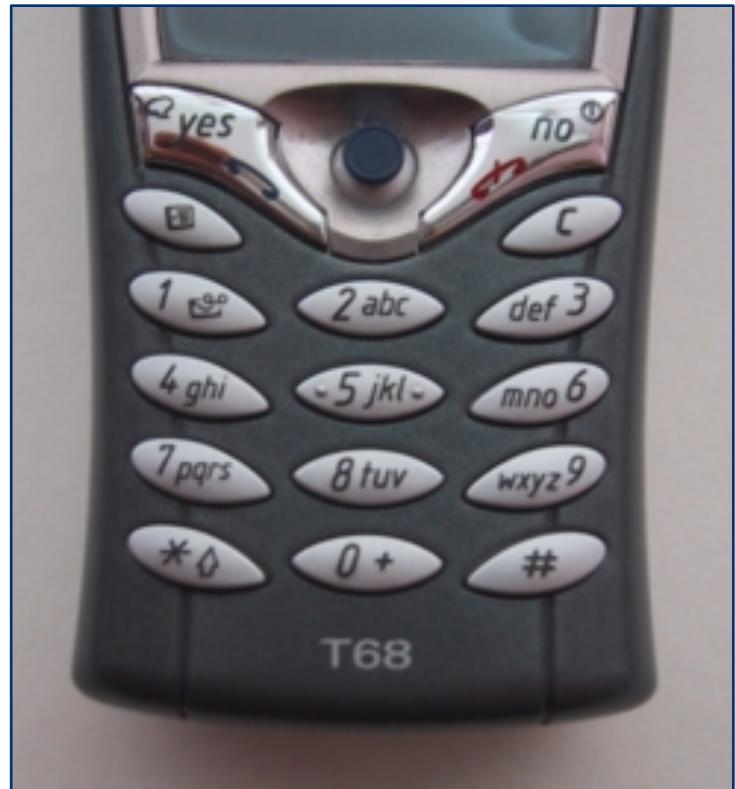
Keypad / T9

- Standard: use numeric keys with multiple presses

hello = 4433555[pause]555666

surprisingly fast!

- T9 predictive entry
 - type as if single key for each letter
 - use dictionary to 'guess' the right word
 - hello = 43556 ...
 - but 26 -> menu 'am' or 'an'

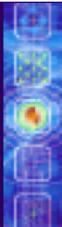


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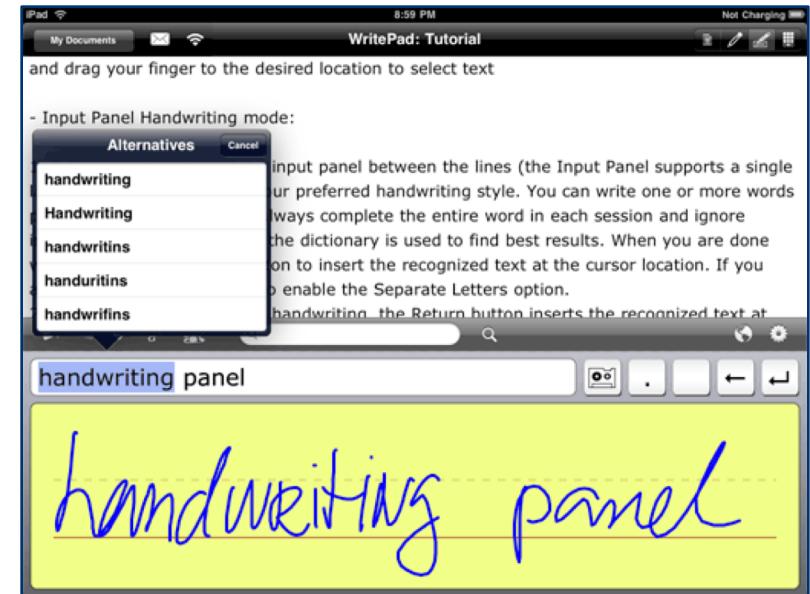


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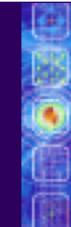
Handwriting recognition

- Input text using a “pen” and a “tablet” (more natural?)
- Technical problems:
 - capturing all useful information: stroke path, pressure, etc.
 - segmenting writing into letters
 - interpreting individual letters
 - coping with different styles of handwriting



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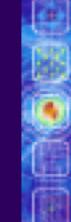
Speech recognition

- Improving **rapidly**
- Most successful when:
 - single user
 - limited vocabulary systems
- Problems with
 - external noise
 - imprecision of pronunciation
 - large vocabularies
 - different speakers



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Lots of others!



Interaction as a reasoning aid

What kinds of (high level) things might someone want to
get the computer to do?



