Visual Analytics

Giuseppe Santucci

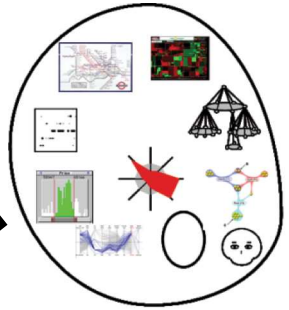
7 – Presentation

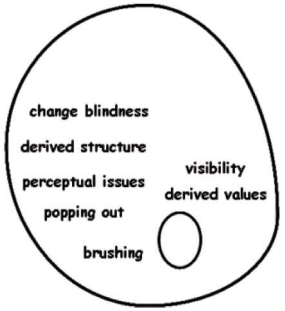
Thanks to John Stasko, Robert Spence, Ross Ihaka, Marti Hearst, Kent Wittemburg

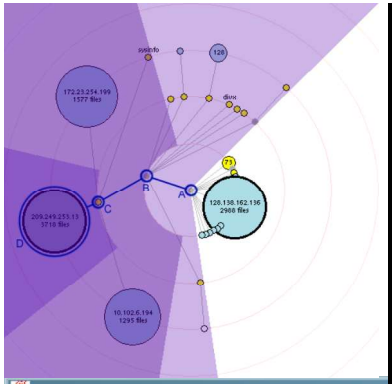
Outline

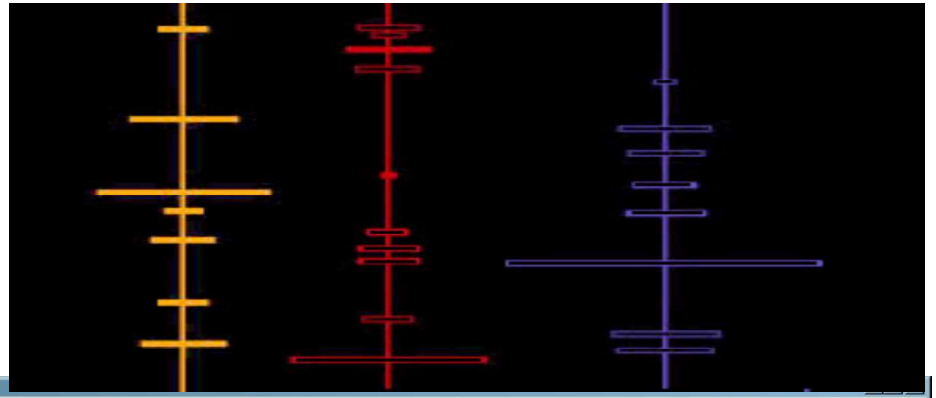
- Presentation & Screen limitations
- Space limitations
  - Scrolling
  - Overview + details
  - Distortion
  - Suppression
  - Zoom & pan
- Time limitation

