1-2. Scientific Foundations

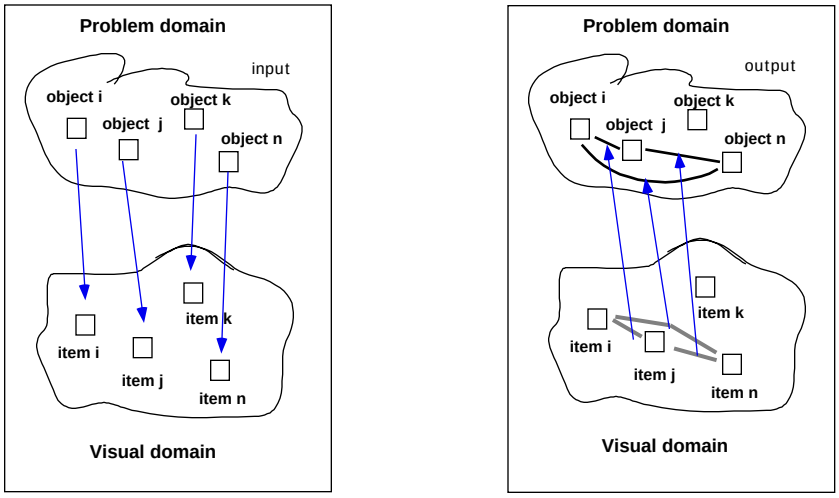
Visual displays/interfaces can be used in a number of ways...

1. Information Visualization = "Using vision to think"

(Card, Mackinlay, Shneiderman)

- provides a way to determine general patterns in a data set. E.g.,
  - general trends
  - outliers
  - anomolous patterns
- ultimately, facilitates hypothesis formation

-> *use ability of visual system to spot patterns*



Visual system as "target machine"

2. Information Navigation = “Using vision to act”

(or “Using vision to access”)

- provides a way to obtain specific items in a data space. E.g.,
  - specific Web sites
  - specific text files
  - specific commands

- ultimately, facilitates interaction with a world

  -> *use ability of visual system to support action*

3. Human-machine interaction (HCI)

- provides a means of “cognitive amplification” of humans (or of machines)

- human+machine form a partnership
  - ideally, interaction between the two is as effortless, rapid, and error-free as possible.
  - visual system seems to be a natural way to do this (high bandwidth)

- so, what’s possible?

Is a Science of Visual Display Possible?

- is perception a convention?
- do different observers see the world differently?
  - effects of age, culture, emotional state?

- or are there (nearly) universal mechanisms?

The good news: much of vision is **not** a convention

- relatively common set of visual mechanisms
  - some individual differences, however,
  - some dependence on age, culture
  - different meanings for symbols
- common set of mechanisms for all mammals? (maybe even all organisms?)

Properties of Sensory Representations

i) understanding without training
- e.g., perception of color, shape

ii) resistance to instructional bias
- intentions can't change experience

iii) cross-cultural constancy
- experiences, categories the same in all cultures

However, some aspects of our experience are <u>not</u> this way -> result of conventions

Properties of Conventional Representations

i) understanding with extensive training
- e.g., learning to read

ii) can change with instructional bias
- e.g. can choose to look at a movie critically, or just enjoy it

iii) cross-cultural variability
- e.g. different ways to represent numbers

Note 1: Conventions don't have to be a bad thing
- could always train users

Note 2: Not all conventions are equally arbitrary
- some associations are easier to learn than others
- some associations can't be learned at all

(cf. demise of Behaviorism)

The boundary between **perception** & **convention** is loosely that between **geometry** & **meaning**

-> As long as we stick to geometry and radiometry (=colors), things should be okay.

How far can this be pushed?

- Gibson -> affordances
  - perception is about what we can do
  - this kind of meaning is also innate

This is a controversial position...

Basics of Information Visualization

Several data types correspond in a natural way to visual structures (*isomorphism)*

1. Entities (items) -> visual objects
   (e.g. file -> icon)
2. Relationships -> spatial relationships
   (e.g., related files -> contained in same folder)
3. Properties -> geometric or radiometric properties
   (e.g., important files -> red icons)

Note 1: need to be careful how properties are represented visually

E.g., can't use orientation for quantity

- use color? No.

Categorization of properties:

1. Nominal: distinct types (e.g., colors)
2. Ordinal: sequential order (e.g., orientation)
3. Ratio: absolute values (e.g., length)

Note 2:

Operations -> ?

- sometimes represented by image of the processor typically used (e.g printer), or by the input or output (e.g. sorted lists)
  - perhaps dynamic representations would be more suitable?

Note 3:

Stuff -> ?

- mass quantities, e.g., water, sand
- perhaps use visual system's ability to represent "stuff" (e.g. texture)?

Presentations:

Jan 13	- Preattentive Vision I
Jan 20	- Perceptual Organization
Jan 27	- Lightness & Brightness Perception
Feb 3	- Color Perception
Feb 10	- Depth & Space Perception
Feb 24	- Visual Attention
Mar 10	- Wayfinding & Navigation
Mar 17	- Visuomotor Control; Awareness
Mar 24	- Motion, Movement, and Events

How to Give a Effective Presentations

How you say something is as just important as **what** you say

Effectiveness = content x style

- **make it compelling (or at least interesting)**

- main purpose of a talk is **not** to convey detail,
  but to **tell a story**

    - have something to say — one main message
    - make it accessible:
        1. provide a context at the beginning
        2. "zoom in" to detailed description later
        3. back to "big picture" in at the end

- should be **coherent**
    - points should "hang together"
    - Centered around **one focus** (storyline)

- **note:**
    - digressions okay, but return to main point

- keep it brief

- provide enough information to convey the "gist"of things, but not much more than that
  - people have only so much attention & memory
  - need to abstract out basic message of the article, and make this clear to audience
  - details can always be filled in later on.

- "Whatever is good, if brief is twice as good"

—Gracián

Basics of delivery (verbal)

i) Always face the audience
- don't talk to blackboard or projection screen

ii) Speak slowly and clearly
- never go faster than conversational speed
- <u>if rushed for time, don't speed up</u>
  - better to skip slides

iii) Speak loudly
- should be loud enough to reach everyone
- vary your pitch; show your enthusiasm
- <u>don't be monotonous</u>

iv) Put the most important information at the end of a sentence

- earliest part of sentence set up context
- later parts supply new information

-e.g.,

In mathematics, Michael received a A.
Michael received an A in mathematics.
In mathematics an A was given to Michael.

v) Don't fade out at the end of the sentence

- audiences find this extremely frustrating
  -> you'll lost their interest

vi) Don't be stationary

- change position from time to time

vii) Make eye contact with audience

- don't stare off into space, or at floor
- establishes that you are talking to them, not just in front of them
- move eyes around
  - don't focus on just one person

viii) Show enthusiasm

- most important part of presentation style (helps get others interested)

Basics of style (overheads/slides)

i) Text should always be large

- small font is annoying, even if you can see it

ii) Don't put too much on a single slide

- 3-4 points max

iii) Each slide should only focus on one issue

- avoid dragging in stuff about other issues

iv) Contents of slide should echo what you say

- multi-media presentation
- in case people miss something spoken, they can get it from the slide
- easier for people who are not native English speakers (both speakers and audience)

v) Always use graphs rather than tables

- make use of "visual intelligence"

vi) For complex slides, "build up" gradually

- incremental addition of points, figures