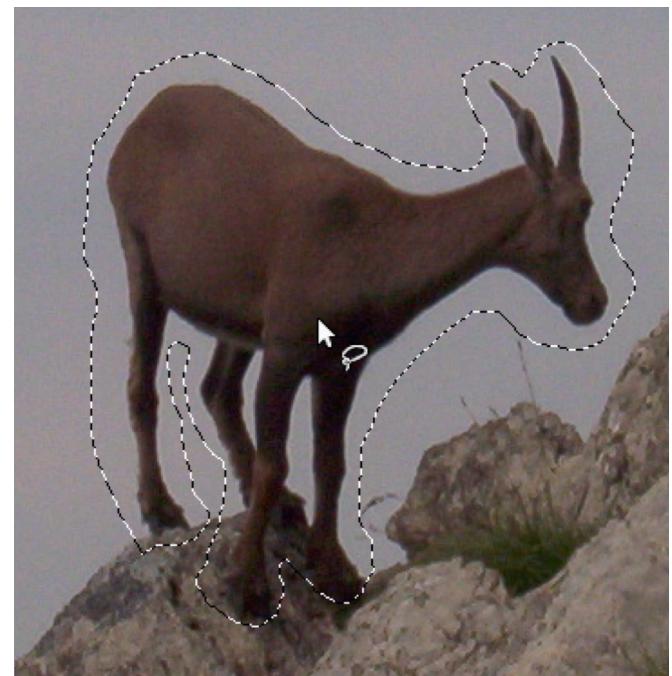
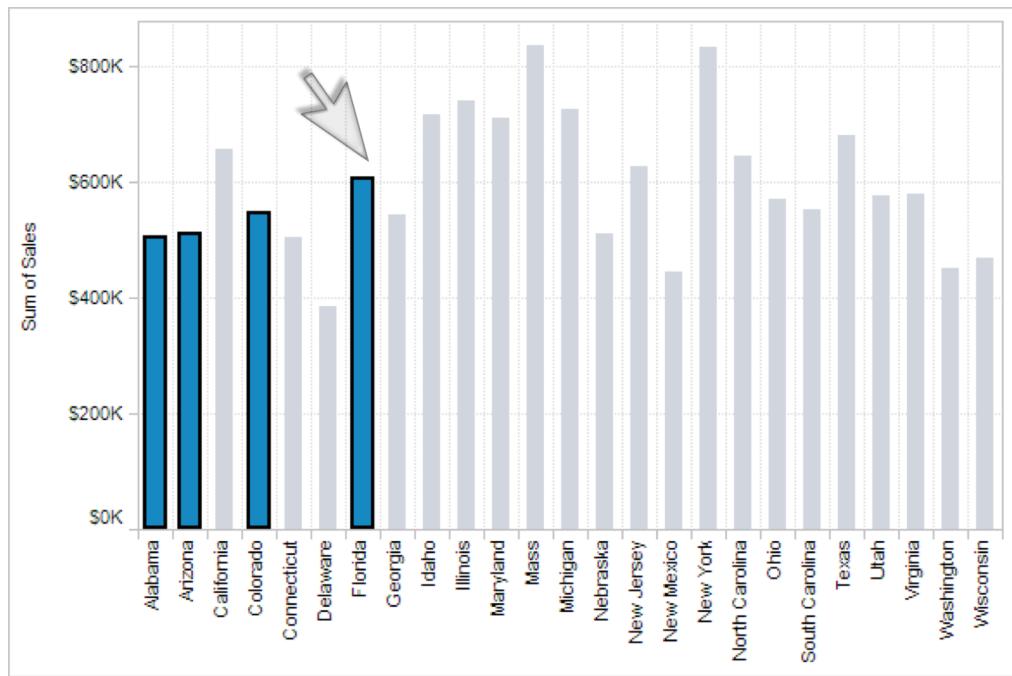
Yi, Kang, Stasko and Jacko (2007)

1. **Select**: mark something as interesting
2. **Explore**: show me something else
3. **Reconfigure**: show me a different arrangement
4. **Encode**: show me a different representation
5. **Abstract/Elaborate**: show me more or less detail
6. **Filter**: show me something conditionally
7. **Connect**: show me related items

Yi, J. S., ah Kang, Y., Stasko, J. T., & Jacko, J. A. (2007). Toward a deeper understanding of the role of interaction in information visualization. *Visualization and Computer Graphics, IEEE Transactions on*, 13(6), 1224-1231.