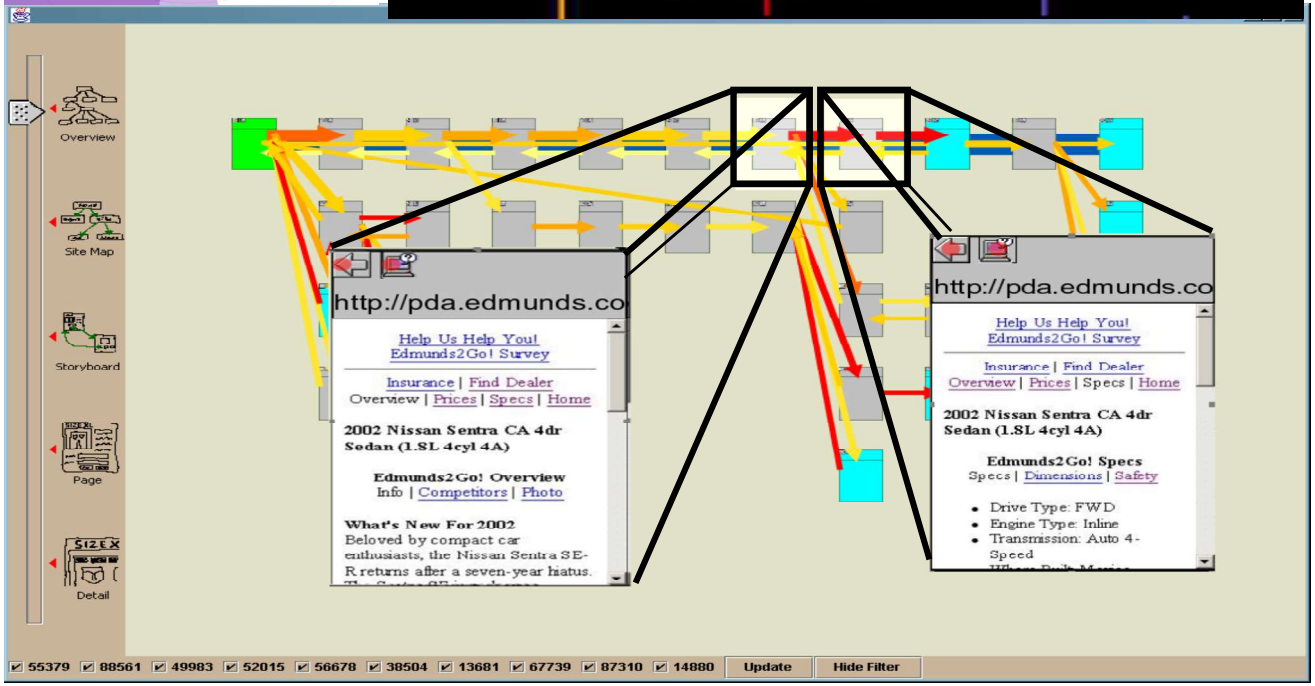
Presentation & Screen limitations











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

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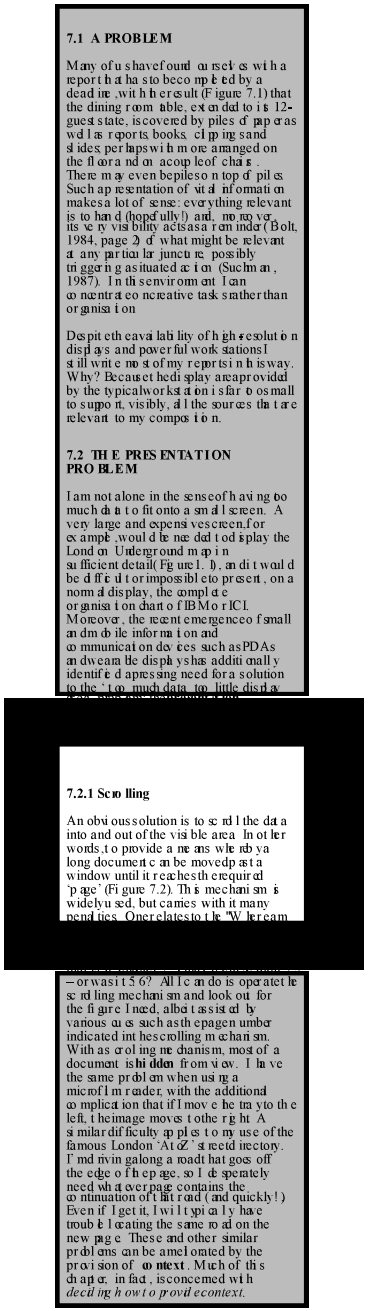
Space limitations: scrolling

- 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 his/her result (Figure 7.1) that the dining room table, extended to its 12-guest state, is covered by piles of paper 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 what ever 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.*

