

Elective in Software and Services
(Complementi di software e servizi per la società dell'informazione)

Section **Information Visualization**

Numbers of credit : 3

Giuseppe Santucci

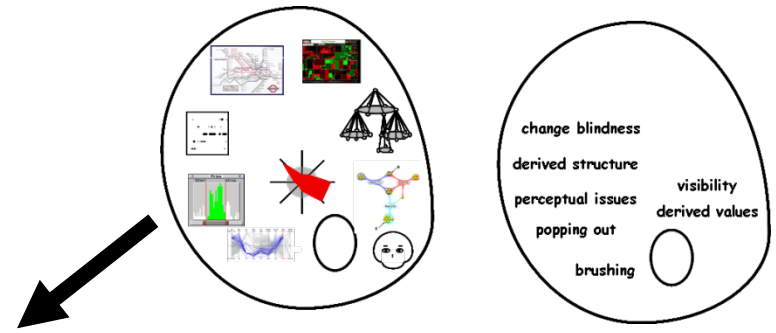
7 – Presentation

Thanks to John Stasko, Robert Spence, Ross Ihaka,
Marti Hearst, Kent Witteburg

Outline

- Presentation & Screen limitations
- Space limitations
 - Scrolling
 - Overview + details
 - Distortion
 - Suppression
 - Zoom & pan
- Time limitation

Presentation & Screen limitations



Overview
Site Map
Storyboard
Page
Detail

http://pda.edmunds.co

Help Us Help You!
Edmunds2Go! Survey

Insurance | Find Dealer
Overview | Prices | Specs | Home

2002 Nissan Sentra CA 4dr
Sedan (1.8L 4cyl 4A)

Edmunds2Go! Overview
Info | Competitors | Photo

What's New For 2002
Beloved by compact car
enthusiasts, the Nissan Sentra SE-
R returns after a seven-year hiatus.

http://pda.edmunds.co

Help Us Help You!
Edmunds2Go! Survey

Insurance | Find Dealer
Overview | Prices | Specs | Home

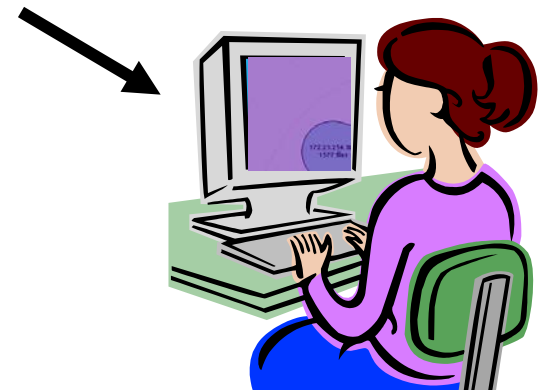
2002 Nissan Sentra CA 4dr
Sedan (1.8L 4cyl 4A)

Edmunds2Go! Specs
Specs | Dimensions | Safety

- Drive Type: FWD
- Engine Type: Inline
- Transmission: Auto 4-Speed

55379 88561 49983 52015 56678 38504 13681 67739 87310 14880 Update Hide Filter

Once you got a **representation** you have to **present** it on the screen



Outline

- Presentation & Screen limitations
- Space limitations
 - Scrolling
 - Overview + details
 - Distortion
 - Suppression
 - Zoom & pan
- Time limitation

Space limitations: scrolling

- Scrolling !
- Scrolling where ?
- Boring
- Time consuming
- Most content is hidden from view

7.1 A PROBLEM

Many of us have found ourselves with a report that has to be completed by a deadline, with the result (Figure 7.1) that the dining room table, extended to its 12-guest state, is covered by piles of papers as well as reports, books, clippings and slides; perhaps with more arranged on the floor and on a couple of chairs.

There may even be piles on top of piles. Such a presentation of vital information makes a lot of sense; everything relevant is to hand (hopefully!) and, moreover, its very visibility acts as a reminder (Bolt, 1984, page 2) of what might be relevant at any particular juncture, possibly triggering a situated action (Suchman, 1987). In this environment I can concentrate on creative tasks rather than organisation.

Despite the availability of high-resolution displays and powerful workstations I still write most of my reports in this way. Why? Because the display area provided by the typical workstation is far too small to support, visibly, all the sources that are relevant to my composition.

7.2 THE PRESENTATION PROBLEM

I am not alone in the sense of having too much data to fit onto a small screen. A very large and expensive screen, for example, would be needed to display the London Underground map in sufficient detail (Figure 1.1), and it would be difficult or impossible to present, on a normal display, the complete organisation chart of IBM or ICI. Moreover, the recent emergence of small and mobile information and communication devices such as PDAs and wearable displays has additionally identified a pressing need for a solution to the 'too much data, too little display

7.2.1 Scrolling

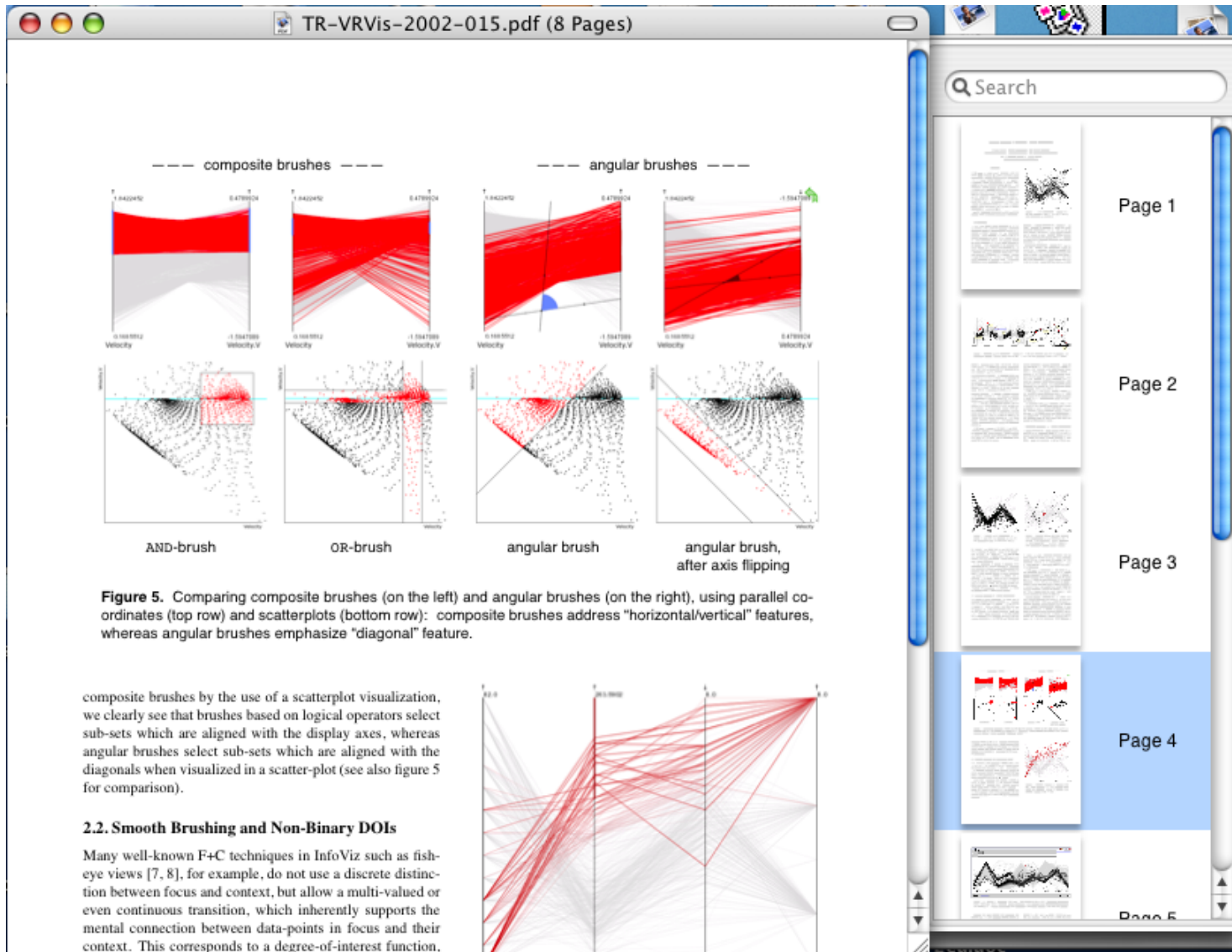
An obvious solution is to scroll the data into and out of the visible area. In other words, to provide a means whereby a long document can be moved past a window until it reaches the required 'page' (Figure 7.2). This mechanism is widely used, but carries with it many penalties. One relates to the "Where am

—or was it 5.6? All I can do is operate the scrolling mechanism and look out for the figure I need, albeit assisted by various cues such as the page number indicated in the scrolling mechanism. With a scrolling mechanism, most of a document is **hidden** from view. I have the same problem when using a microfilm reader, with the additional complication that if I move the tray to the left, the image moves to the right. A similar difficulty applies to my use of the famous London 'A to Z' street directory. I'm driving along a road that goes off the edge of the page, so I desperately need whatever page contains the continuation of that road (and quickly!). Even if I get it, I will typically have trouble locating the same road on the new page. These and other similar problems can be ameliorated by the provision of **context**. Much of this chapter, in fact, is concerned with *deciding how to provide context*.

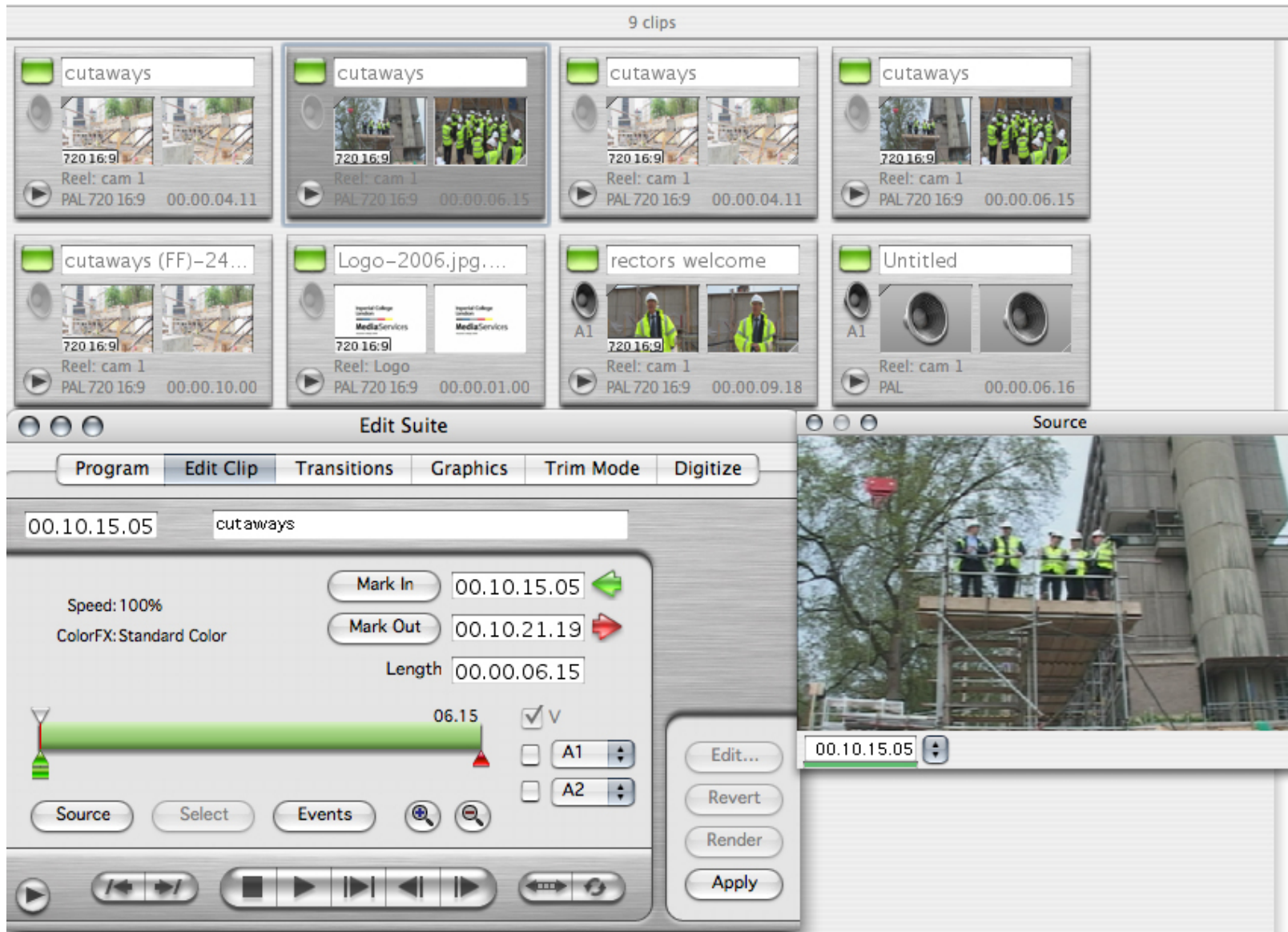
Outline

- Presentation & Screen limitations
- Space limitations
 - Scrolling
 - Overview + details
 - Distortion
 - Suppression
 - Zoom & pan
- Time limitation

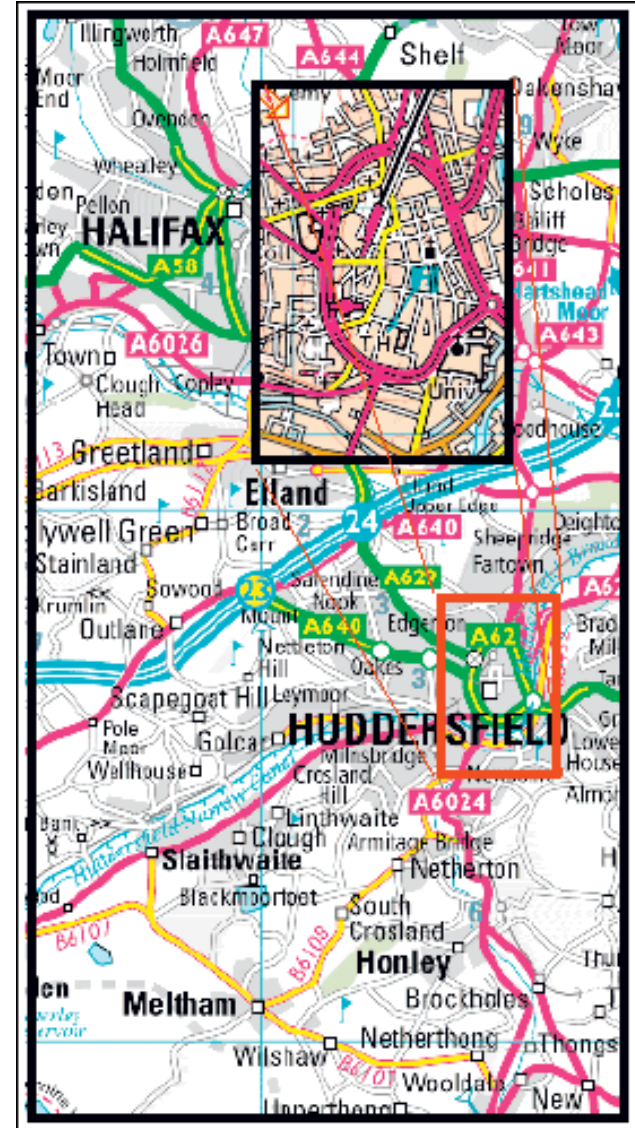
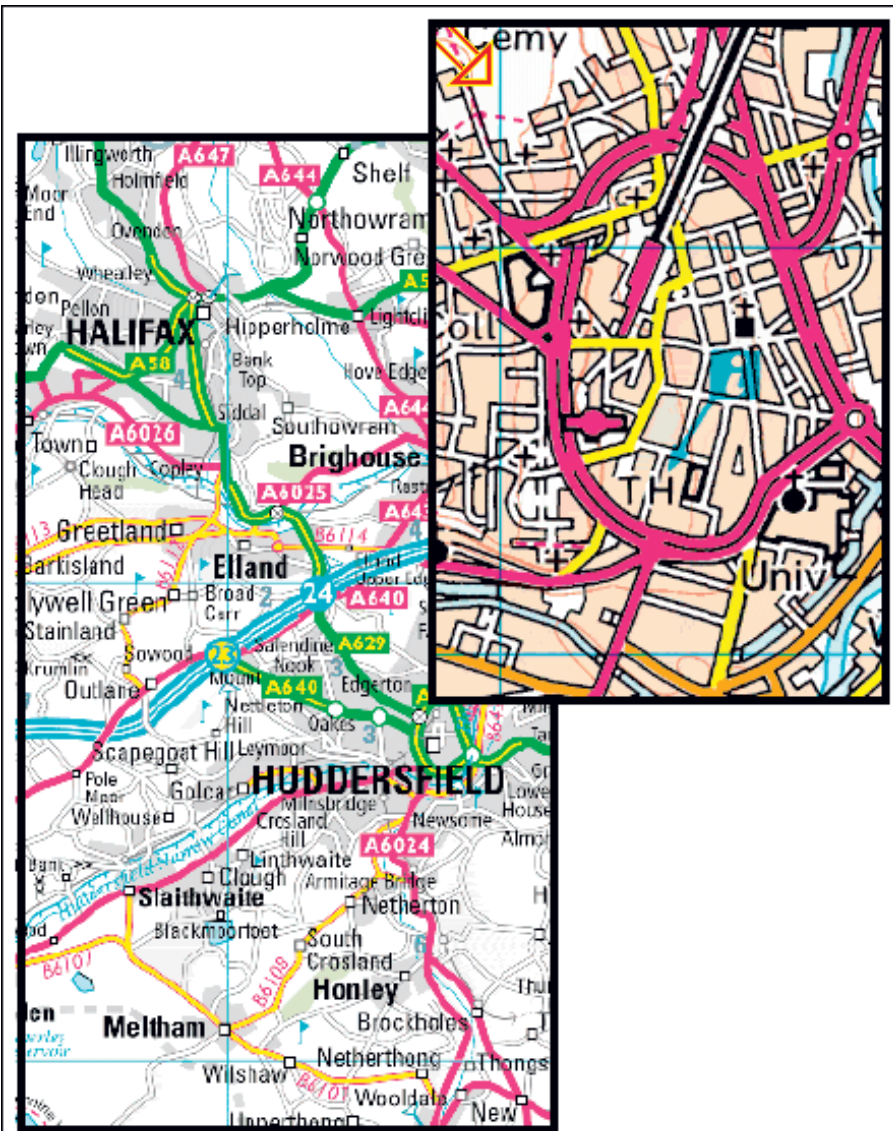
Space limitations : overview + detail