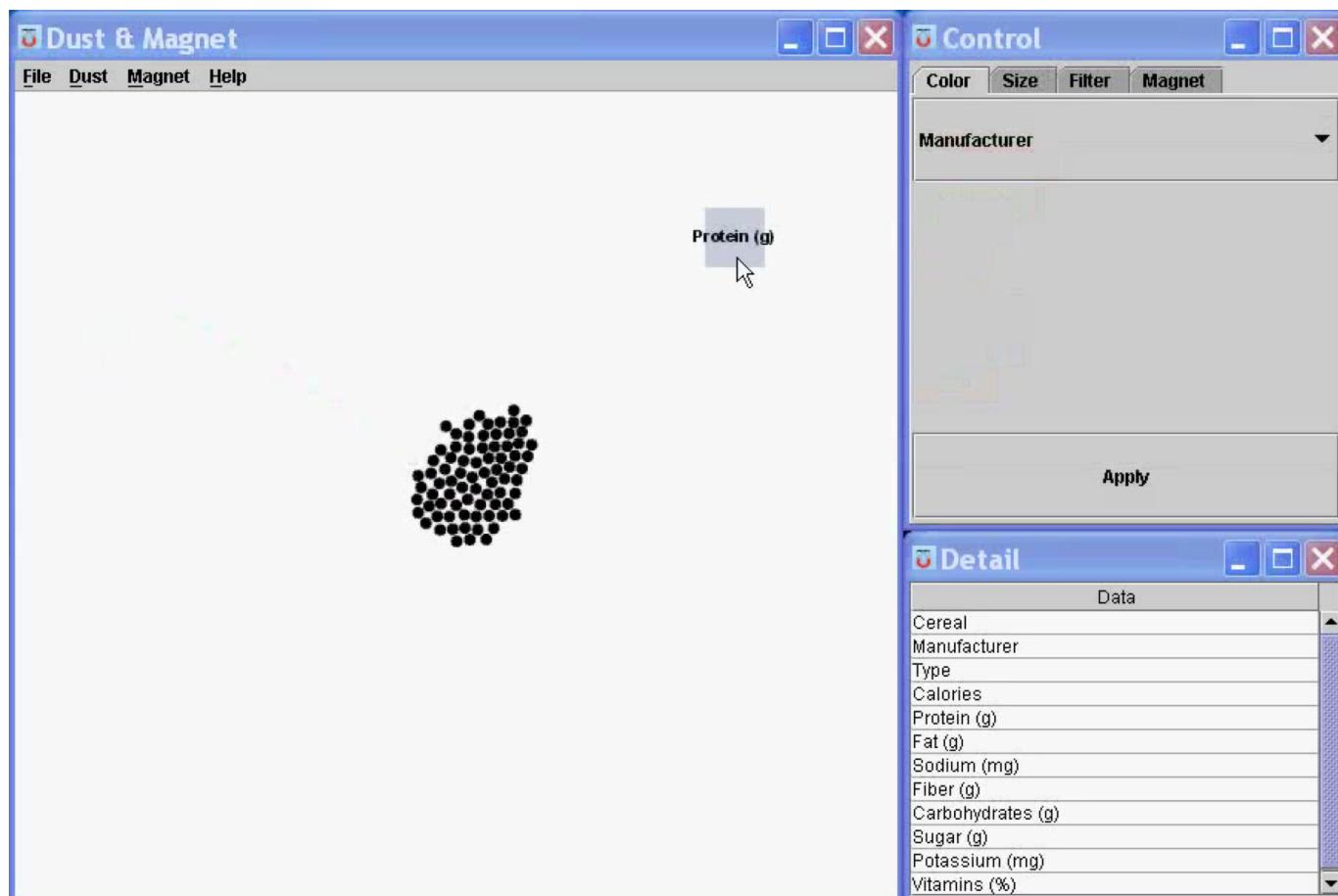
1. Select

“That’s interesting!”



1. Select

“That’s interesting!”



2. Explore

“Show me something else”

- Scroll bars
- Panning
- Direct-Walk (e.g. hyperlink traversal)

The image displays two side-by-side examples of user interface design for exploration. The left side shows a map of Pittsburgh, Pennsylvania, with a focus on its major highway network and city streets. The right side shows the Wikipedia homepage, specifically the navigation sidebar which provides links to various sections of the site.

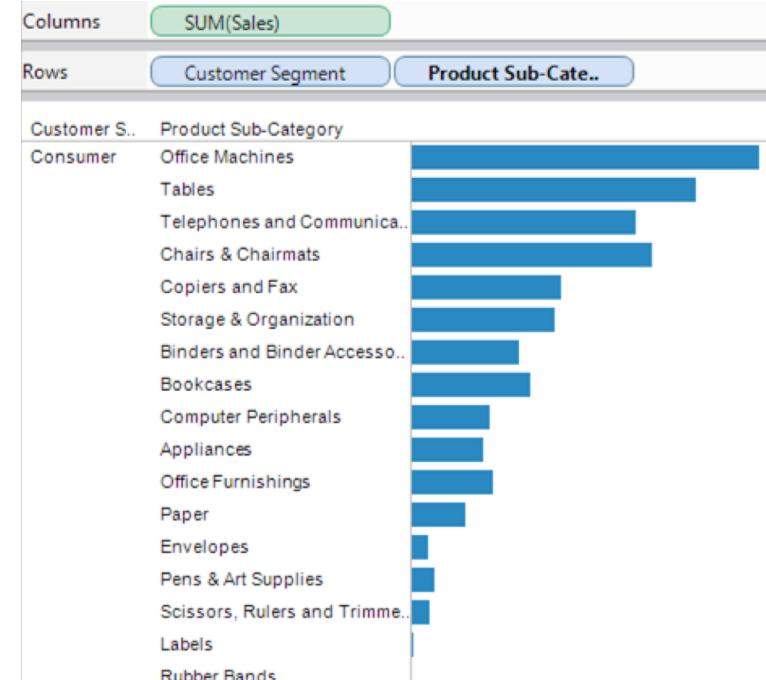
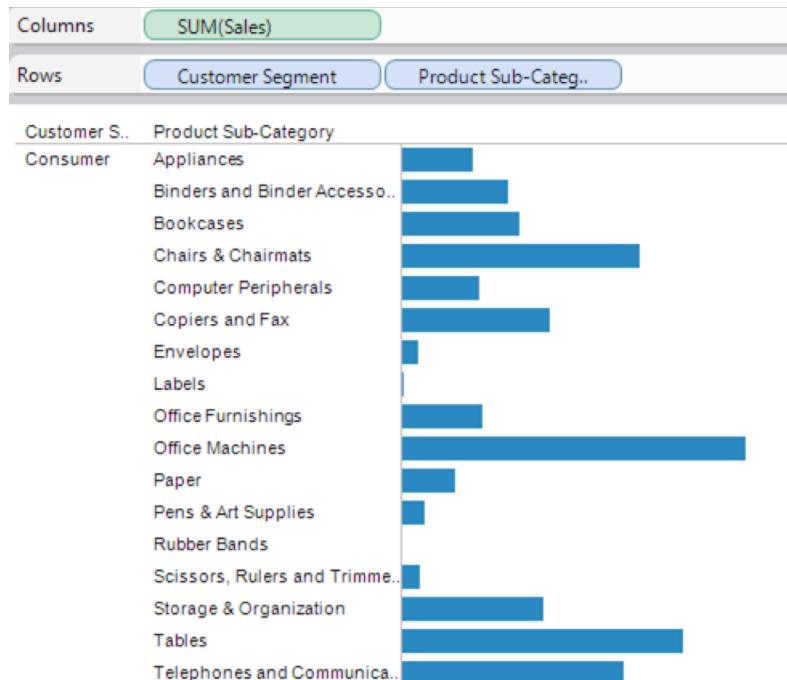
Pittsburgh Map: This map shows the city of Pittsburgh, Pennsylvania, with major highways I-65, I-79, I-279, I-376, and I-837 highlighted in yellow. Local streets such as Penn Ave, Grant St, Centre Ave, and 5th Ave are also visible. The map includes labels for the Andy Warhol Museum, Bedford Reservoir Parklet, and the Hill District. A zoom control and a compass icon are visible in the top-left corner.