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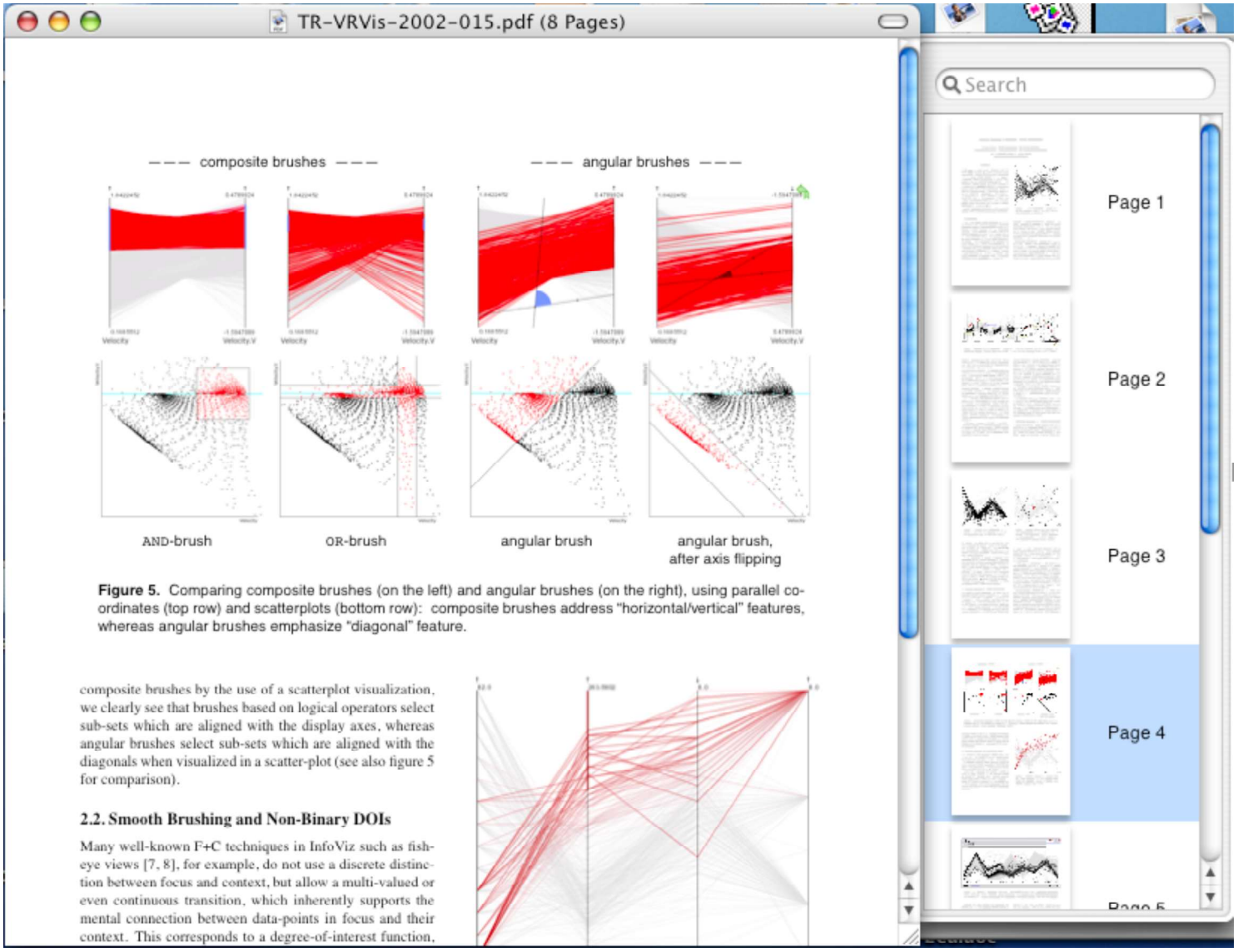
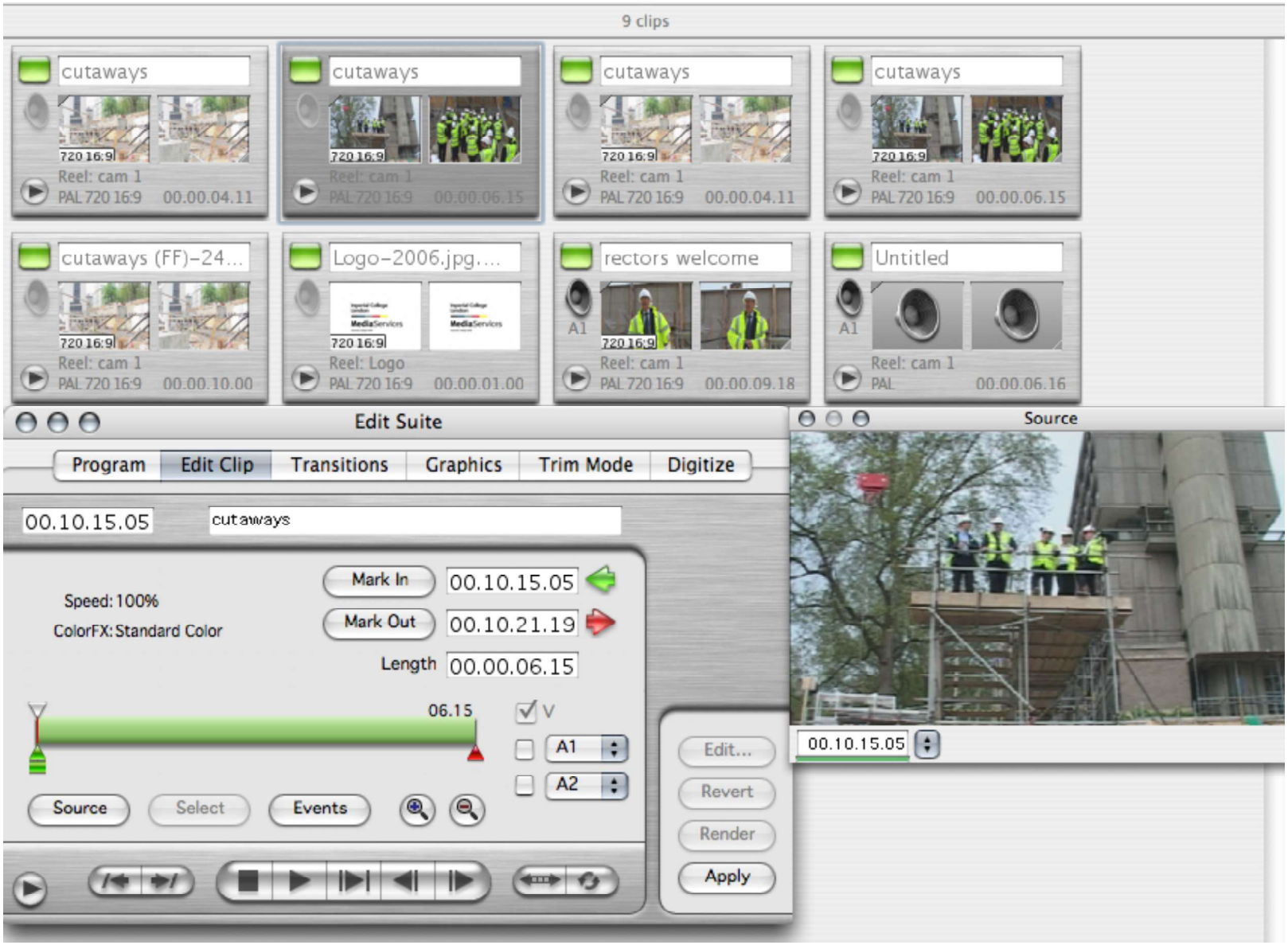
  - Distortion
  - Suppression
  - Zoom & pan
- Time limitation