Space limitations : overview + detail

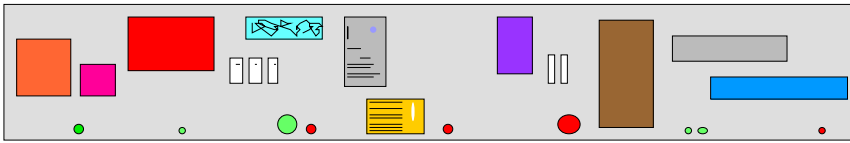


Space limitations : overview + detail

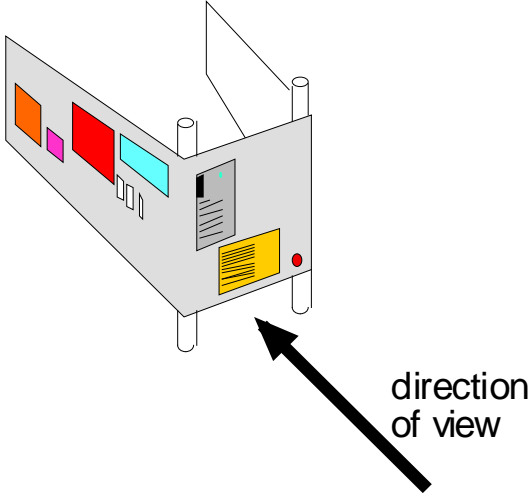


Outline

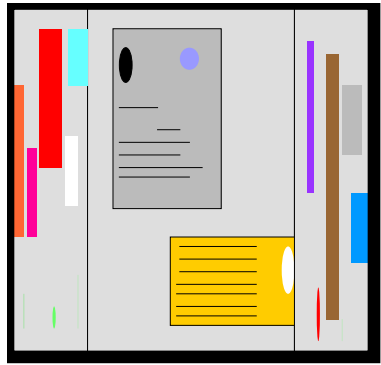
- Presentation & Screen limitations
- Space limitations
 - Scrolling
 - Overview + details
 - Distortion
 - Suppression
 - Zoom & pan
- Time limitation



(a) An information space containing documents, emails, etc.

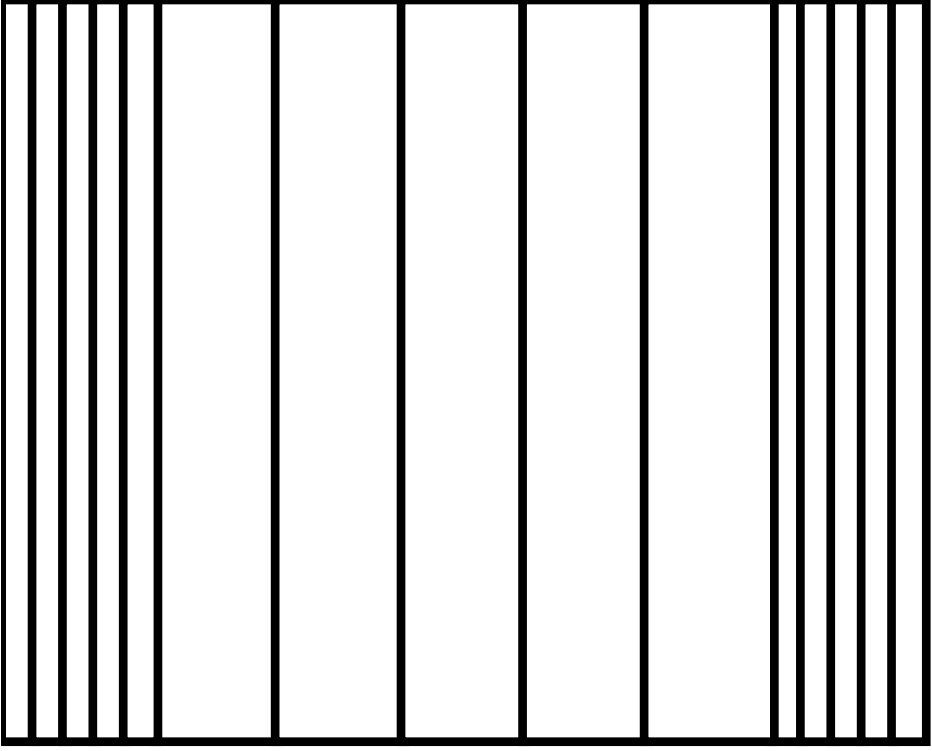


(b) The same space wrapped around two uprights.



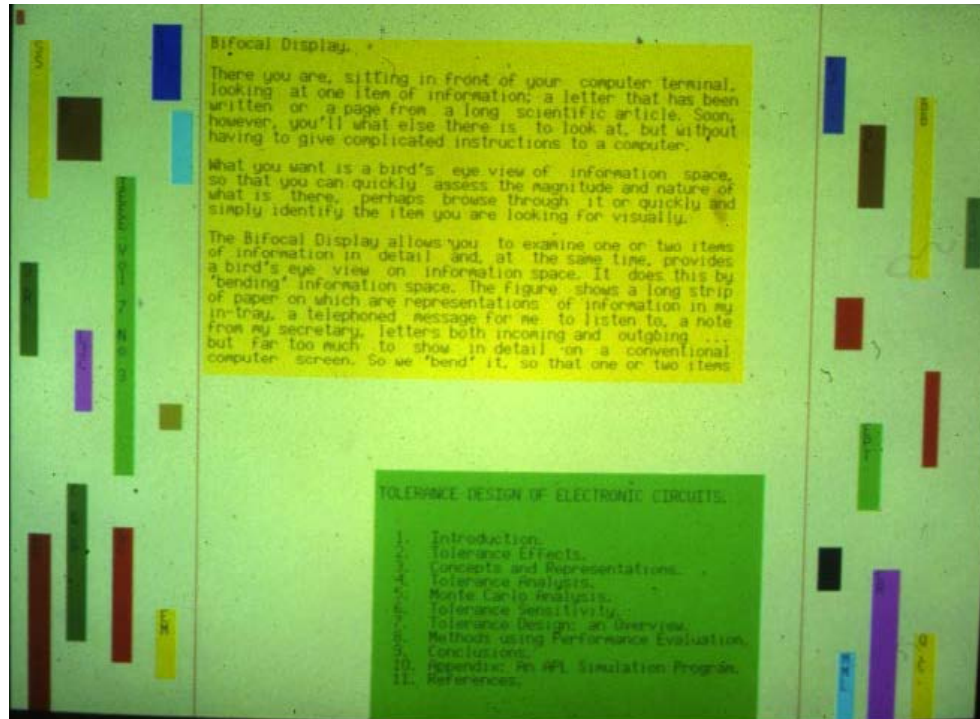
(c) Appearance of the information space when viewed from an appropriate direction

Space limitations : distortion



Horizontal distortion

Space limitations : distortion



Documents on a (early) bifocal display

MIEIKDKQLTGLRFIDLFAGLGGFRLALESCGAEC

Sequence of amino acids

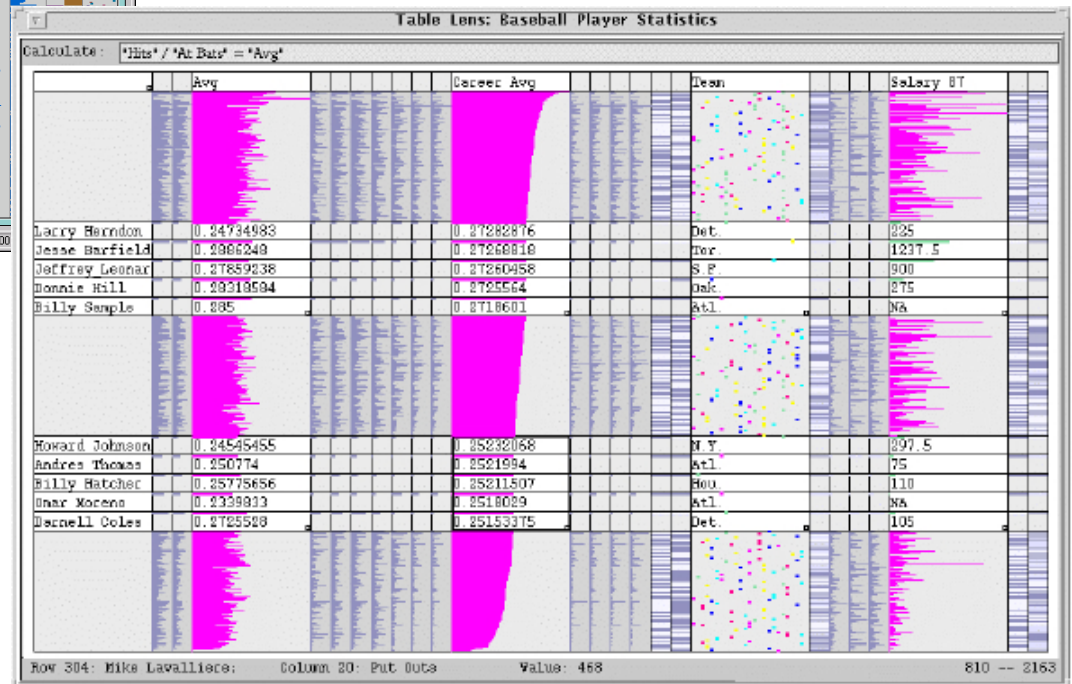
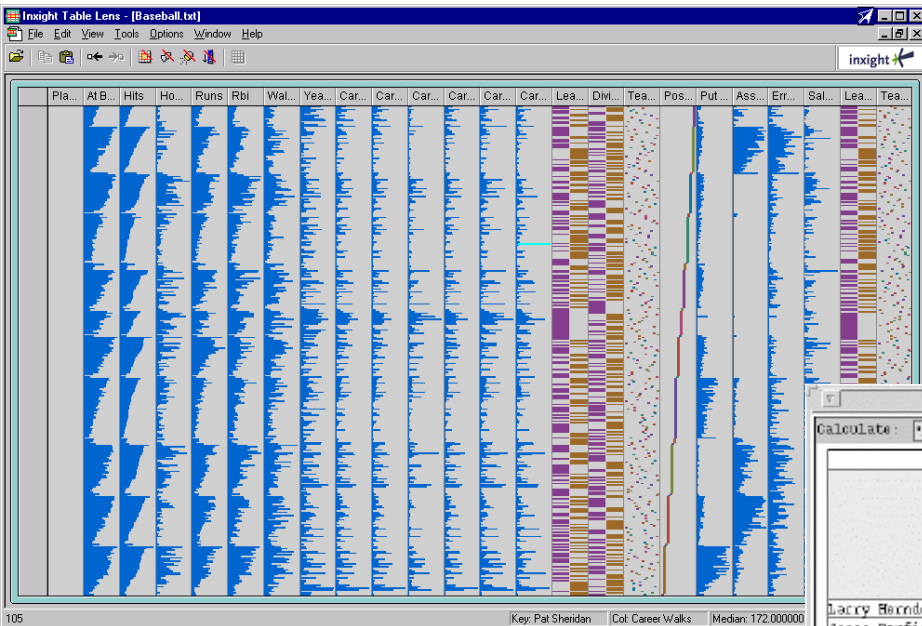
Space limitations : distortion

Data (histograms) about baseball players:

- number of 'hits'
- ball speed

Interaction

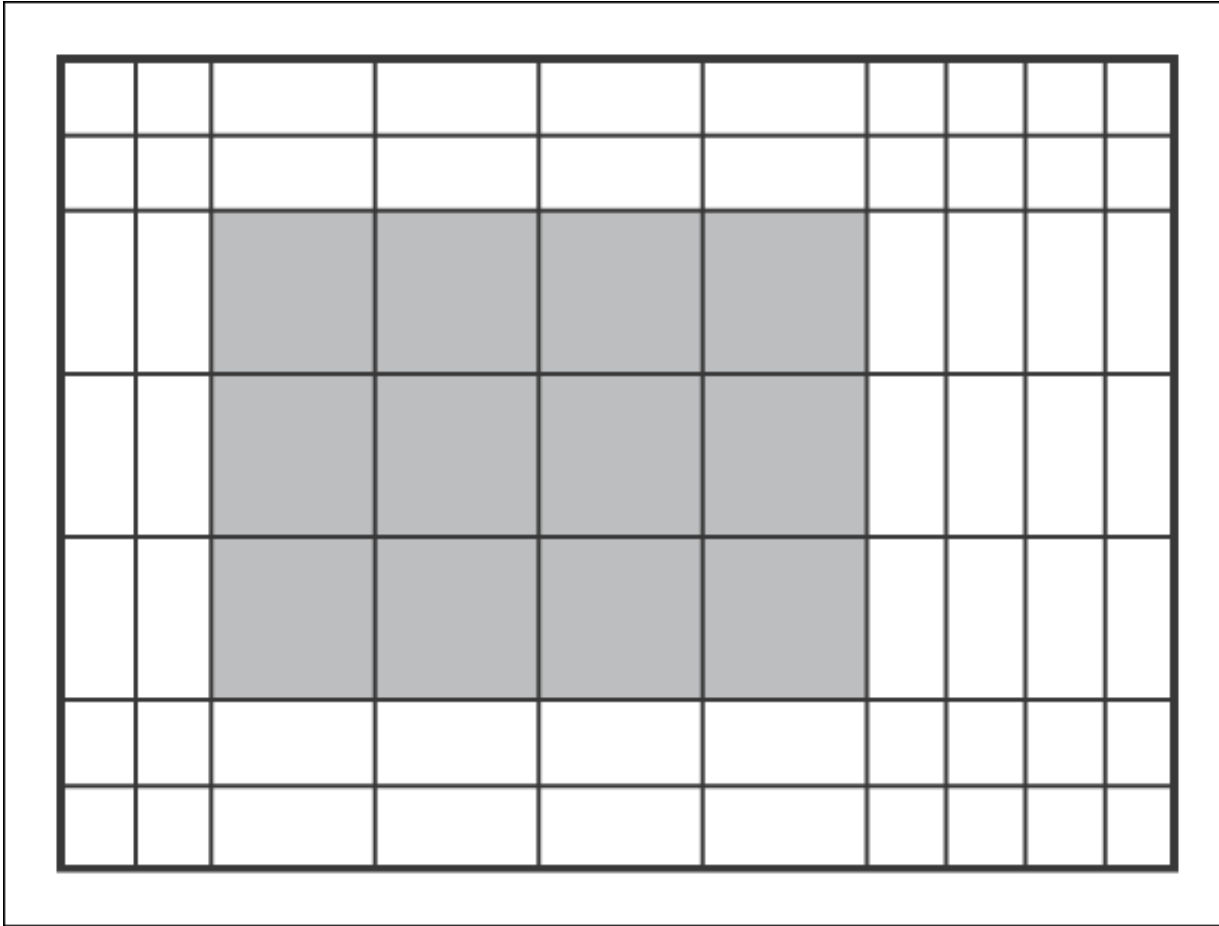
- sort



The table lens

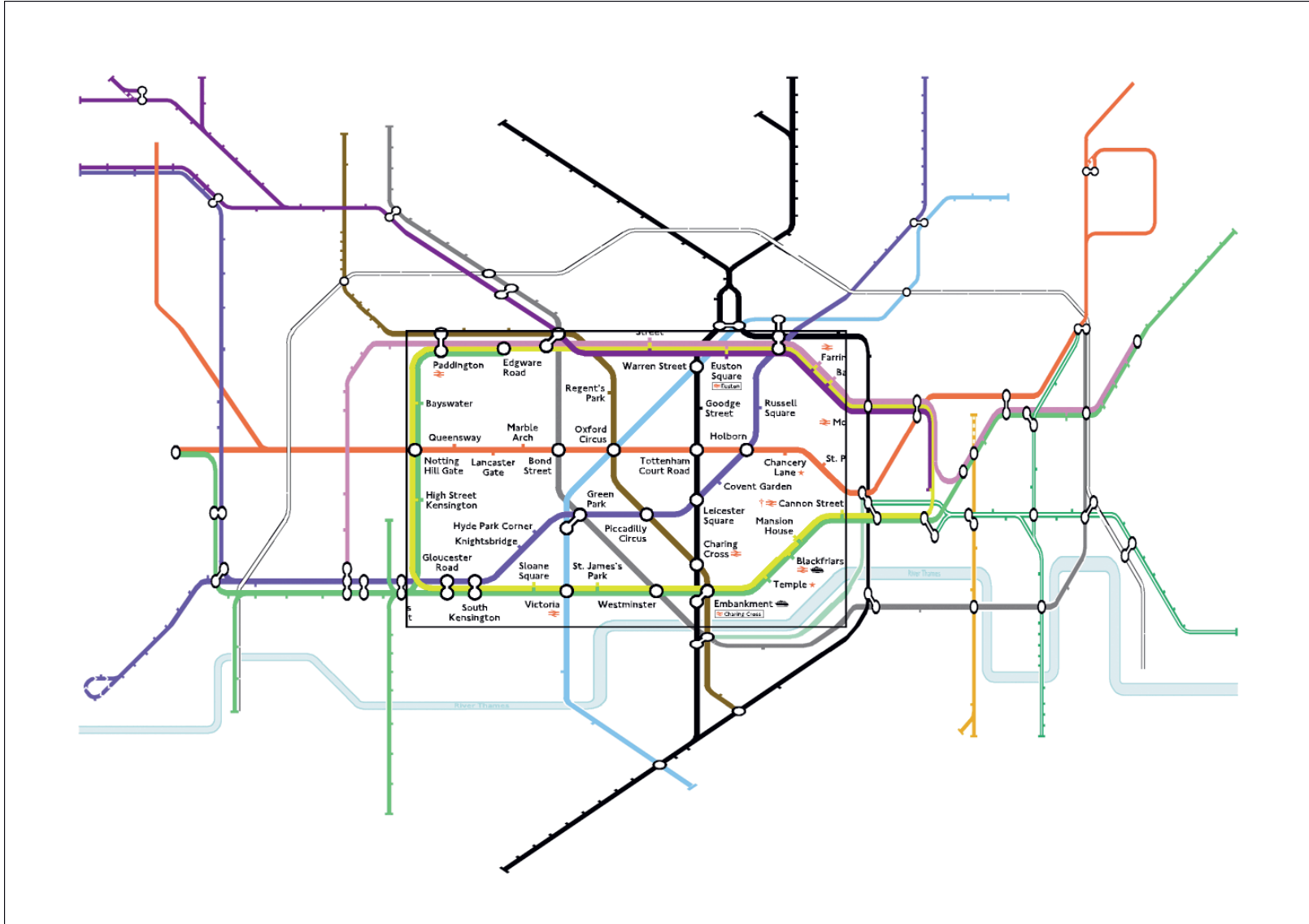
Expansion to show names and numbers

Generalized distortion



Combined X- and Y-distortion

London Underground map

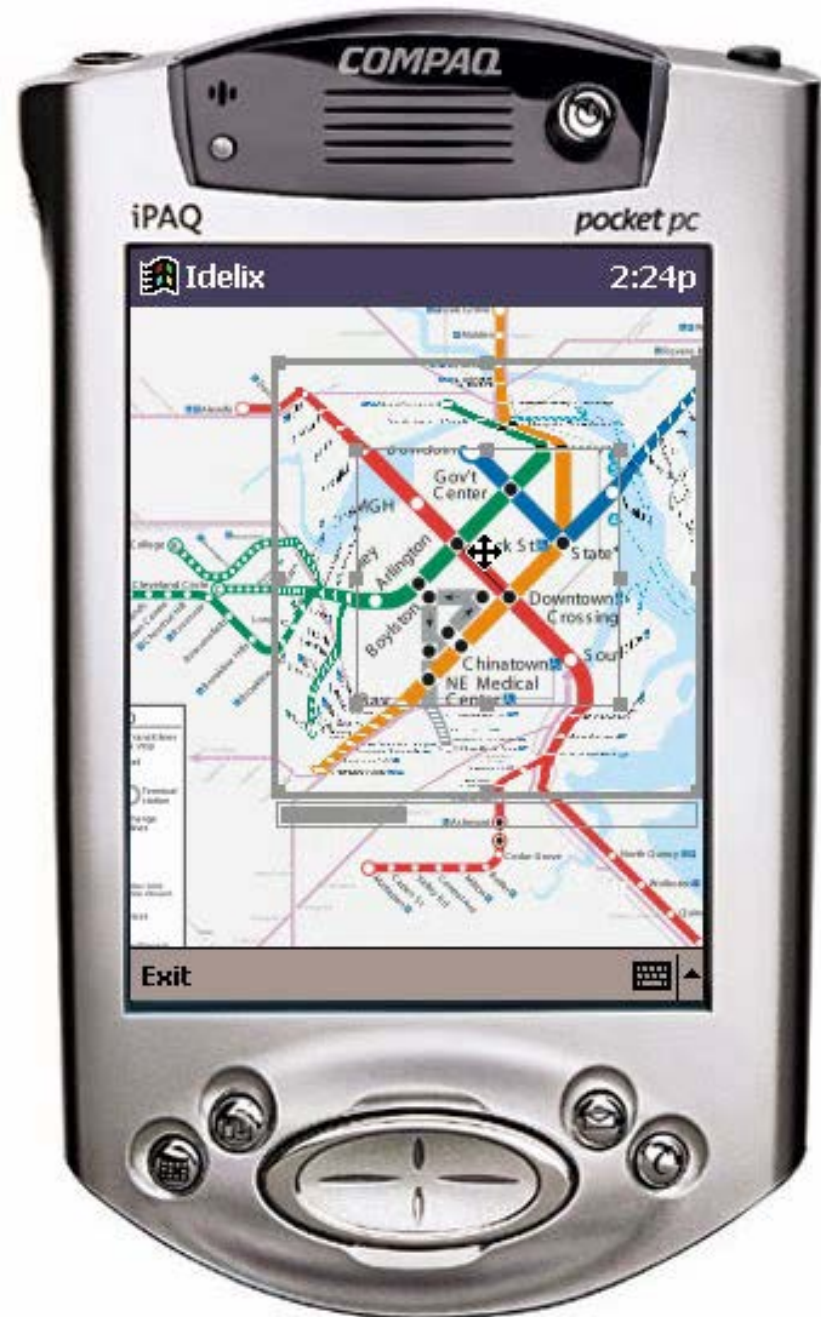


Combined distortion for a calendar

Mar	April	May	June	July			Aug	Sept	Oct
				11 Sun	Check slides, notes. Family barbeque				
				12 Mon	Fly LA Kathy to airport Model Maker				
				13 Tue					
				14 Wed					
				15 Thur					
				16 Fri	Flight to SFO Tutorial set-up Tutorial United flight Heathrow Pointer Color OHs Jane+John Call Kathy				
				17 Sat	Fly LHR Kathy to collect Chapter 2/see Dave March				

Combined distortion on a PDA

The distortion preserves the continuity of transportation links

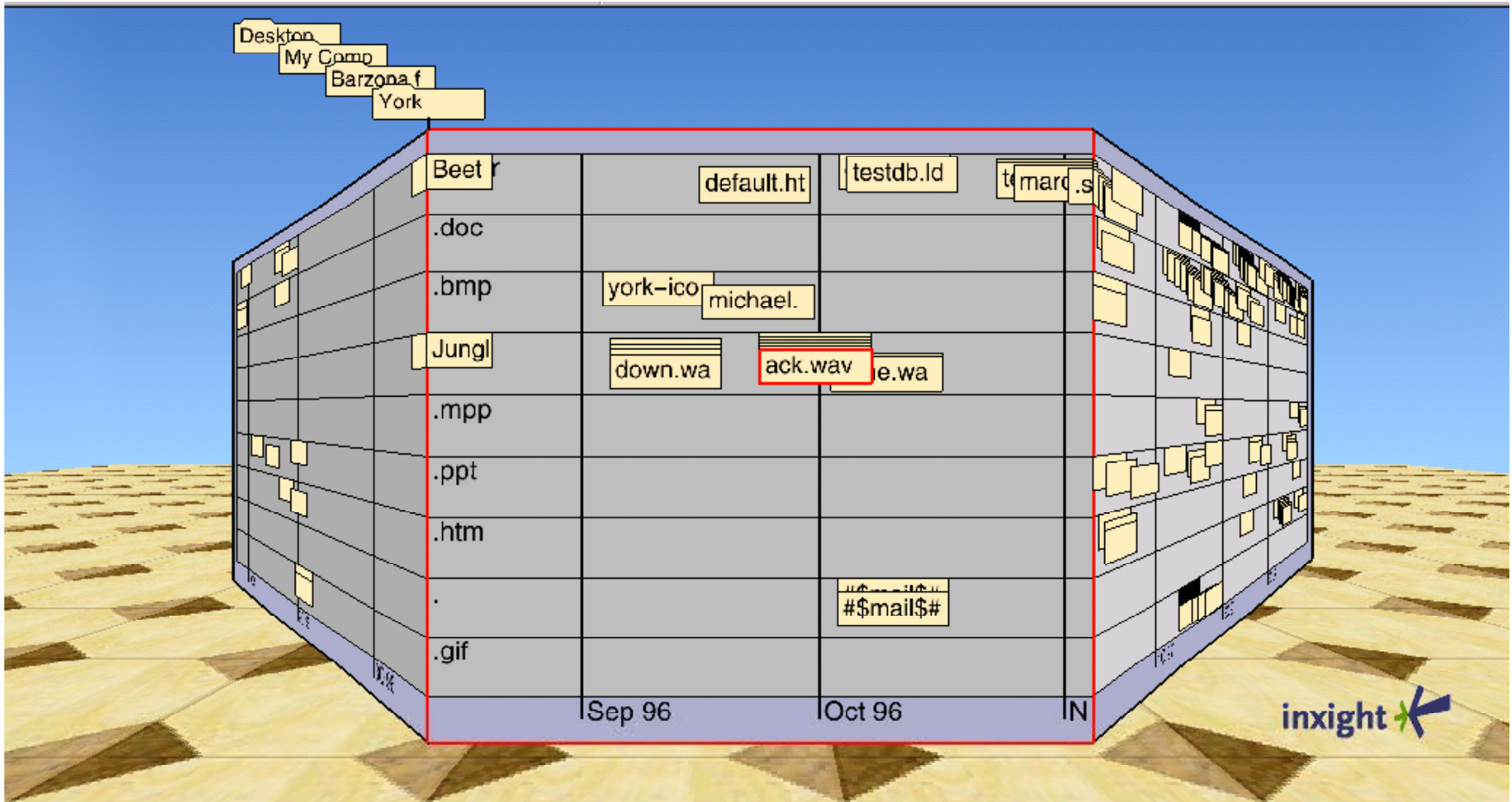


Macintosh OSX distortion



The perspective wall

- Bifocal display + 3D



Outline

- Presentation & Screen limitations
- Space limitations
 - Scrolling
 - Overview + details
 - Distortion
 - **Suppression**
 - Zoom & pan
- Time limitation

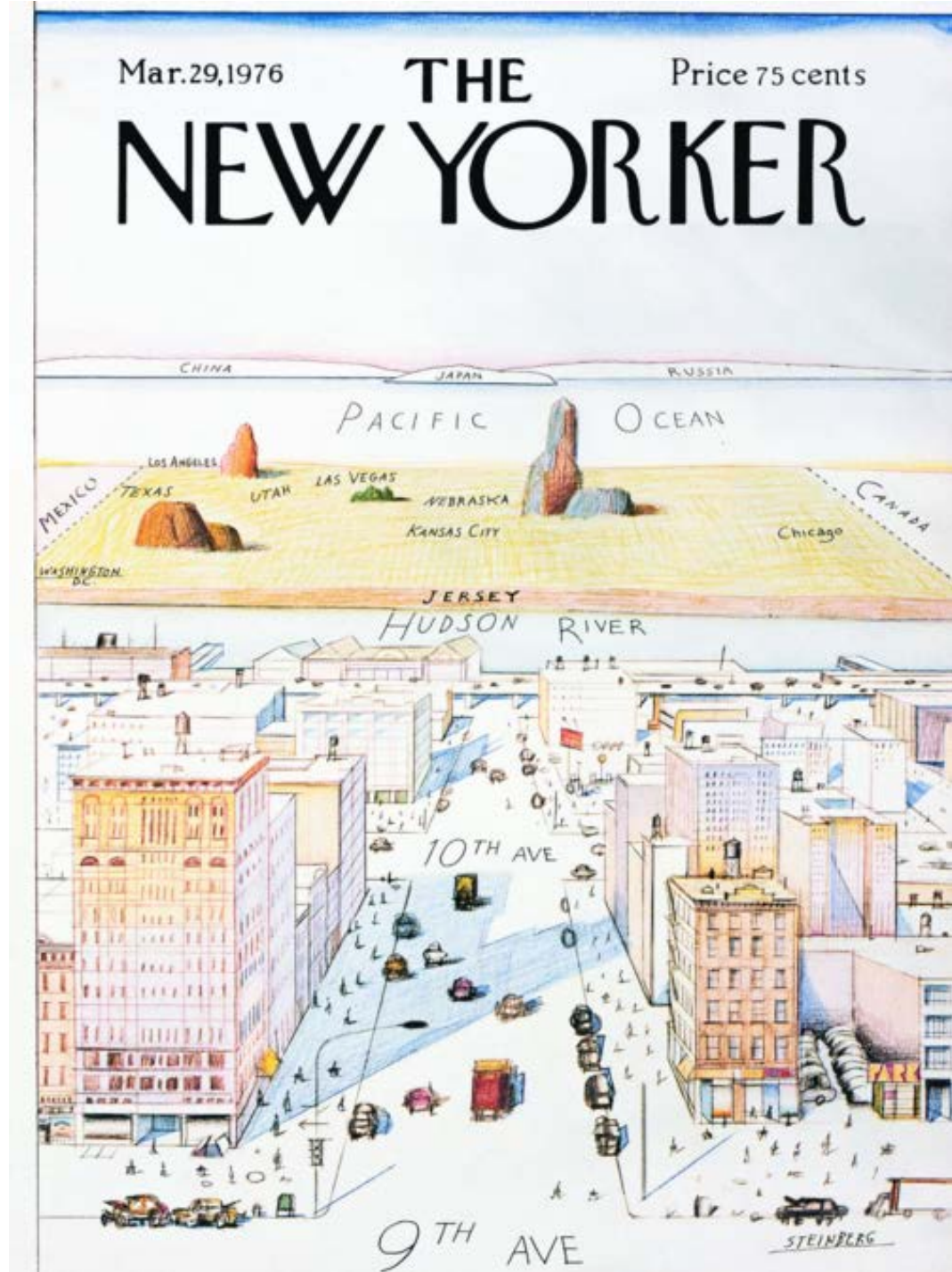
Suppression

Saul Steinberg

A view of the world
from 9th Avenue

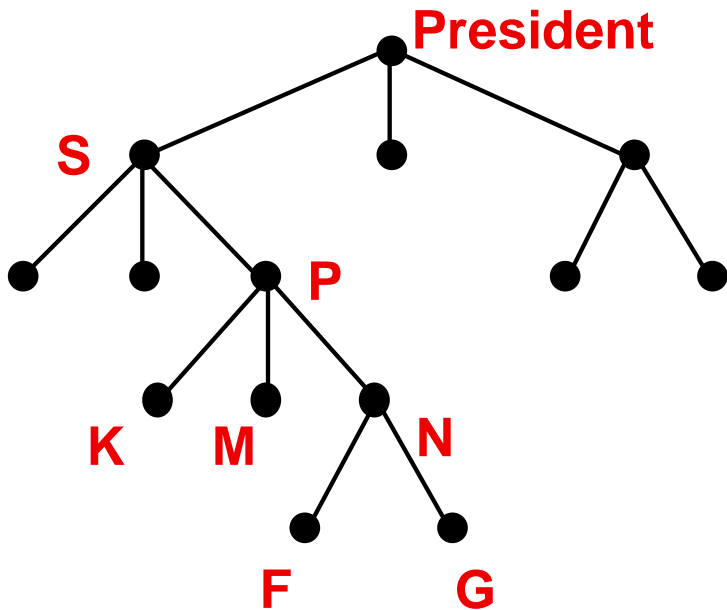
Distortion +
Suppression

Presenting only
relevant data

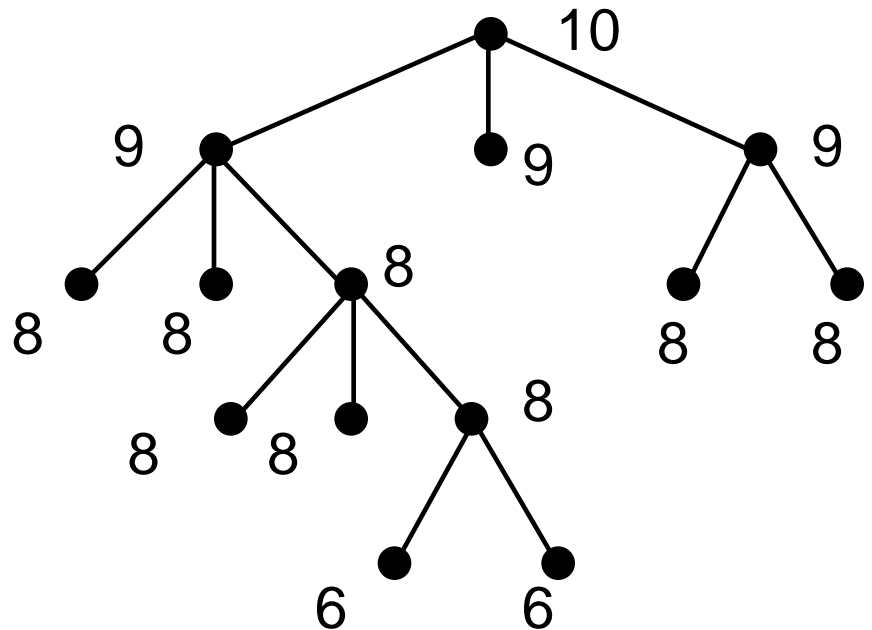


Relevant data (?)