Wikipedia Navigation: This screenshot shows the Wikipedia homepage with the title "WIKIPEDIA The Free Encyclopedia". Below the title is a "navigation" sidebar with the following links:

- Main page
- Contents
- Featured content
- Current events
- Random article

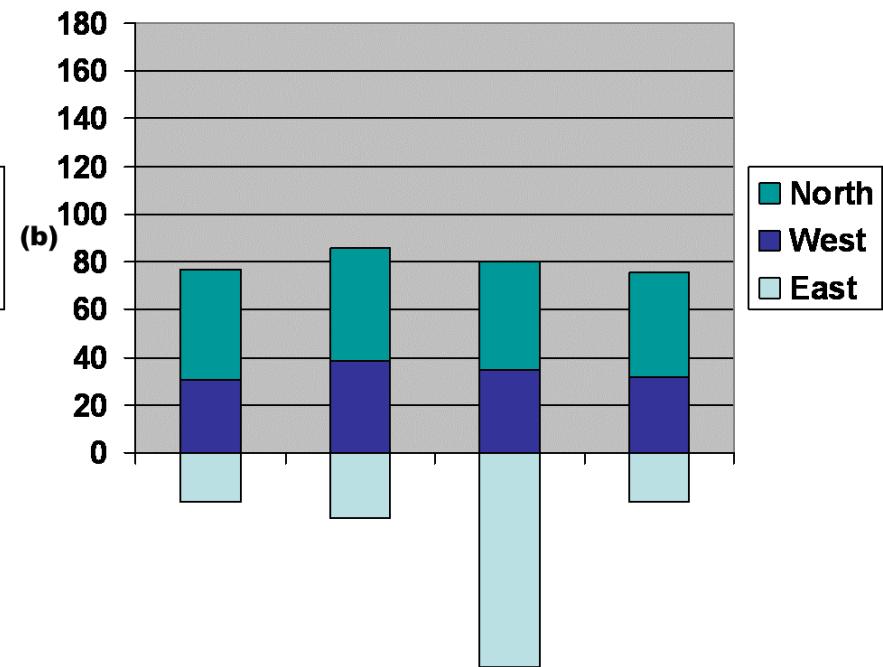
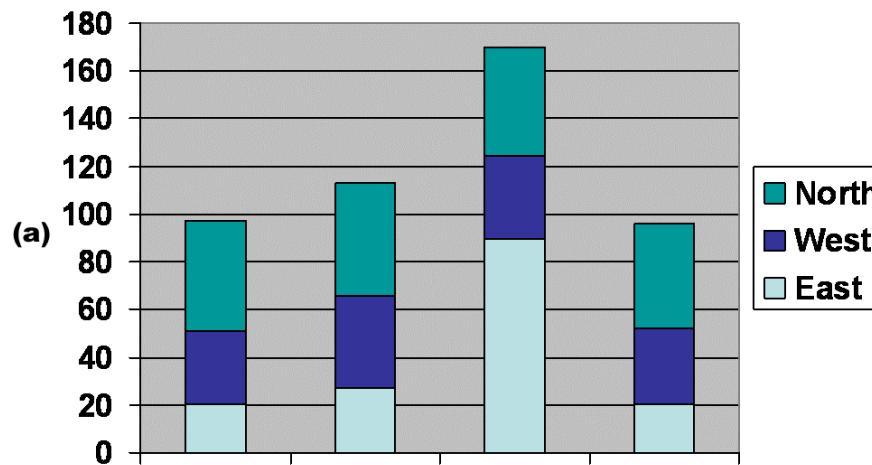
3. Reconfigure

“Show me a different arrangement”: sorting



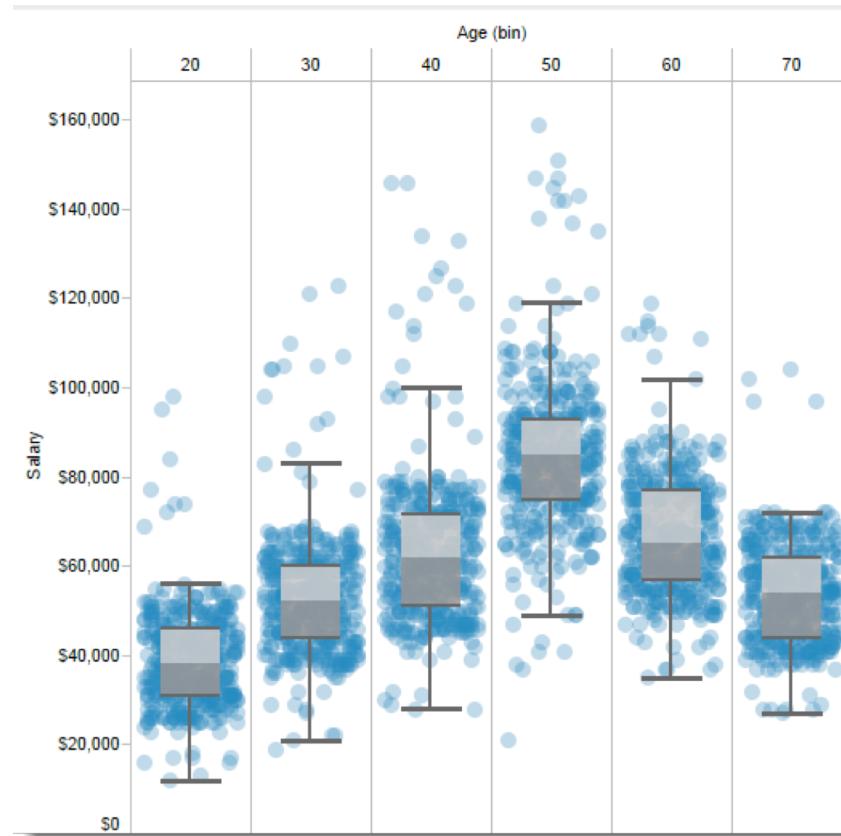
3. Reconfigure

“Show me a different arrangement”: baseline adjustment



3. Reconfigure

“Show me a different arrangement”: reduce occlusion



4. Encode

“Show me a different representation”: visualization type, color, size, orientation, etc.