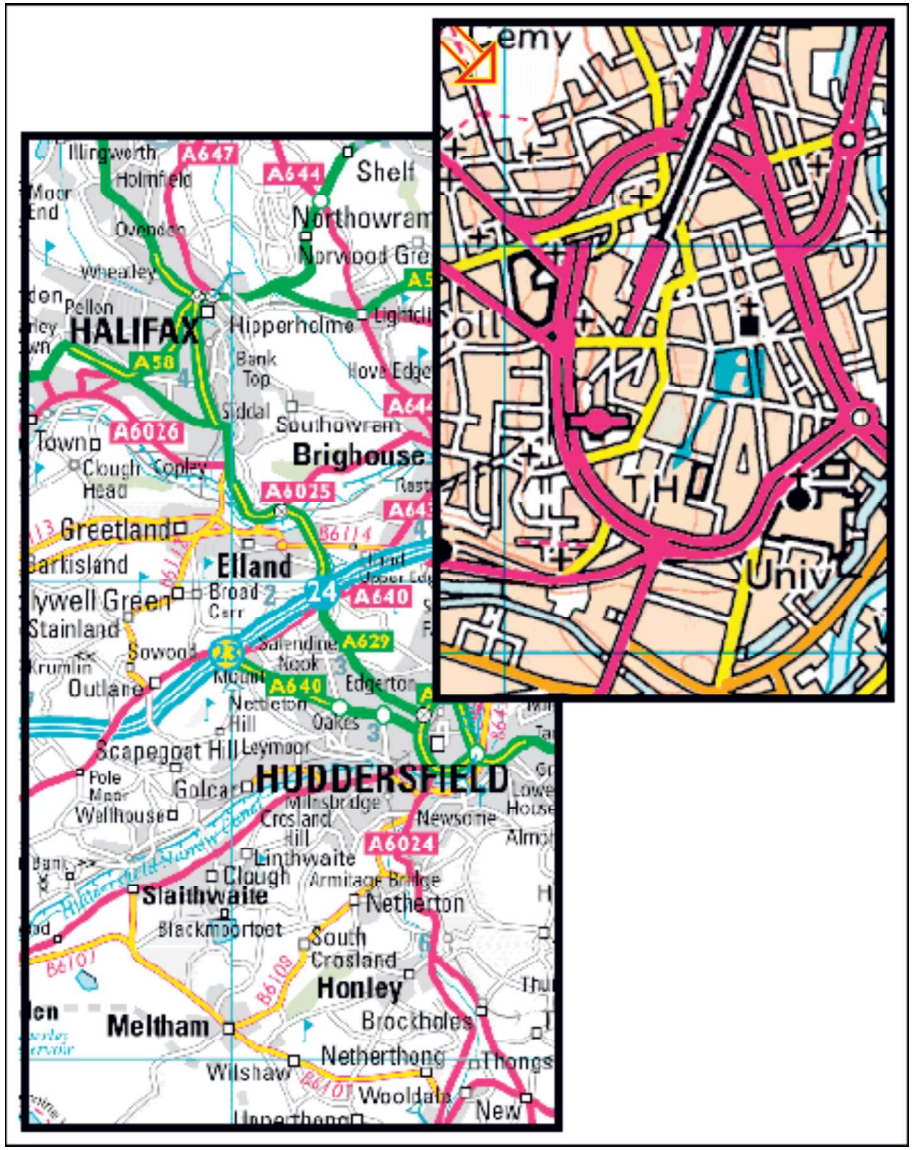
Space limitations : overview(more or less) + details