- A more formal definition
- Degree of interest (Doi) = $f(\text{API}, D)$
 - API = a priori importance
 - D = distance

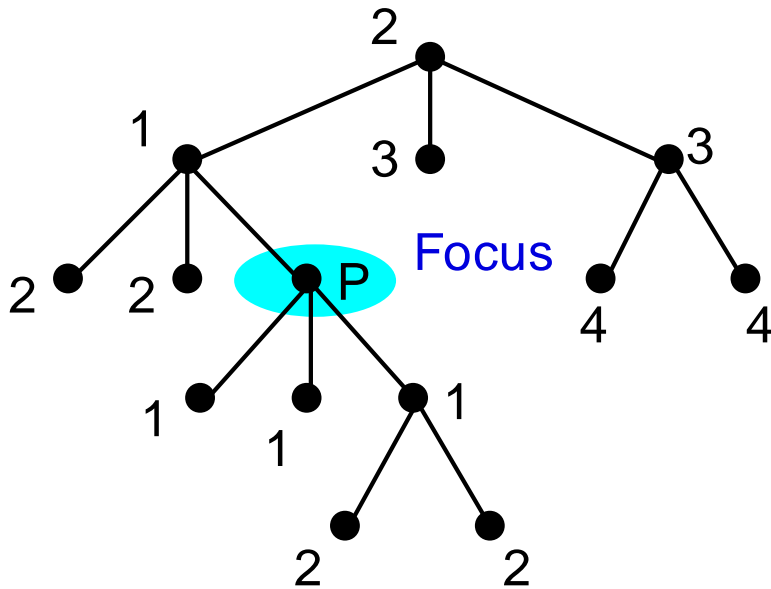
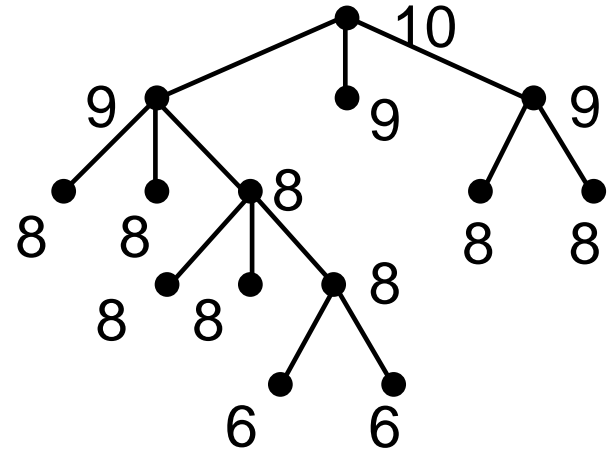


Organization tree of a company

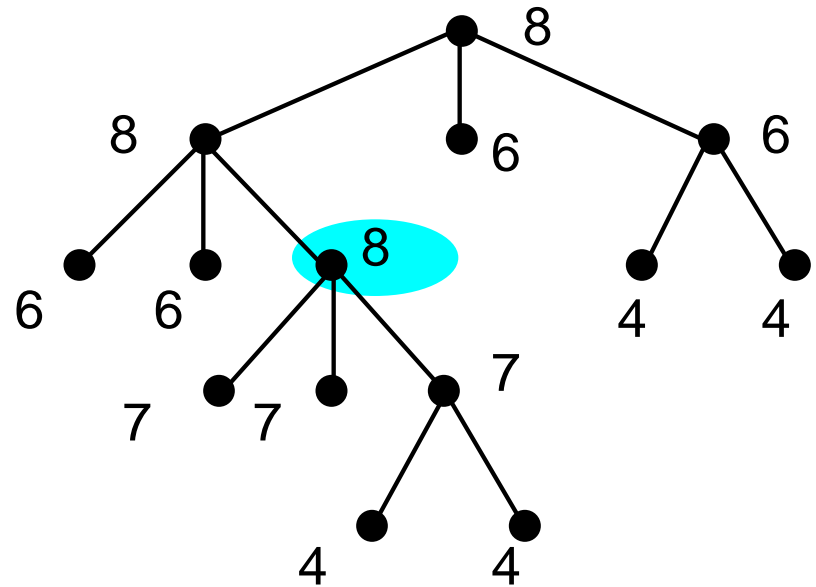


A priori importance

Relevant data (?)



Distance from the focus

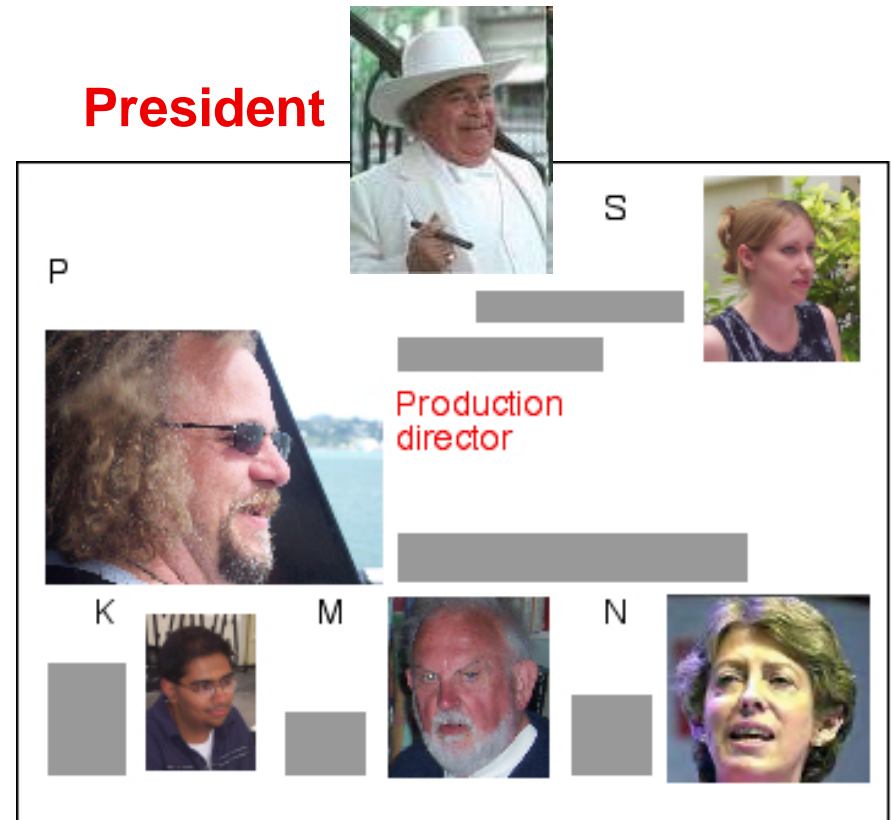
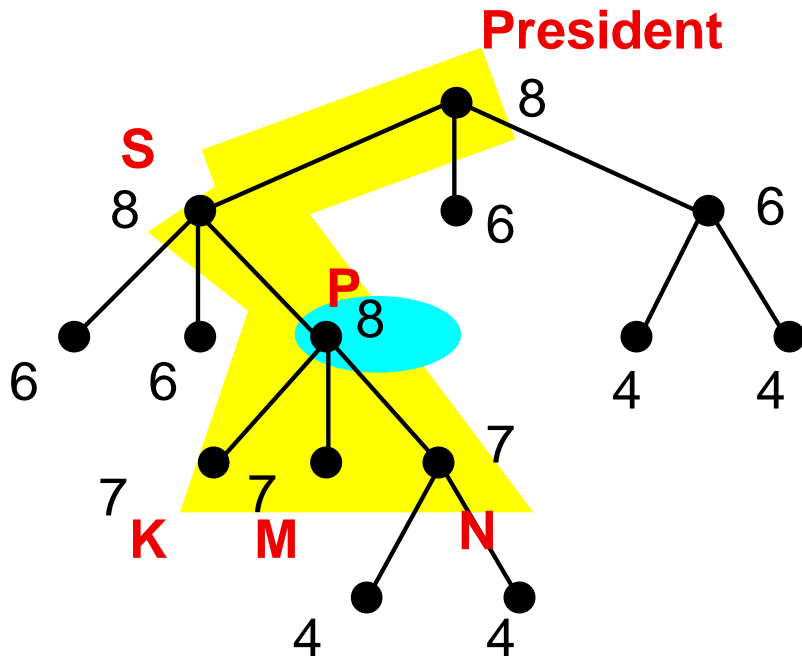


Dol=API-D

Relevant data (?)

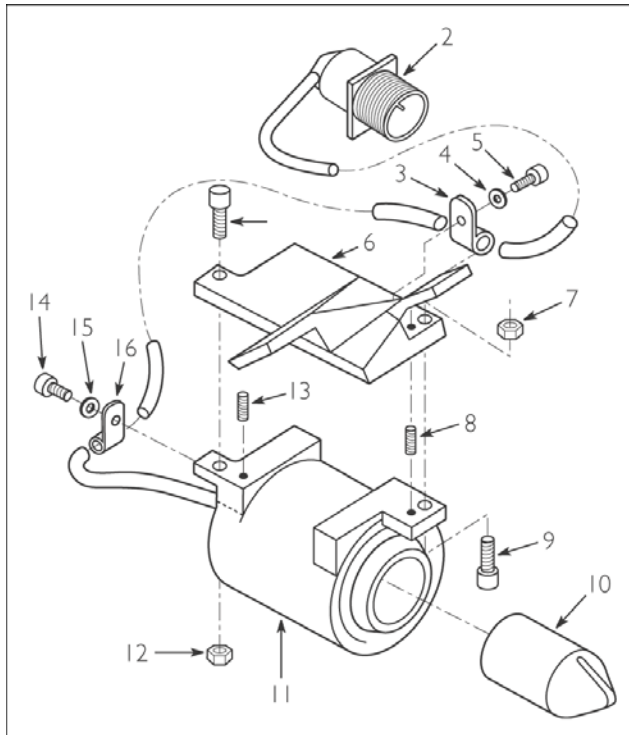
- Defining a Doi threshold define context

Doi ≥ 7

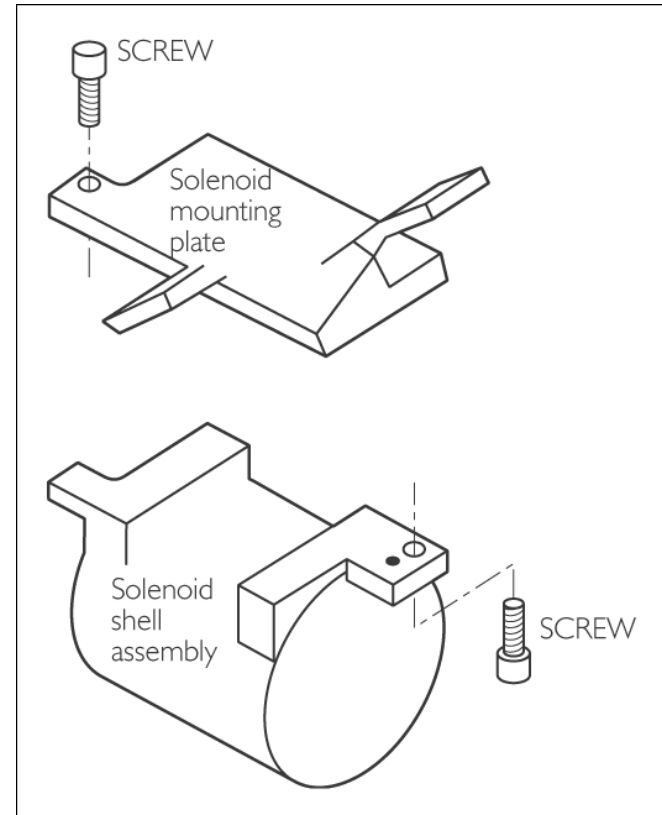


OntoViewer Demo

Relevant data

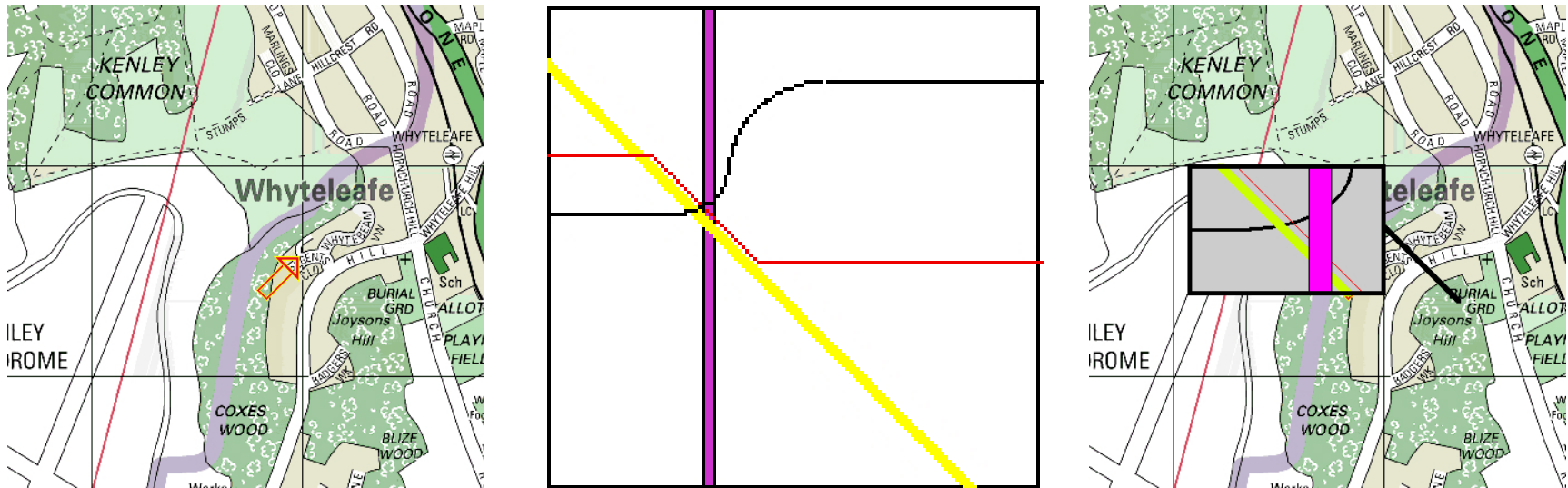


Part of an engineering drawing



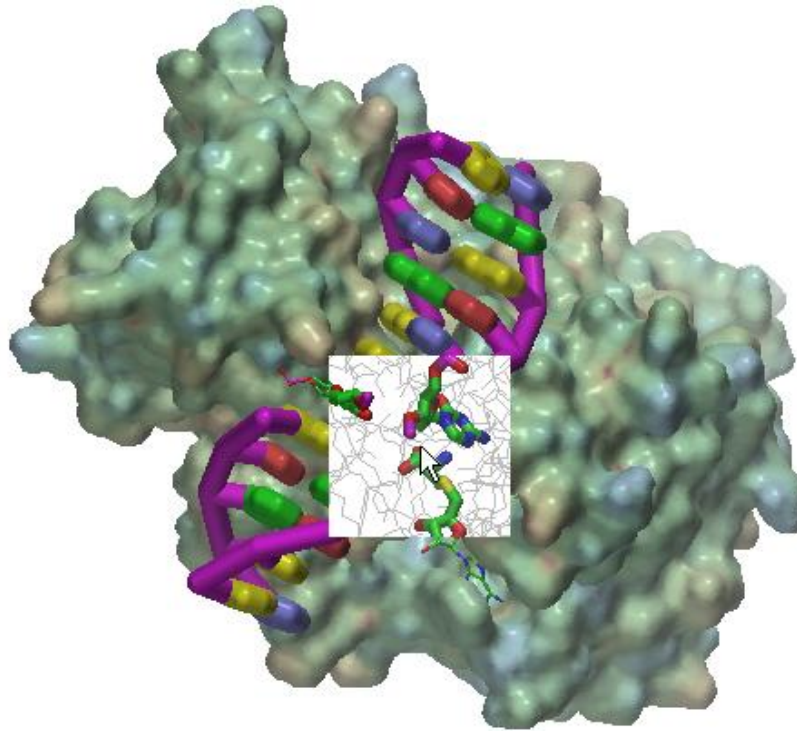
The drawing simplified in the context of a suspected fault