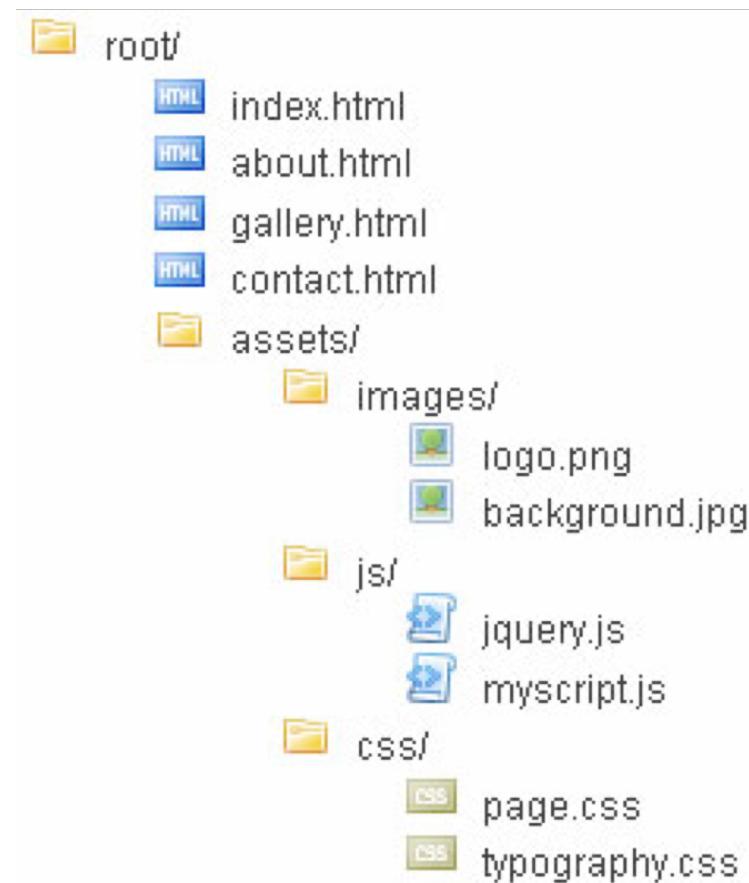
5. Abstract / Elaborate

“Show me more or less detail”: zooming



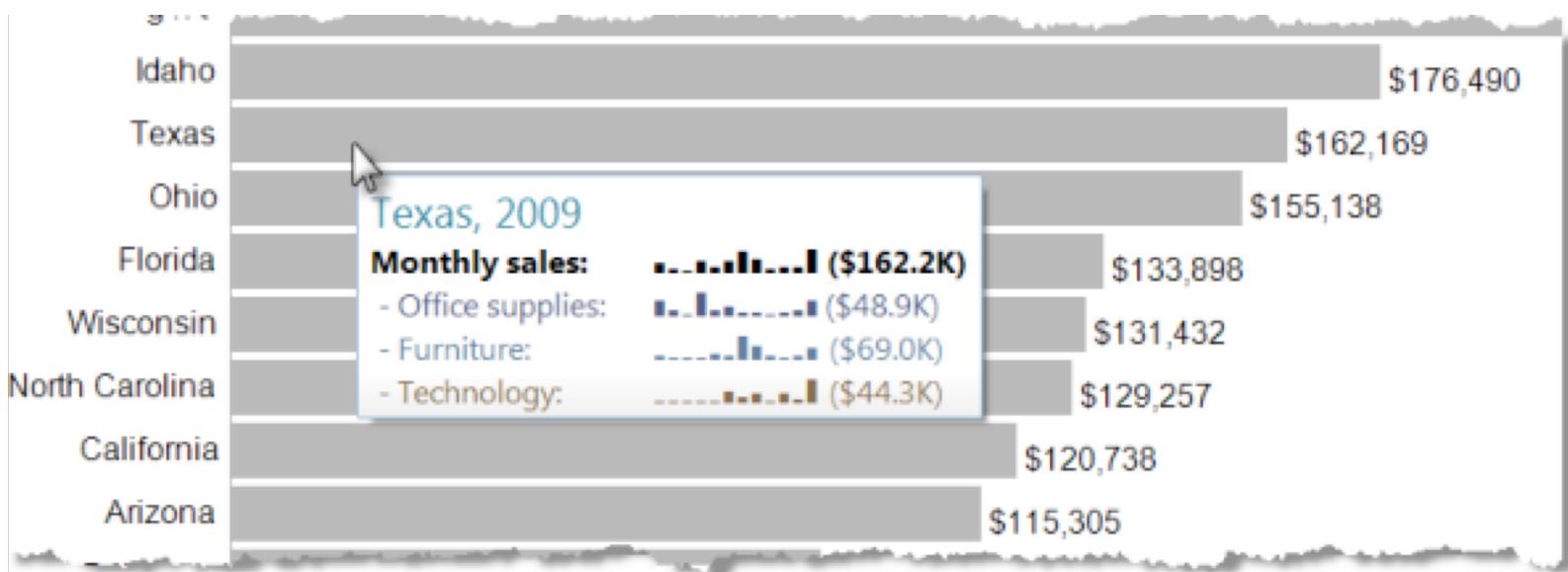
5. Abstract / Elaborate

“Show me more or less detail”: drill up/down