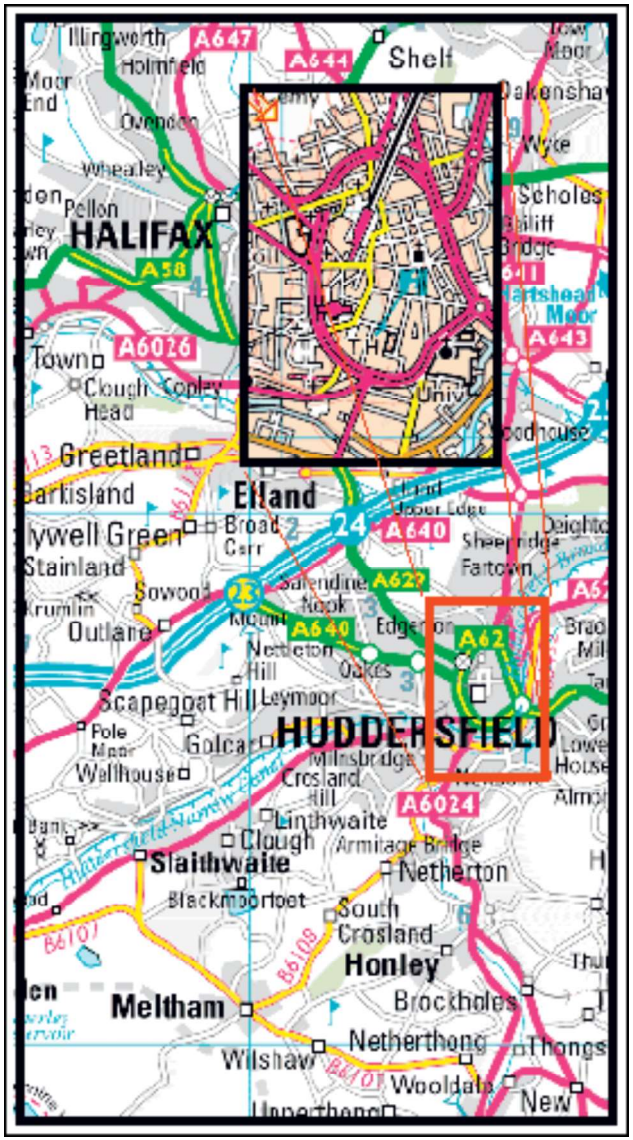


Space limitations : overview + details



Space limitations : overview + details





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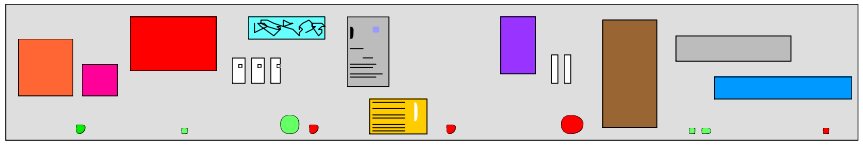
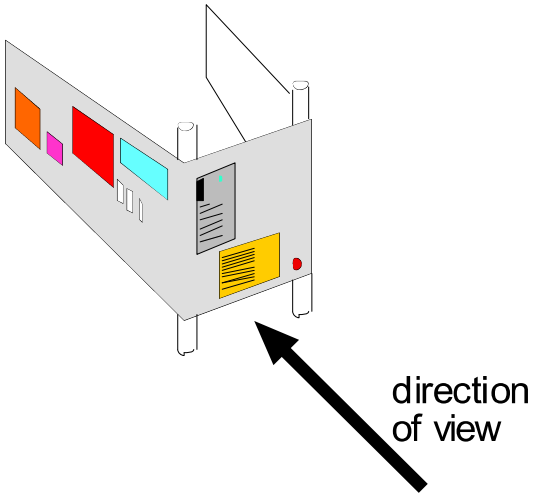
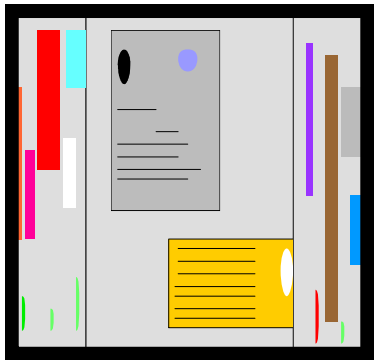
Space limitations : distortion



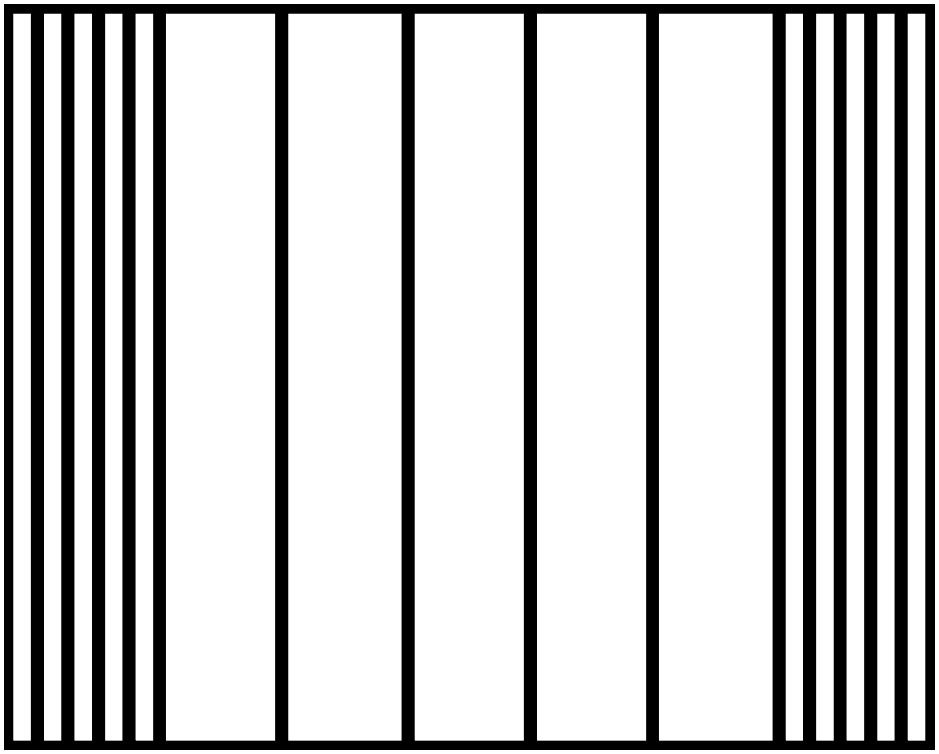
(a) An information space containing documents, emails, etc.



(b) The same space wrapped around two uprights.

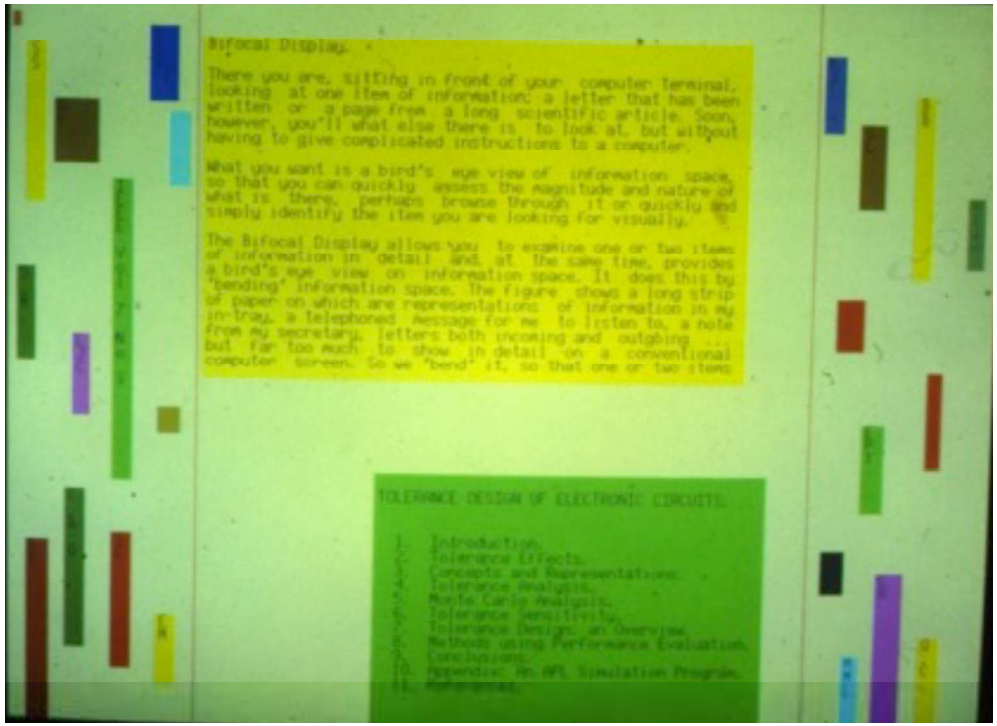


(c) Appearance of the information space when viewed from an appropriate direction