Suppression through layers: magic lens



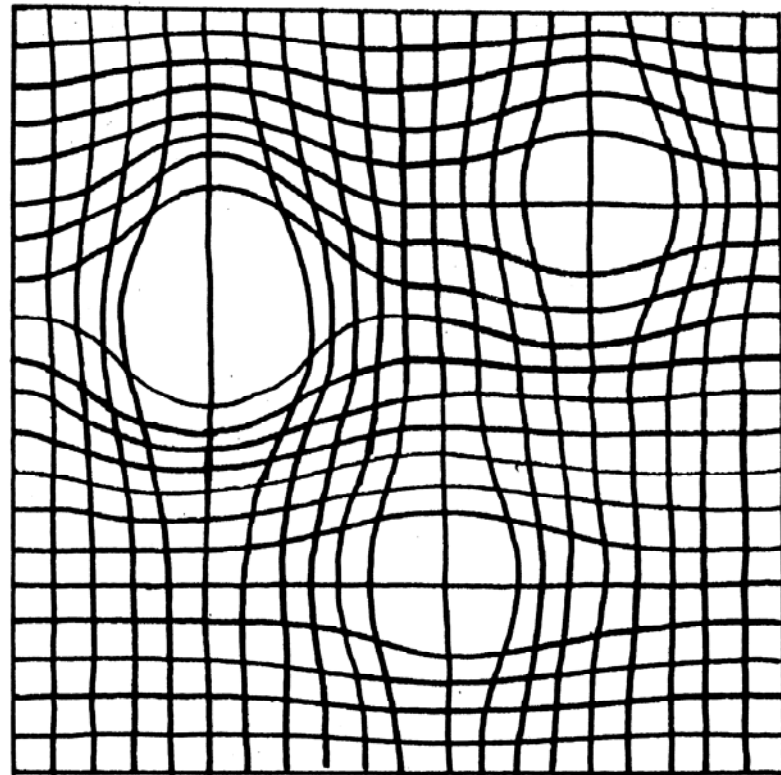
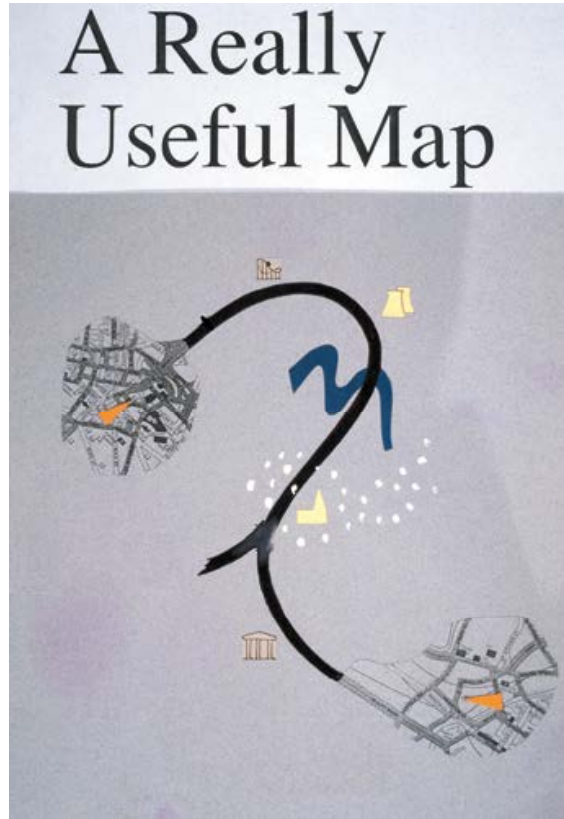
Magic lens. (a) shows a conventional map of an area, (b) shows the location of services (gas, water and electricity pipes) in the same area, and (c) a (movable) magic lens shows services in an area of interest, in context

Suppression through layers: magic lens

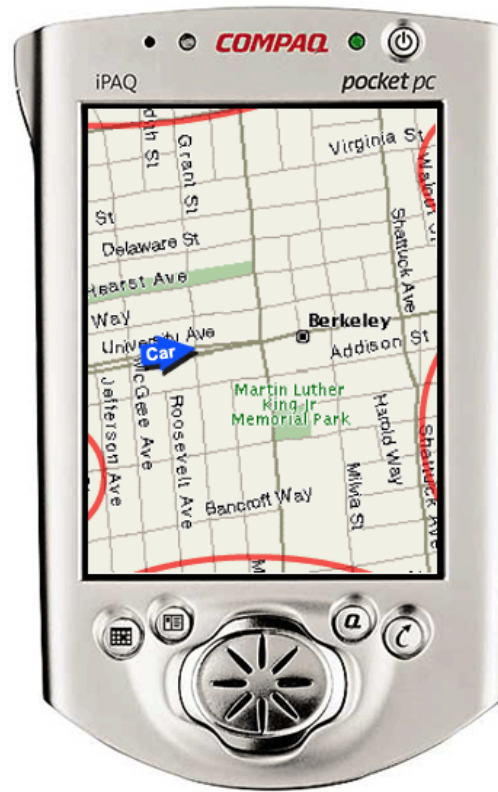
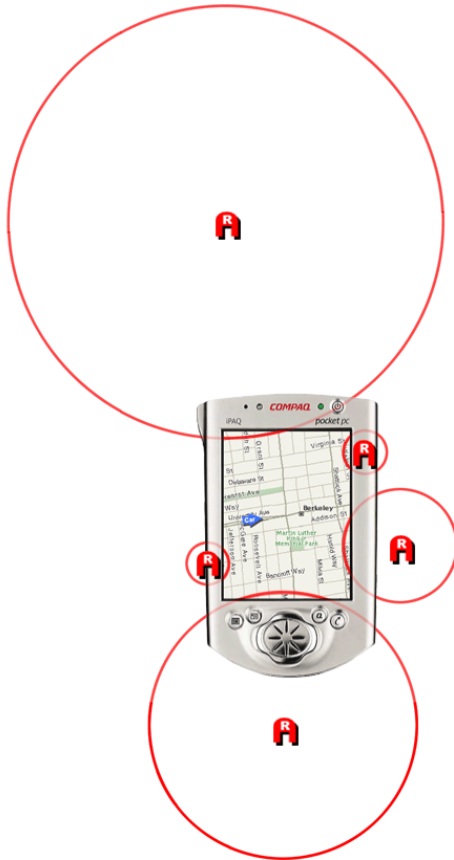


A molecular surface of the protein transferase. The magic lens window allows a view of the atomic structure bonding to be shown, thereby providing a view inside the protein

Distortion + suppression



Link between representation & presentation

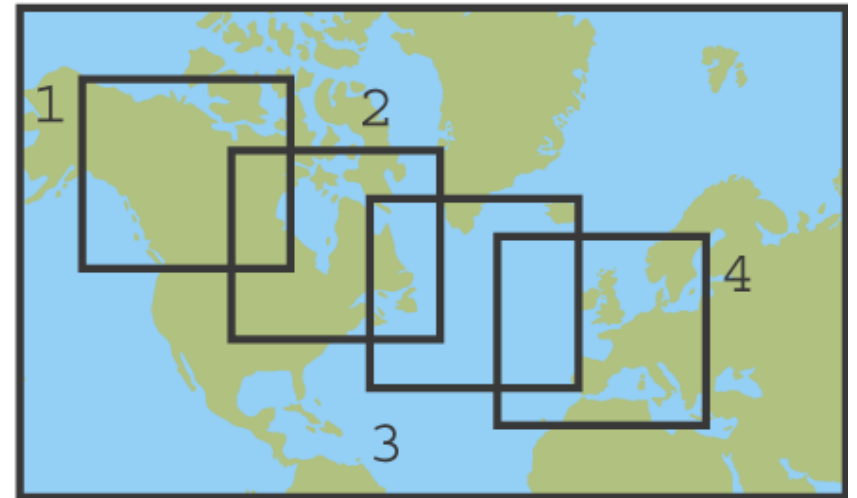
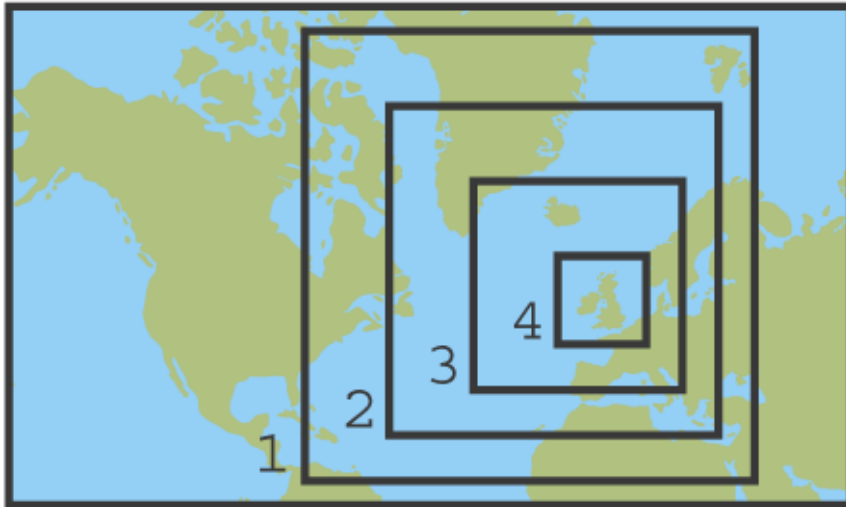


Representation & presentation to provide context for a small display

Outline

- Presentation & Screen limitations
- Space limitations
 - Scrolling
 - Overview + details
 - Distortion
 - Suppression
 - Zoom & pan
- Time limitation

Zoom and pan



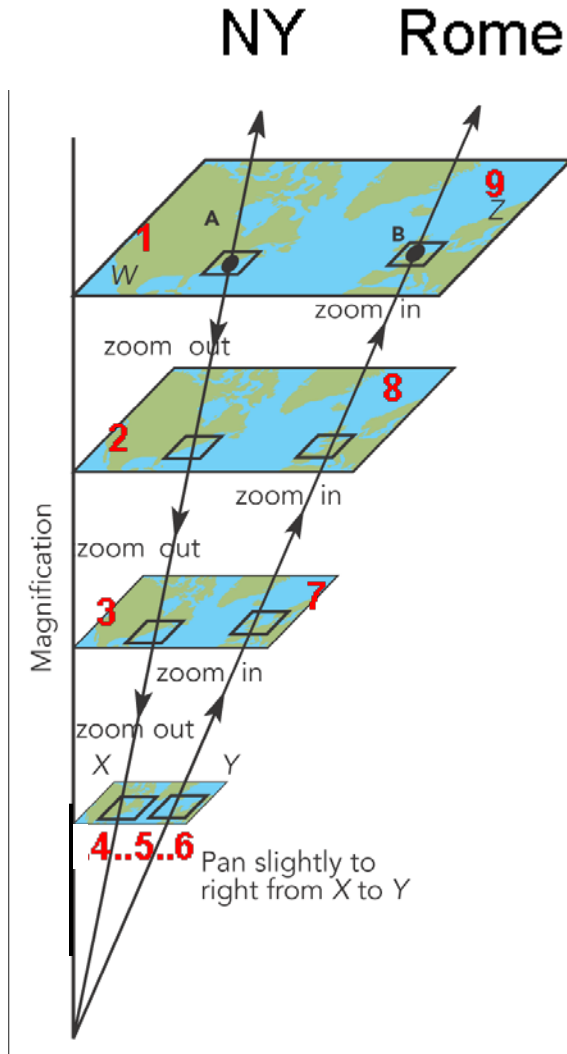
In both cases we have to care about the context

NY to London

Long, boring panning (unless you like blue ...)



Combining zoom and panning

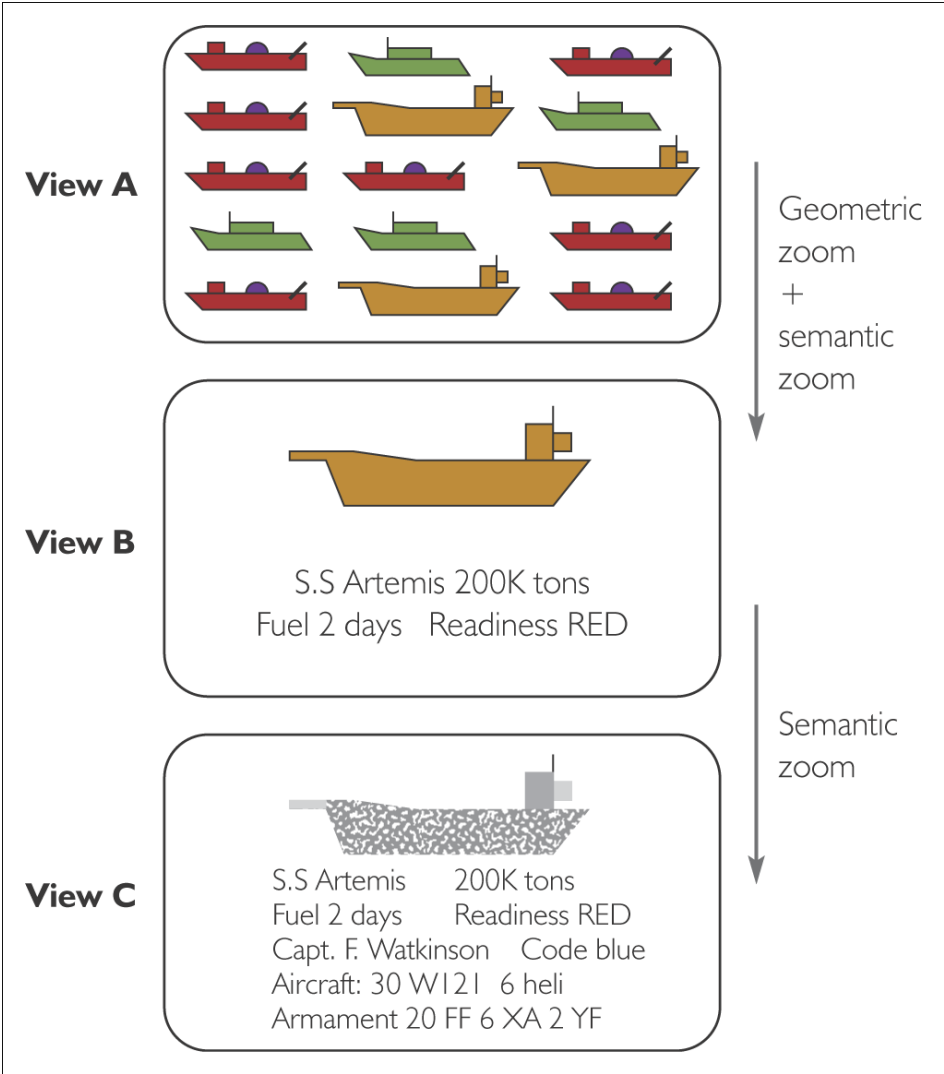


What a complex interaction !

Who acts this way?