5. Abstract / Elaborate

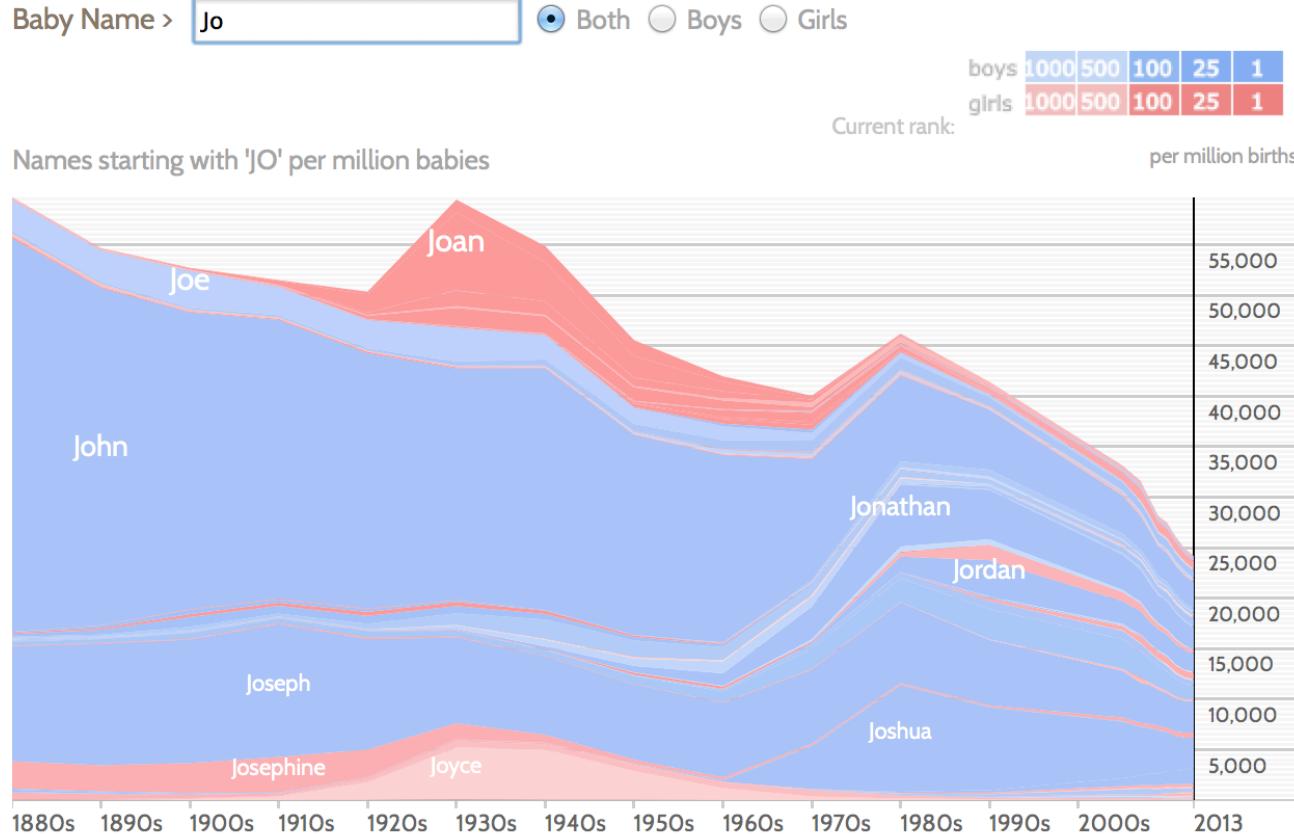
“Show me more or less detail”: tooltips



6. Filter

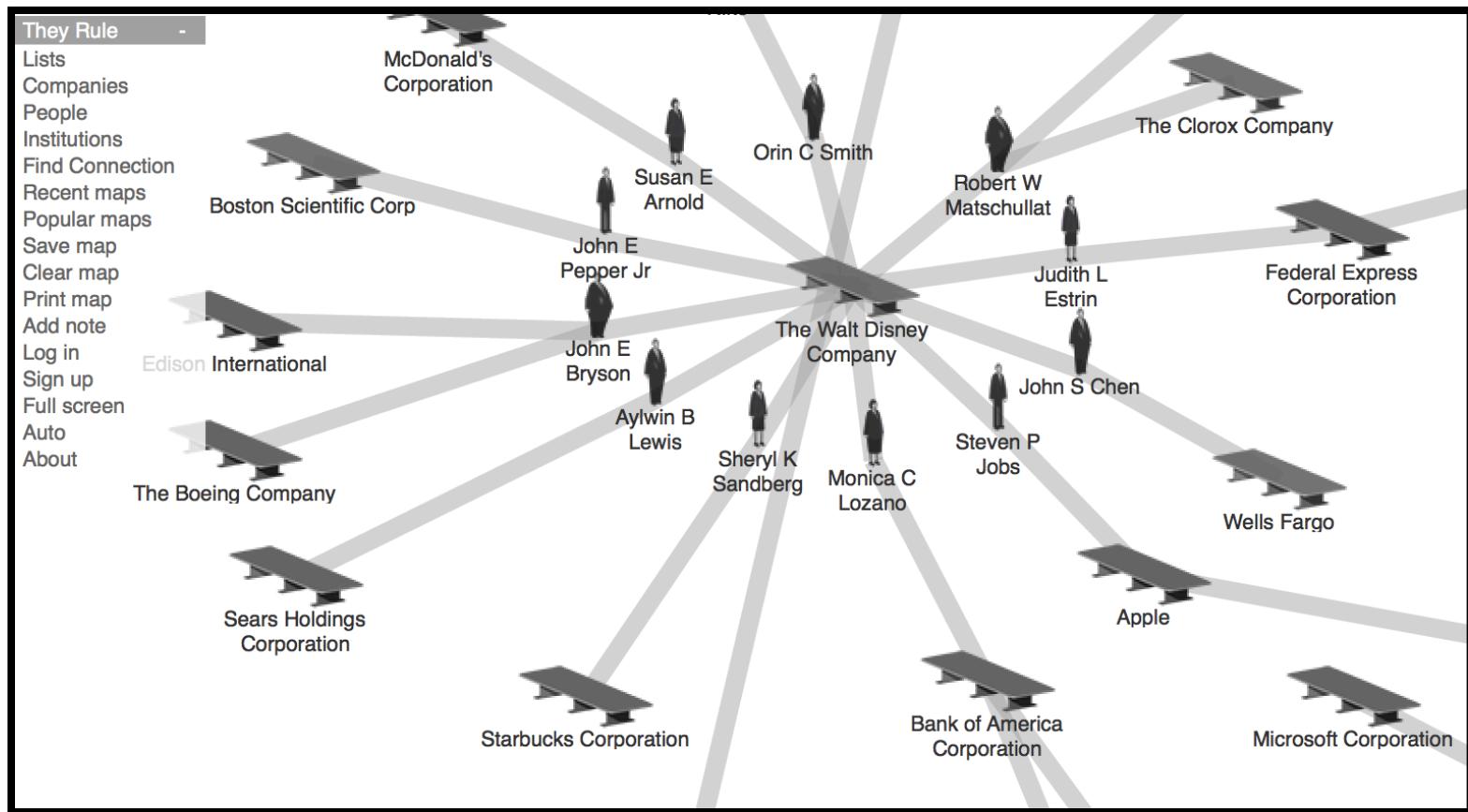
“Show me something conditionally”