Horizontal distortion

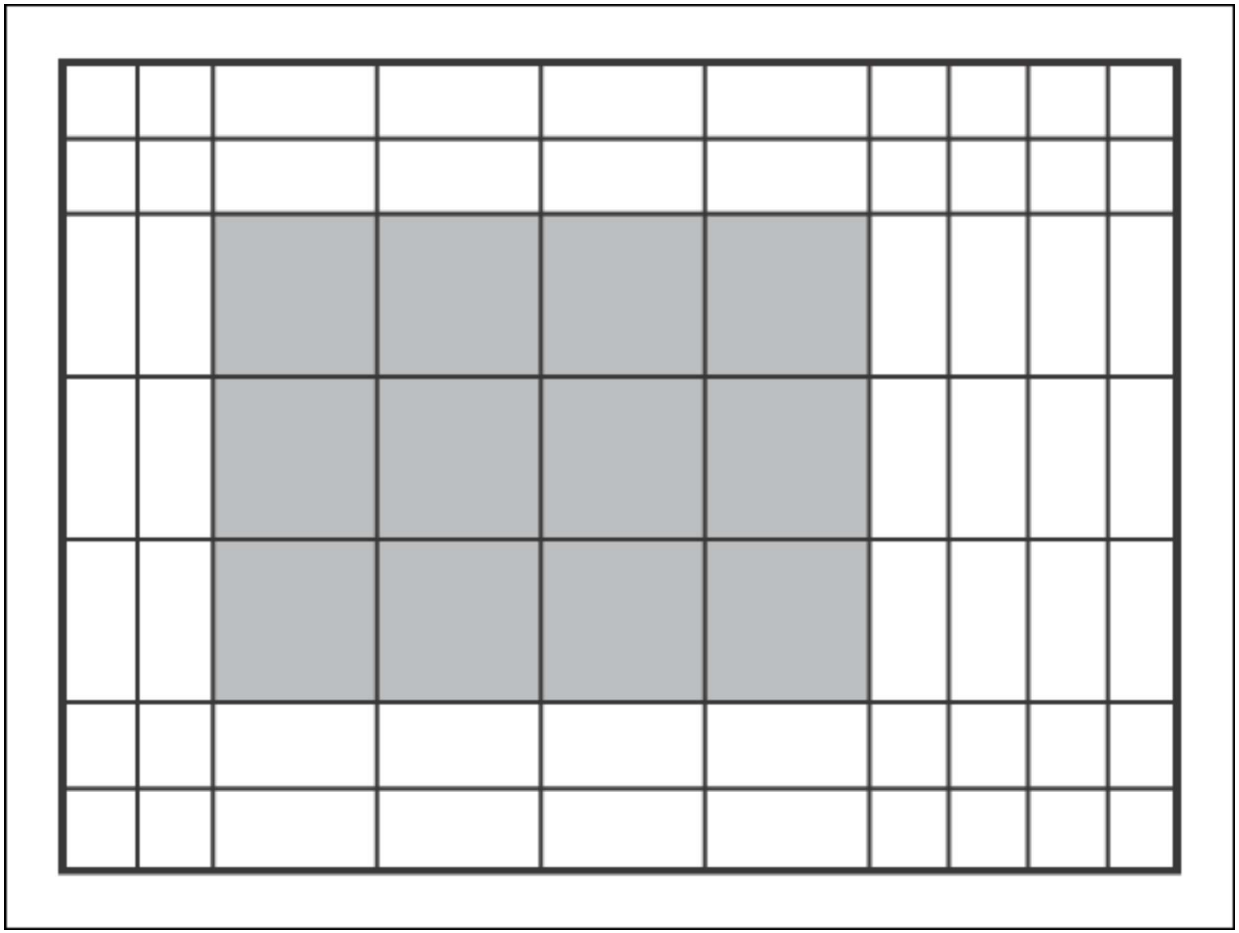
Space limitations : distortion



Documents on a (early) bifocal display

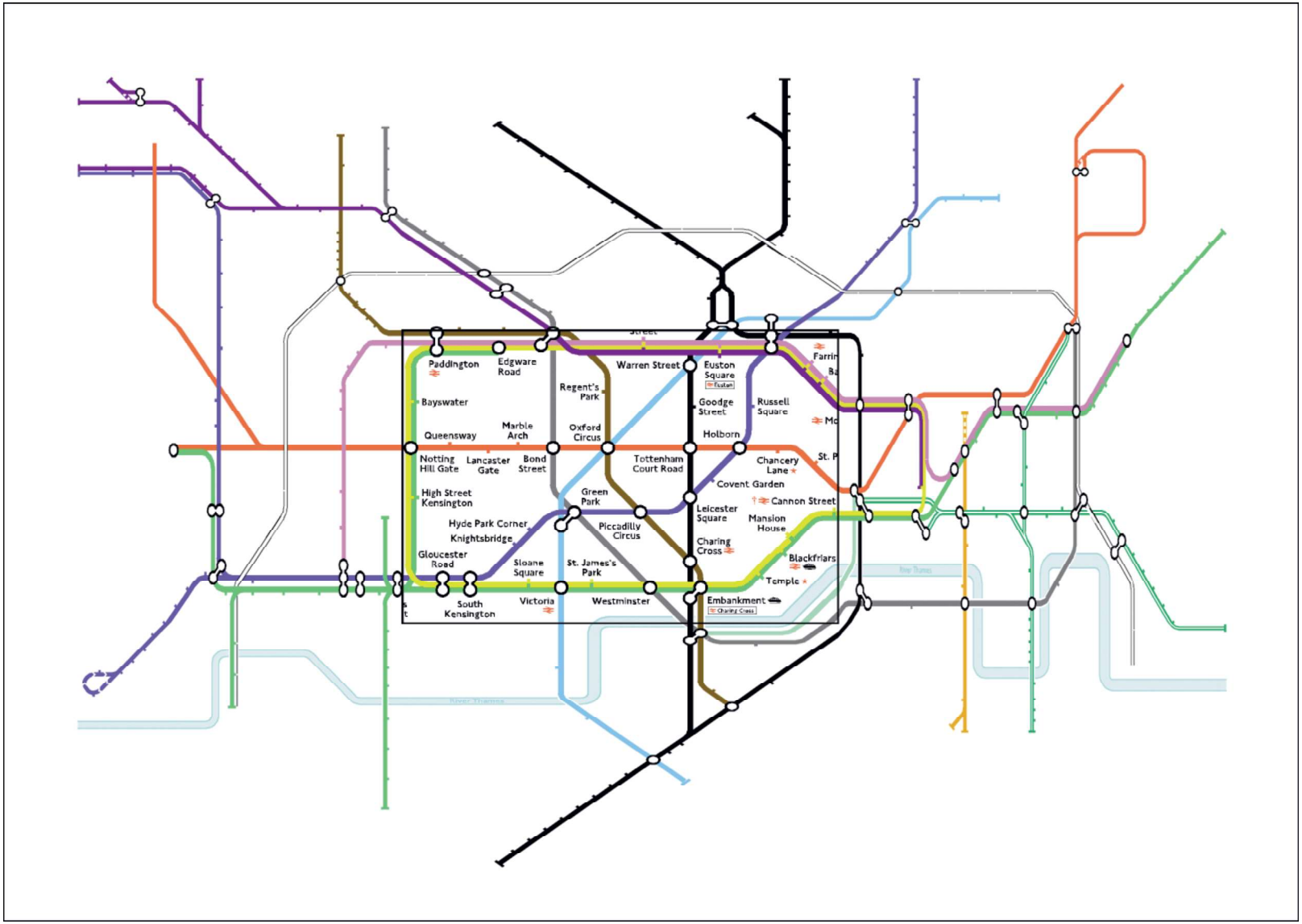