[video](#)

Geometric & semantic zoom

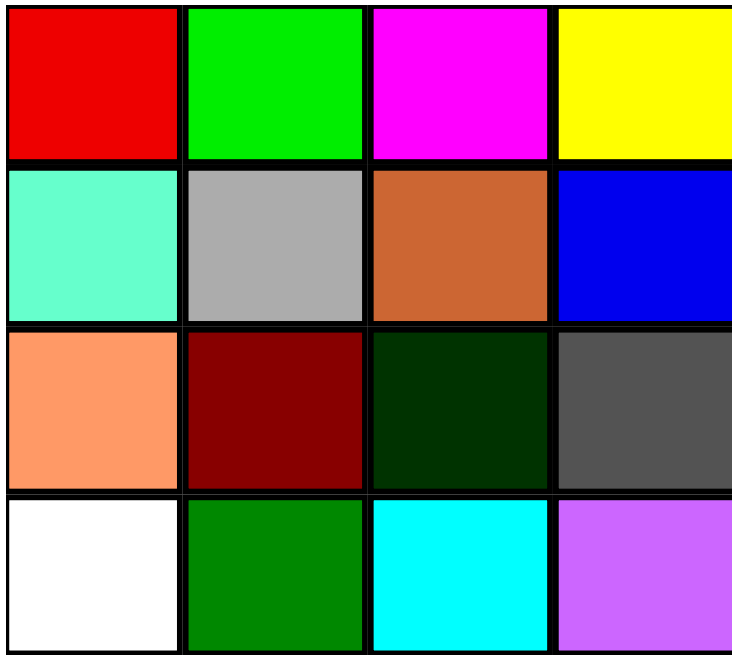


Outline

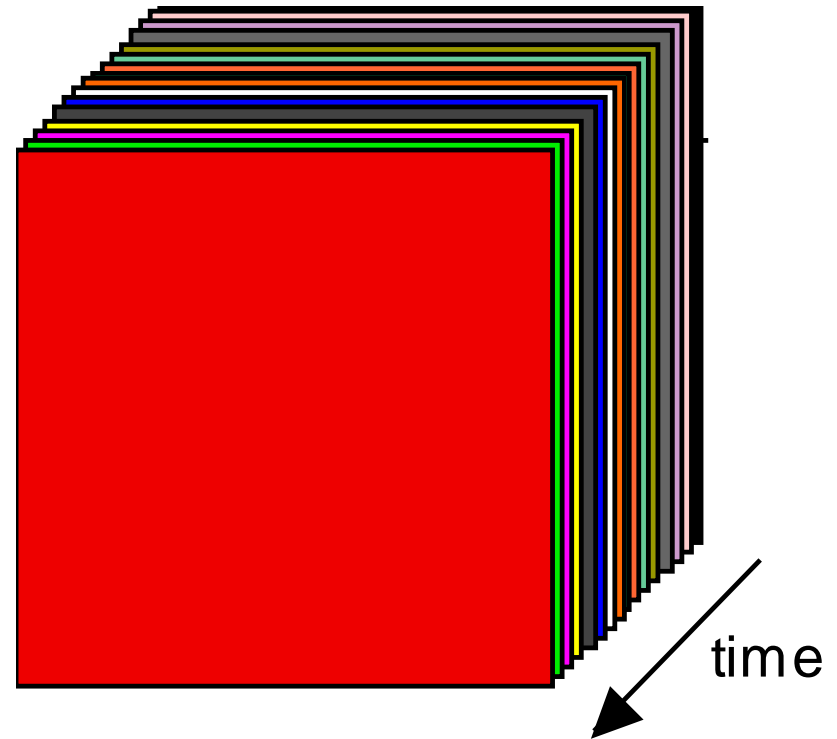
- Presentation & Screen limitations
- Space limitations
 - Scrolling
 - Overview + details
 - Distortion
 - Suppression
 - Zoom & pan
- Time limitation

Time limitations

- Rapid serial visual presentation vs parallel visualization
- Up to 10 images per second ...



Concurrent presentation

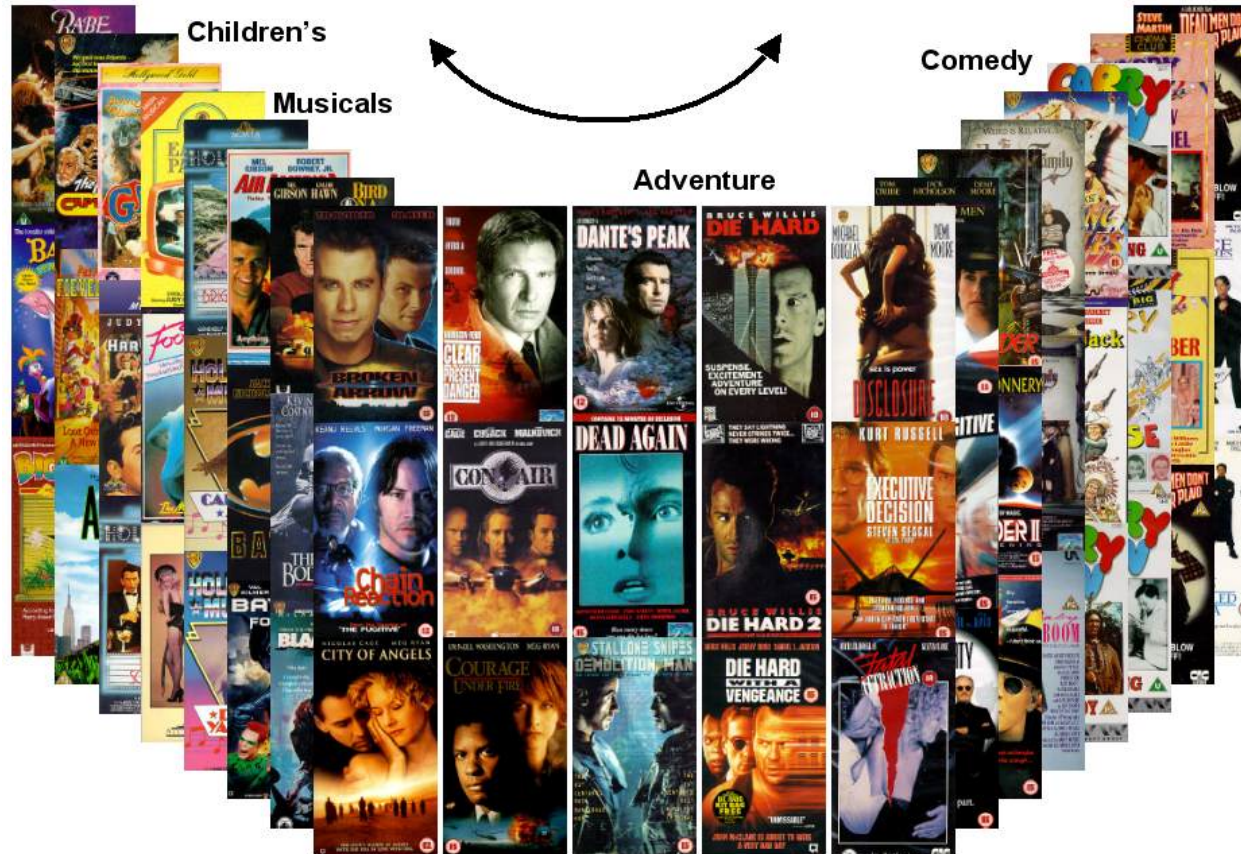


Serial presentation

What an odd task?

- Browsing !!!
 - Looking for a page in a book (using its appearance)
 - Looking for a picture in a collection of photos
 - Looking at a movie through a trailer
 - Looking for a gift in a catalogue
 - Searching a product in a supermarket shelf
-video ([v21imagebrowsing.mov](#))

Browsing video posters

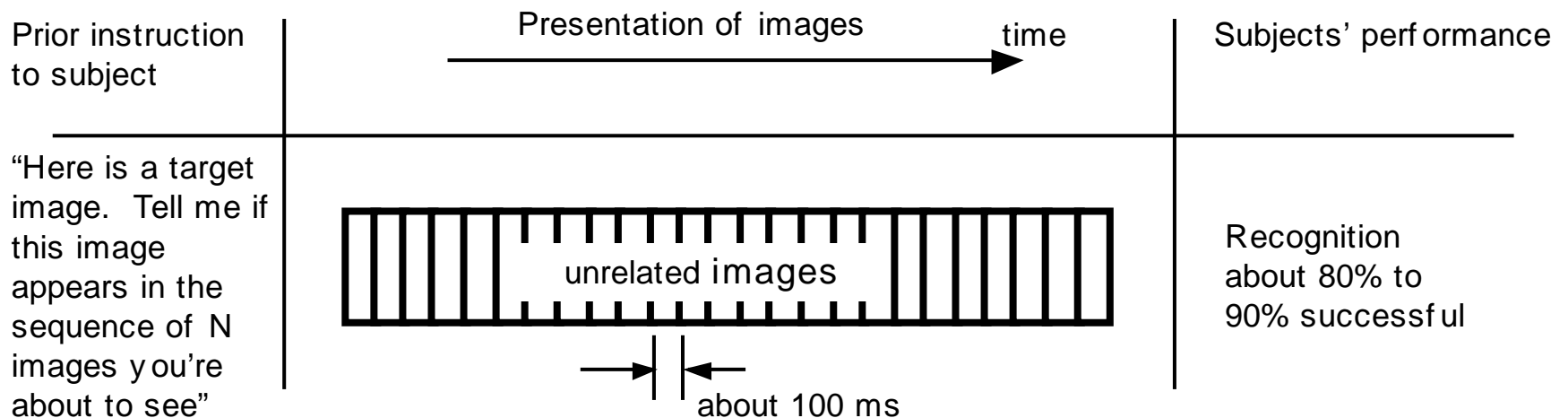


Browsing of posters advertising videos. Cursor movement along the stacks causes posters to briefly 'pop out' sideways, and the whole bifocal structure can be scrolled to bring a video of interest to the central region, where a mouse click will cause a clip from a video to be played

How fast we can go?

- Experiment

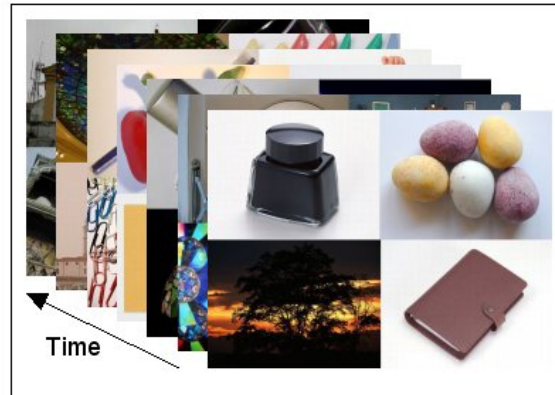
- A subject is shown an image
- After he is exposed to a large set of images at rate 10 per seconds
- The subject is asked for the target image belongs to the set
- 80%-90% success rate



Space and time...



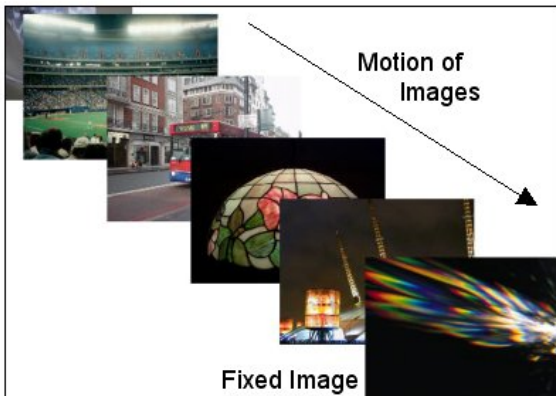
Mode A: Slideshow



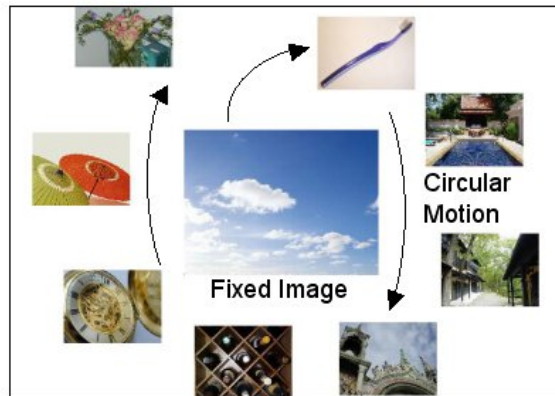
Mode B: Mixed



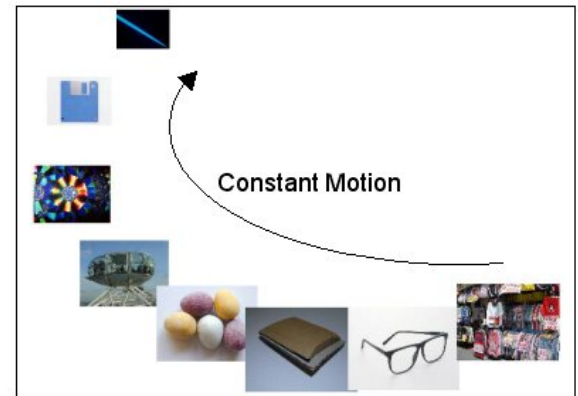
Mode C: Tile



Mode D: Diagonal



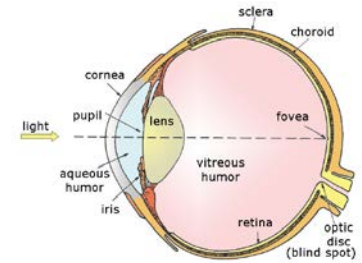
Mode E: Ring



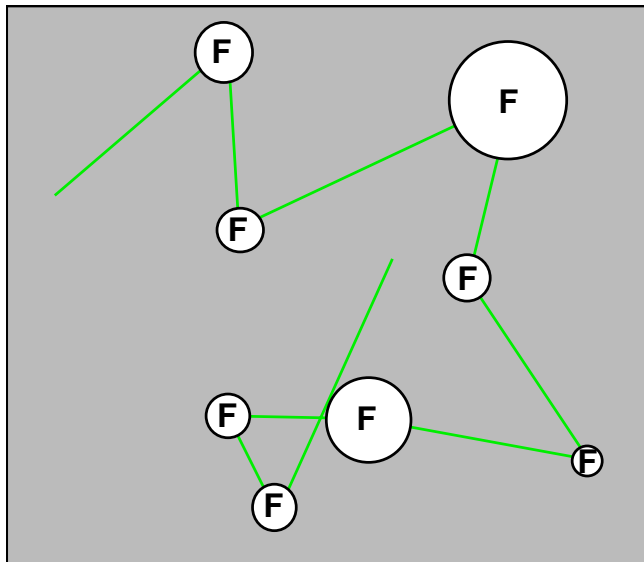
Mode F: Stream

Videos... A B D

Do you remember the 1° fovea?