NameVoyager: Explore baby names and name trends letter by letter
Looking for the perfect baby name? [Sign up for free](#) to receive access to our expert tools!



7. Connect

“Show me related items”



Discussion

What's **left** to learn?

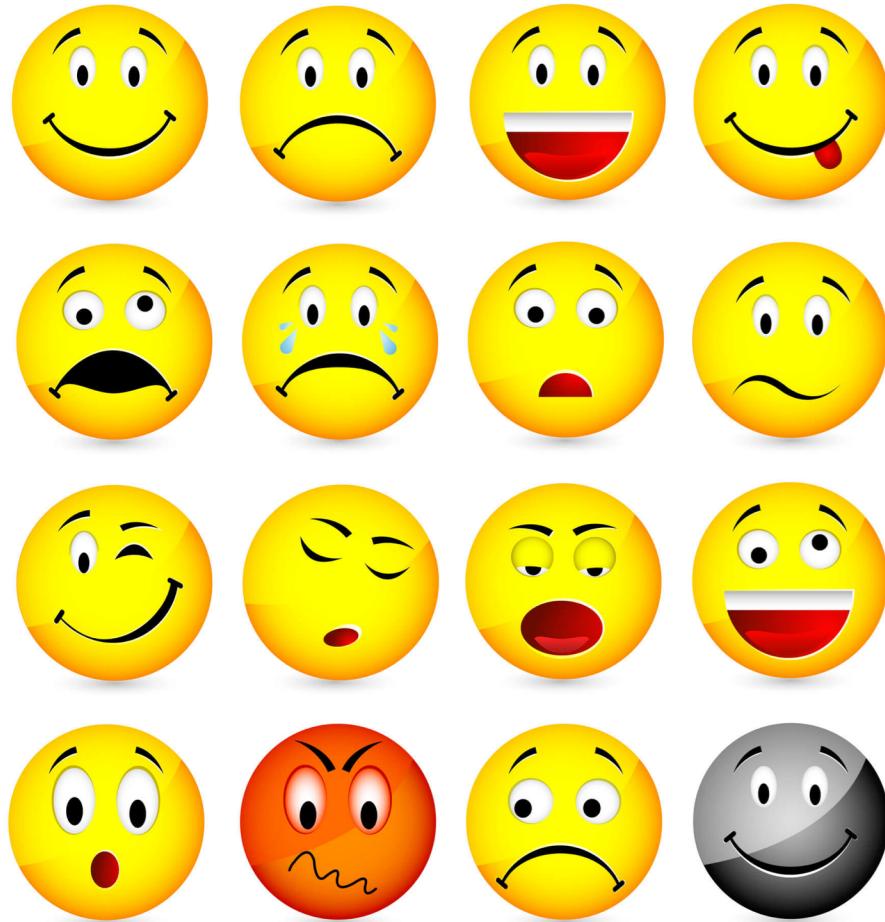


Some open questions in HCI

Do individual
differences matter?



Some open questions in HCI



What about
emotion?

Some open questions in HCI



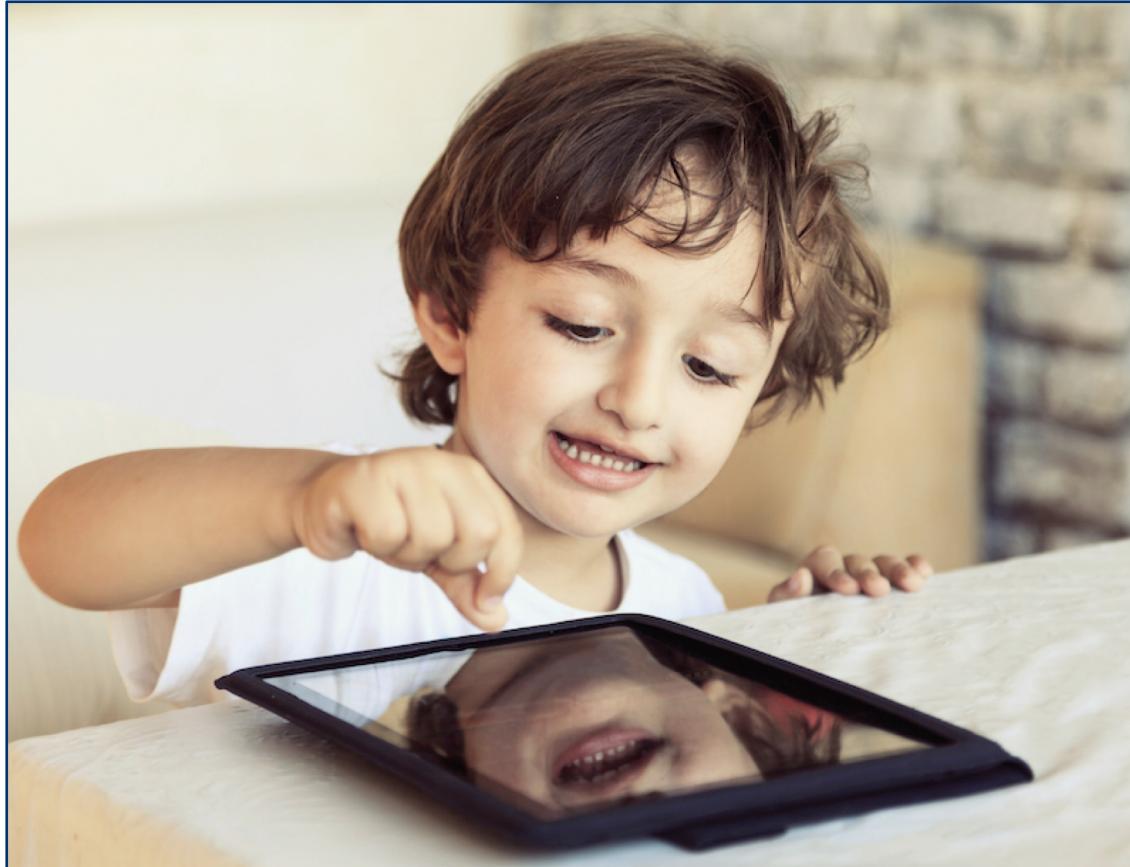
What about
emotion?