Sequence of amino acids

Generalized distortion

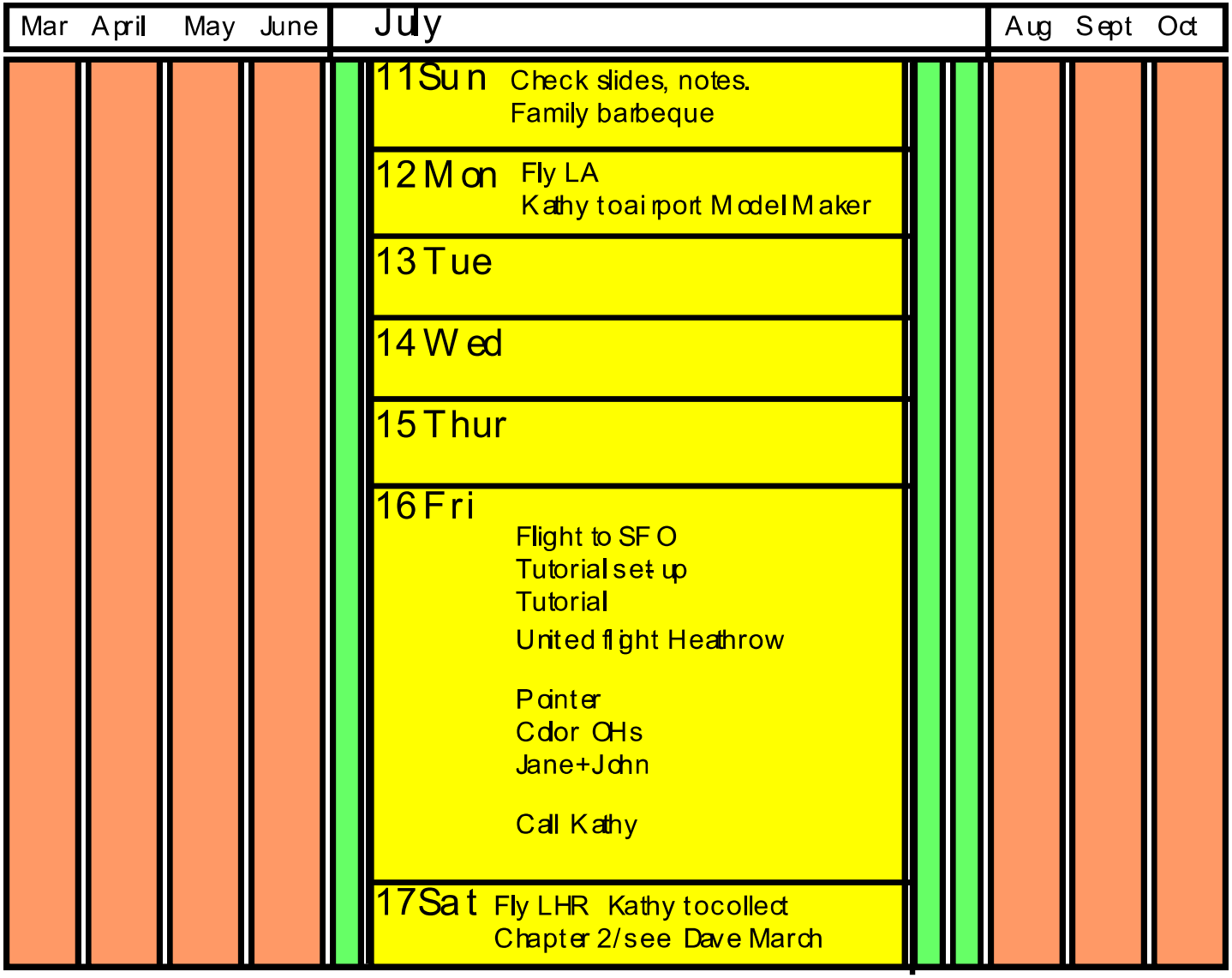


Combined X- and Y-distortion

London Underground map