- To evaluate such kind of interfaces it is mandatory to recall the way an eye behaves
- Fovea: narrow high resolution spot
- Quick eye-gazes plus fixations



A simple representation of eye-gaze behavior. The rapid saccades are shown green, the fixations (F) of varying duration by circles of proportionate size

Eye tracking

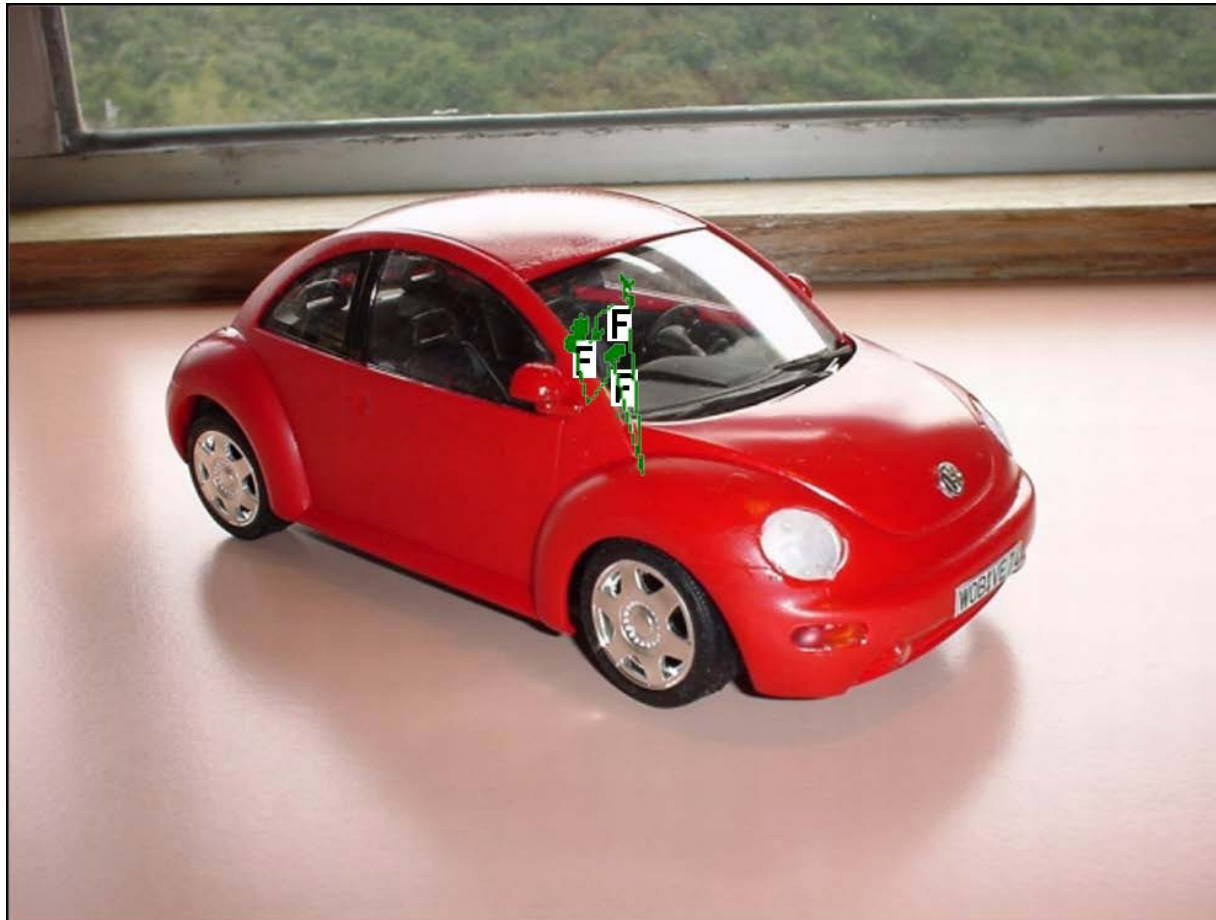


Recording of eye-gaze. An infra-red laser beam is aimed at the user's eye, and reflections from the retina and cornea are detected by a television camera. It also records pupil diameter

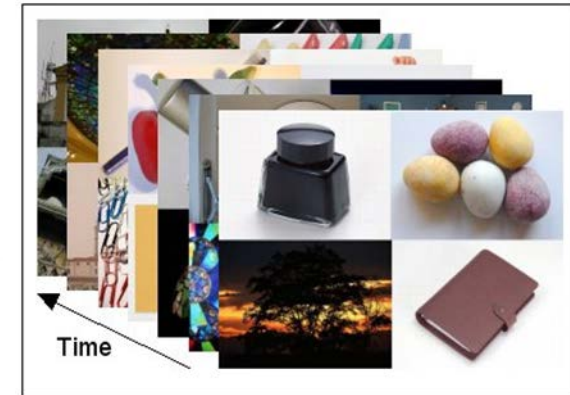
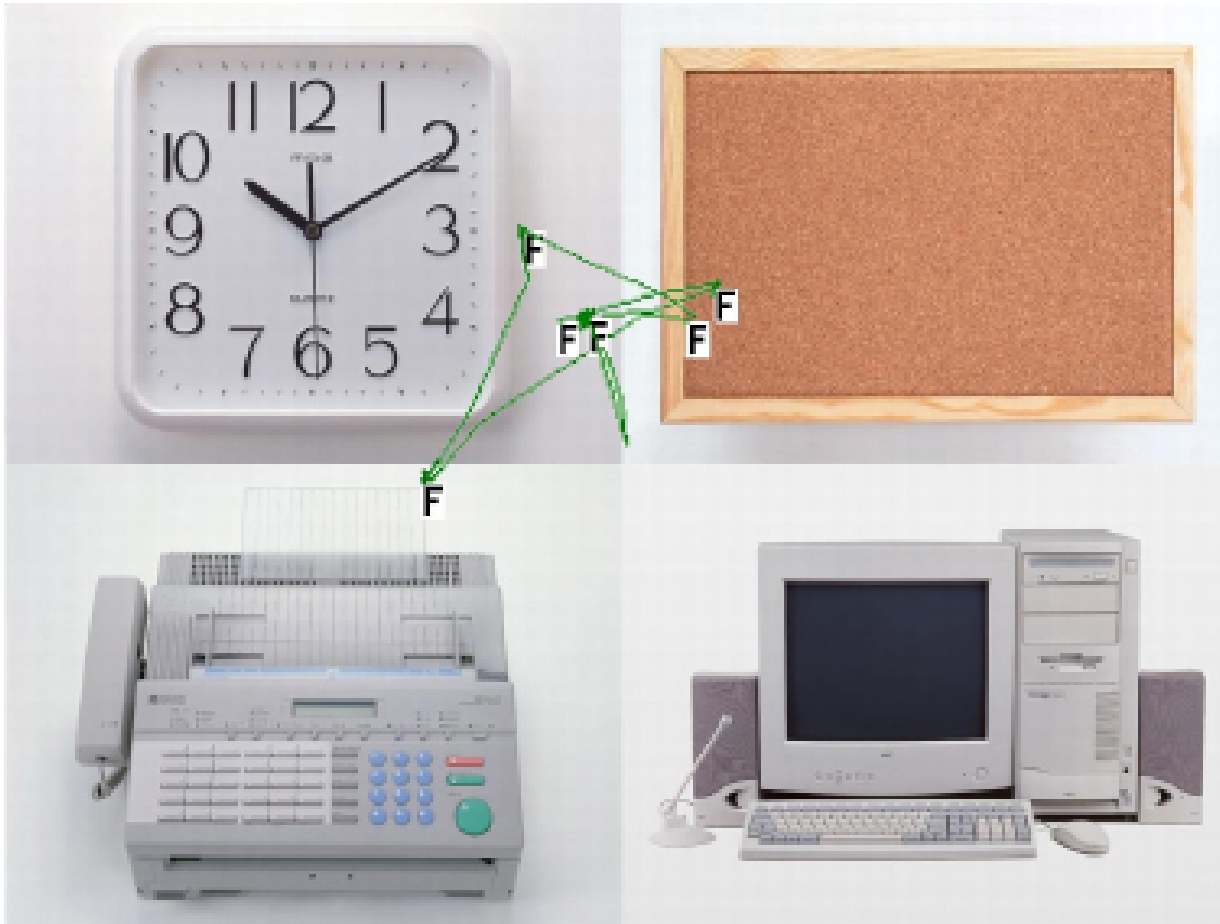
Eyes gazes: A) slide-show