Some open questions in HCI



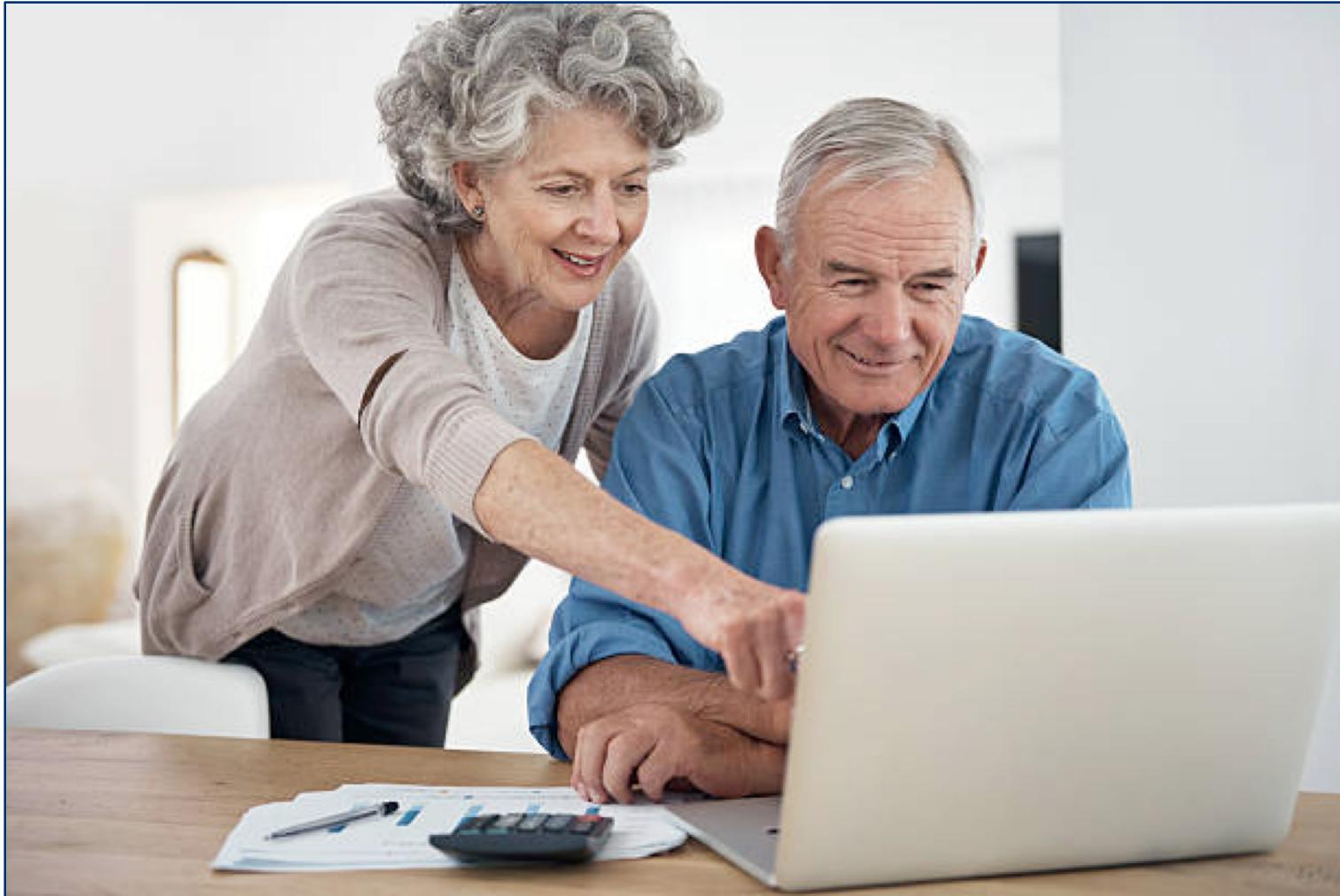
What about **scale**?

Some open questions in HCI



How do we design for **kids**?
Are they just smaller grownups, or are they **different**?

Some open questions in HCI



What about **older** people?

Some open questions in HCI



What people with **limited mobility, vision, hearing, or speech?**

Some open questions in HCI



How do we design tools that support **collaboration**?

Some open (ethical) questions in HCI

- How does interacting through a computer influence **decision-making?**
- How does it change **human relationships?**
- Are we obligated to design **only systems that improve human life**, or should we explore other interactions?
(i.e. ones that are cumbersome, difficult, scary,...)

Discussion

What do **you** think we should be asking?