Mode A: Slideshow

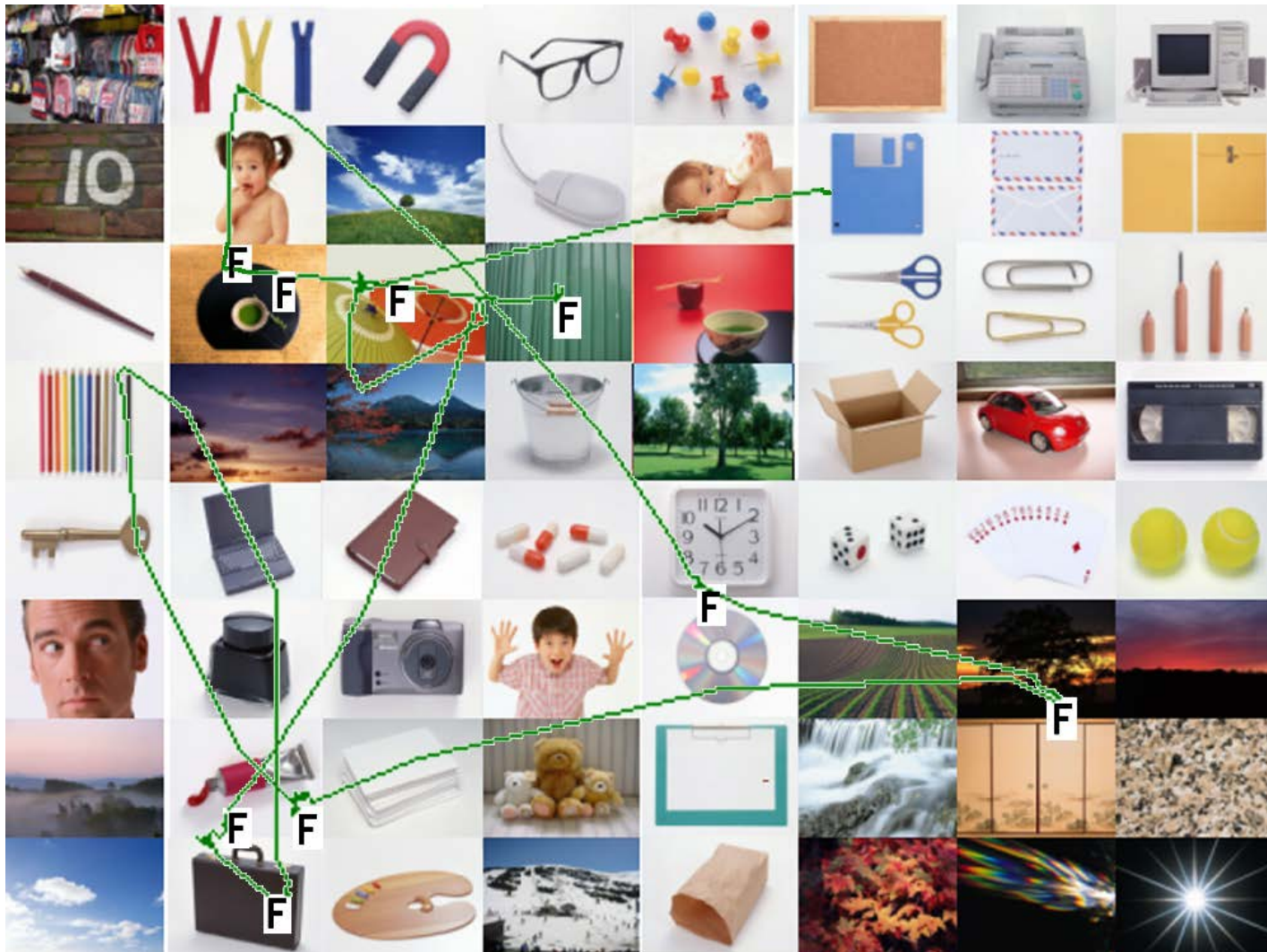


Eyes gazes: B) mixed

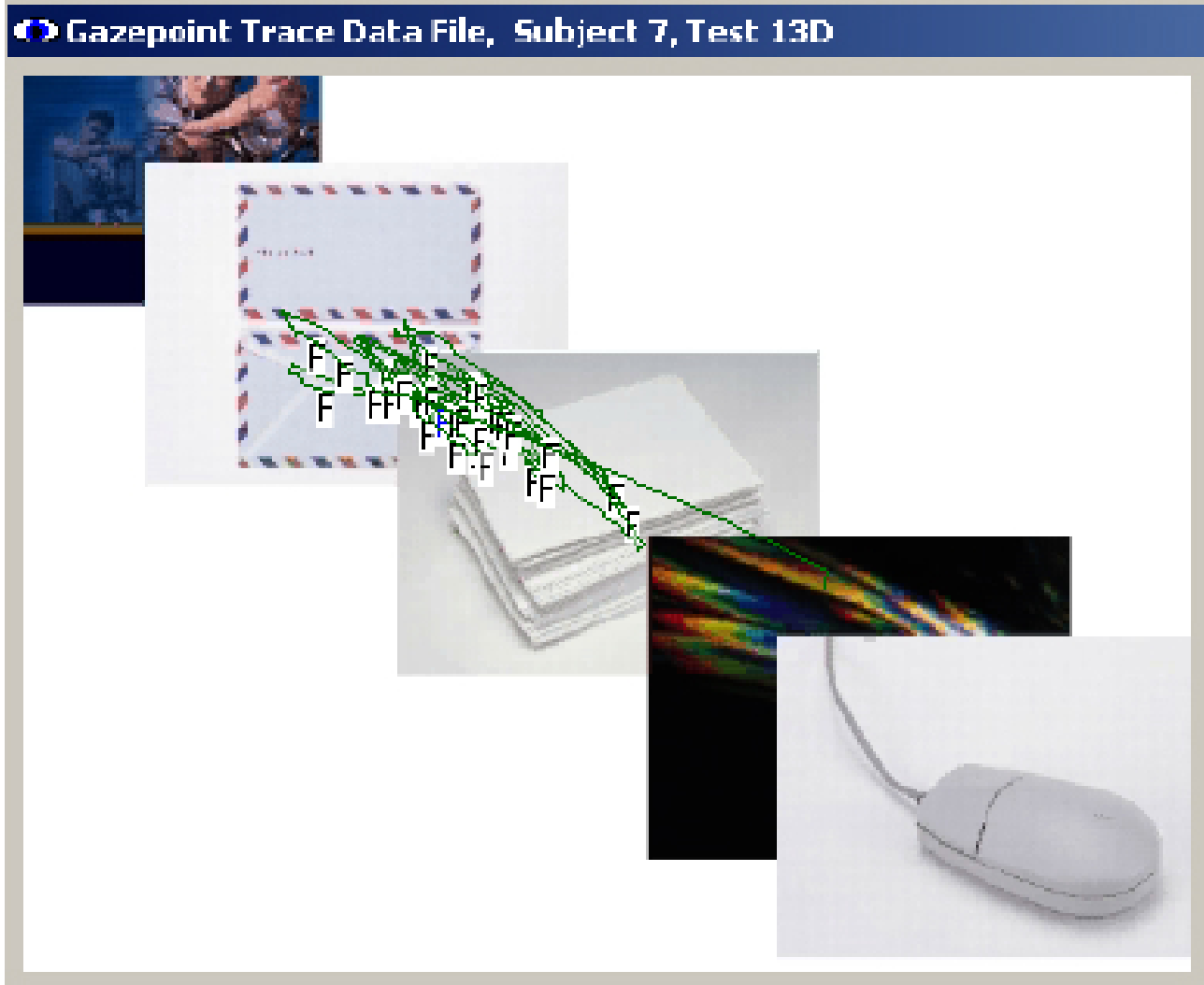


Mode B: Mixed

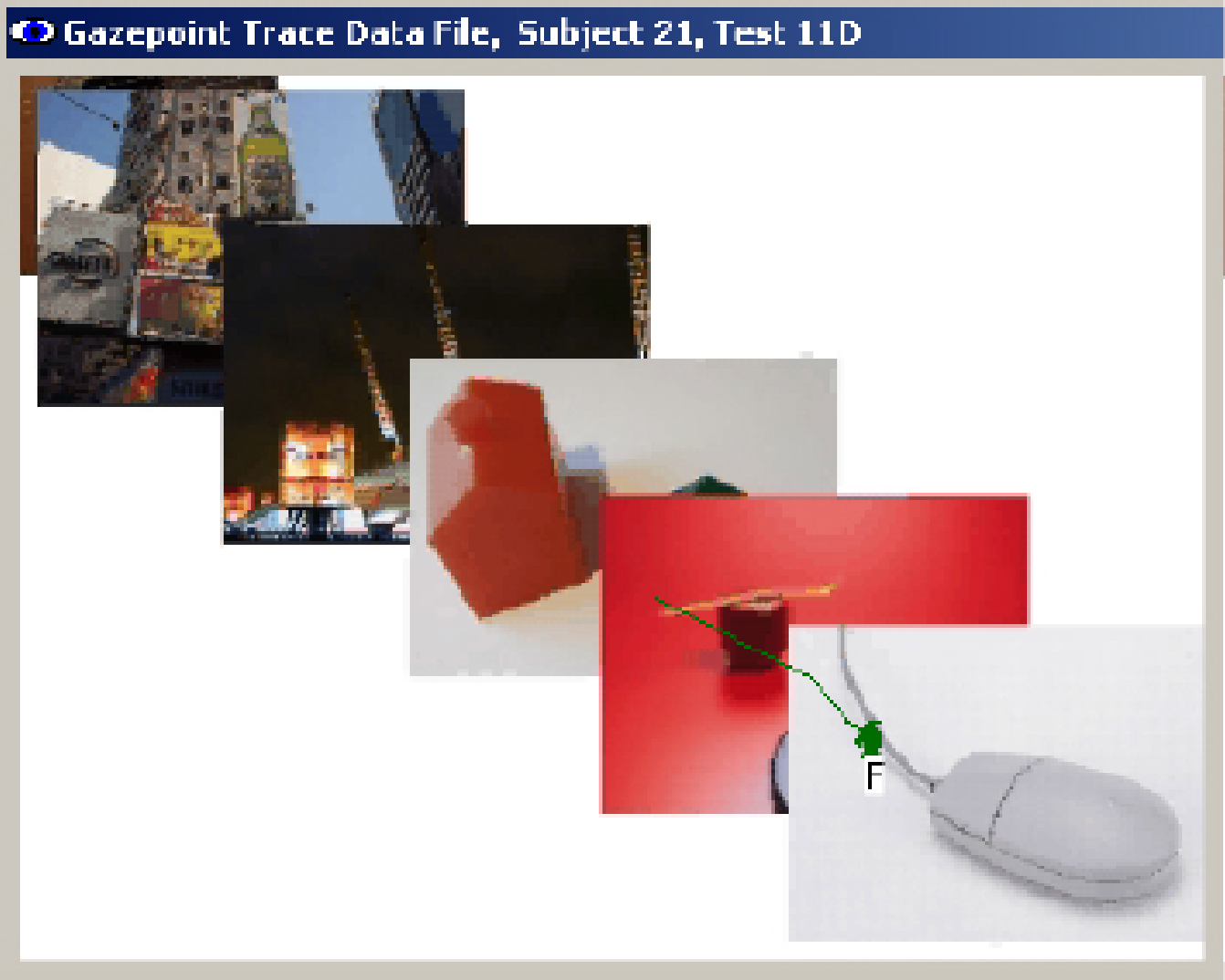
Eyes gazes: C) tile



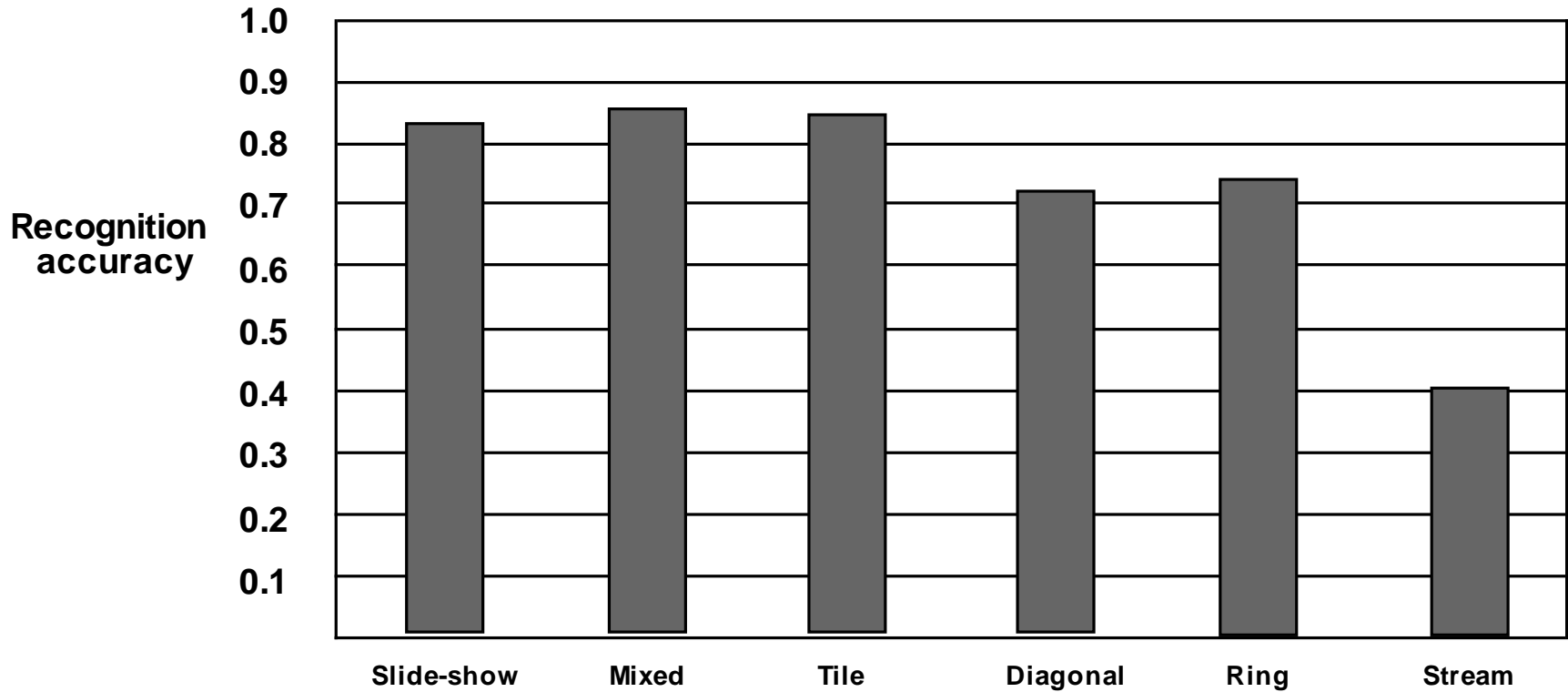
Eyes gazes: D) diagonal (liking it)



Eyes gazes: D) diagonal (disliking it)

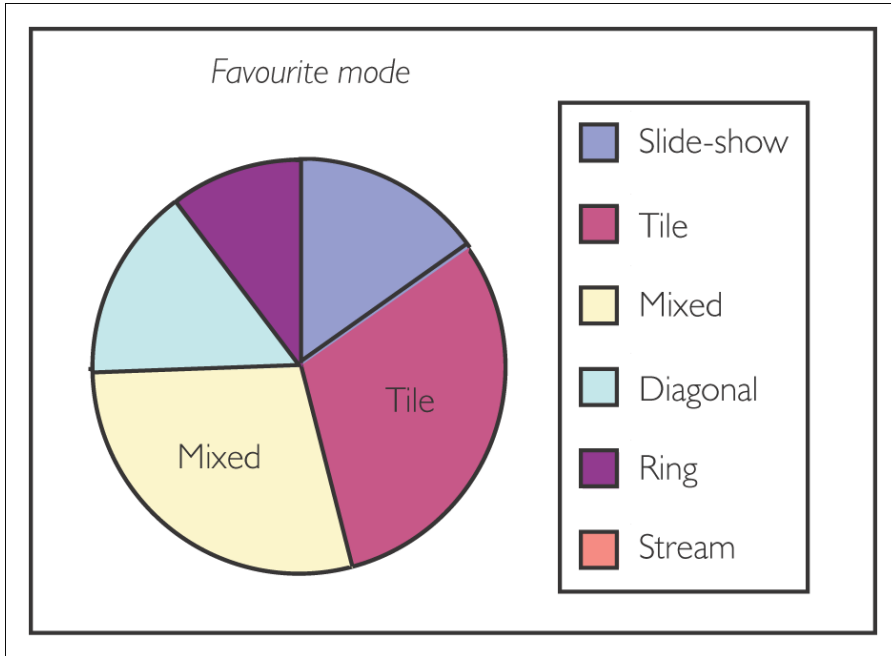
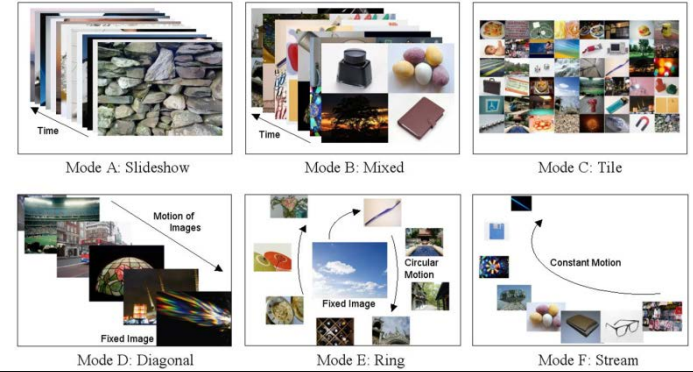


Accuracy

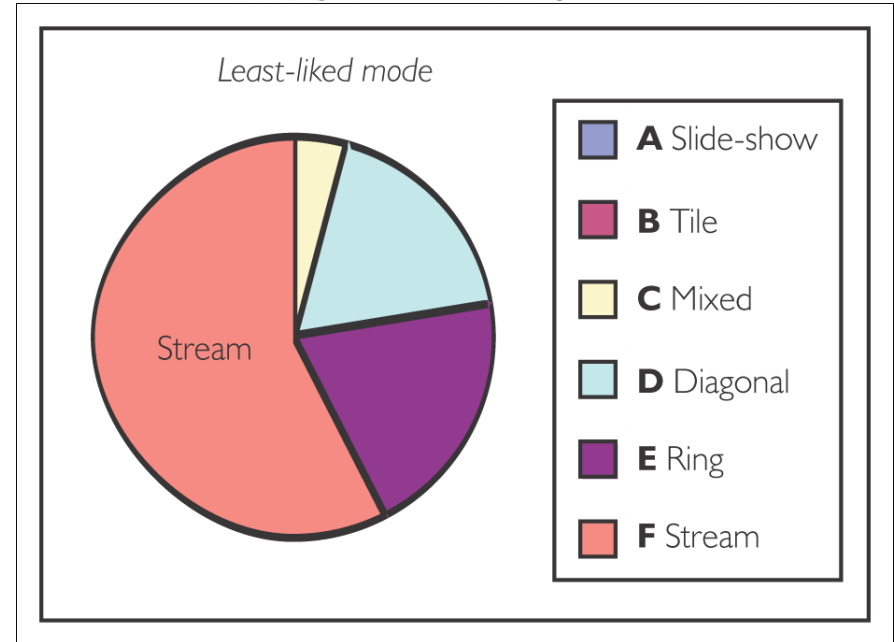


The accuracy with which the presence or absence of a target image was reported for the six presentation modes

Matter of opinion...



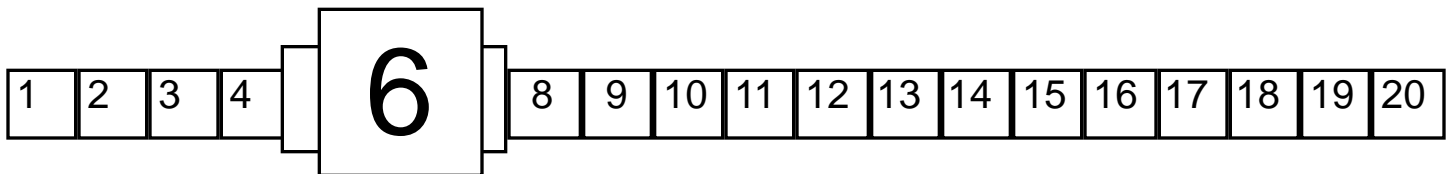
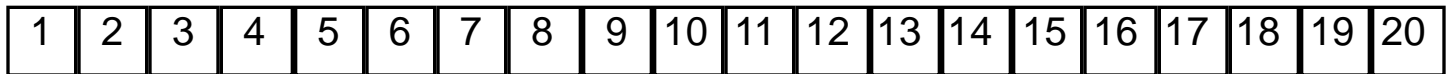
The (static) slide-show, mixed and tile image presentation modes account for three-quarters of the preferred modes



Almost all the least preferred image presentation modes were moving modes and the stream mode accounted for over half

Interaction !

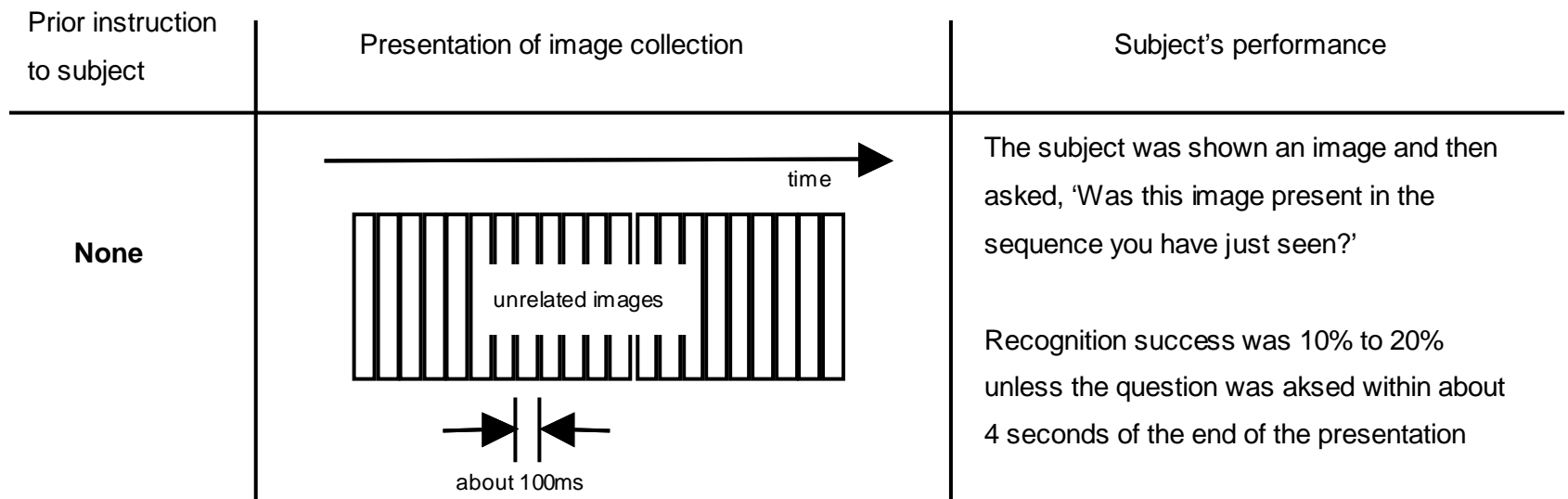
- Control the speed
- Expand images



Macintosh like interaction...

Still on human visual performance

- Another experiment

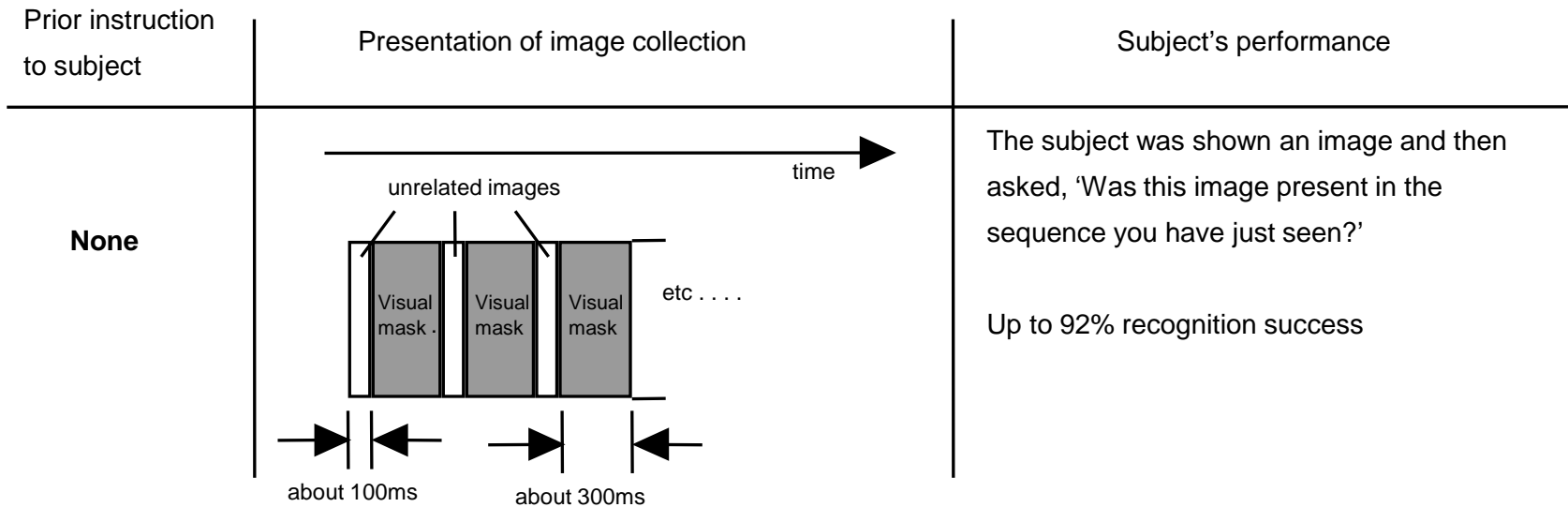


4 seconds?

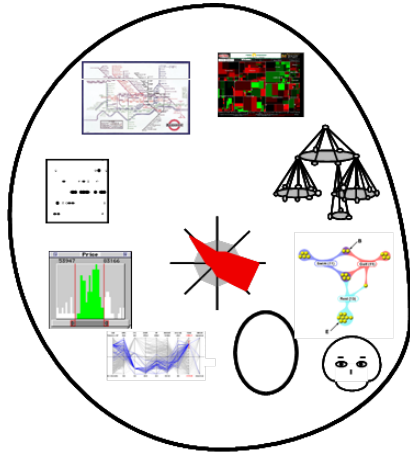
Conceptual short-term memory (sound and images)...

Still on human visual performance

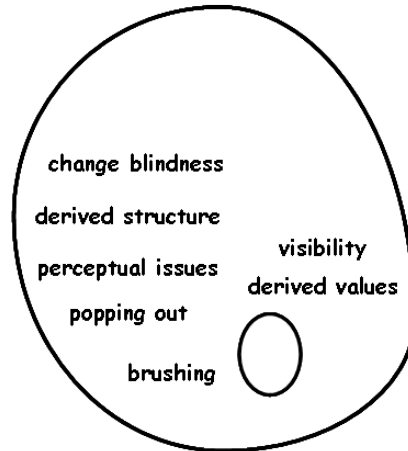
- You can argue that 100 ms is too short but...



Interaction design



Techniques



Concepts

A third palette for designing Infovis applications