Combined distortion for a calendar



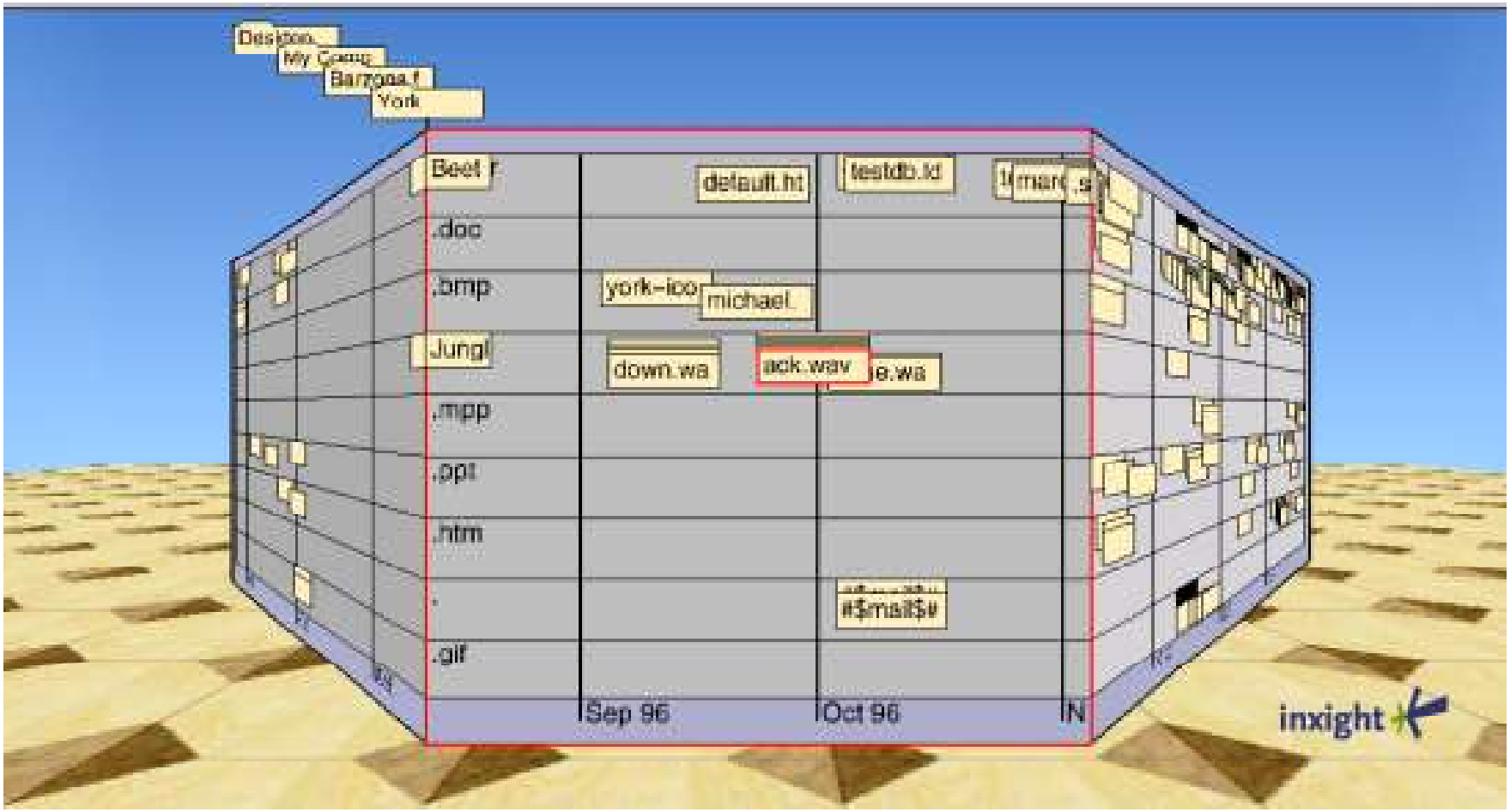
Combined distortion on a PDA

The distortion preserves the continuity of transportation links

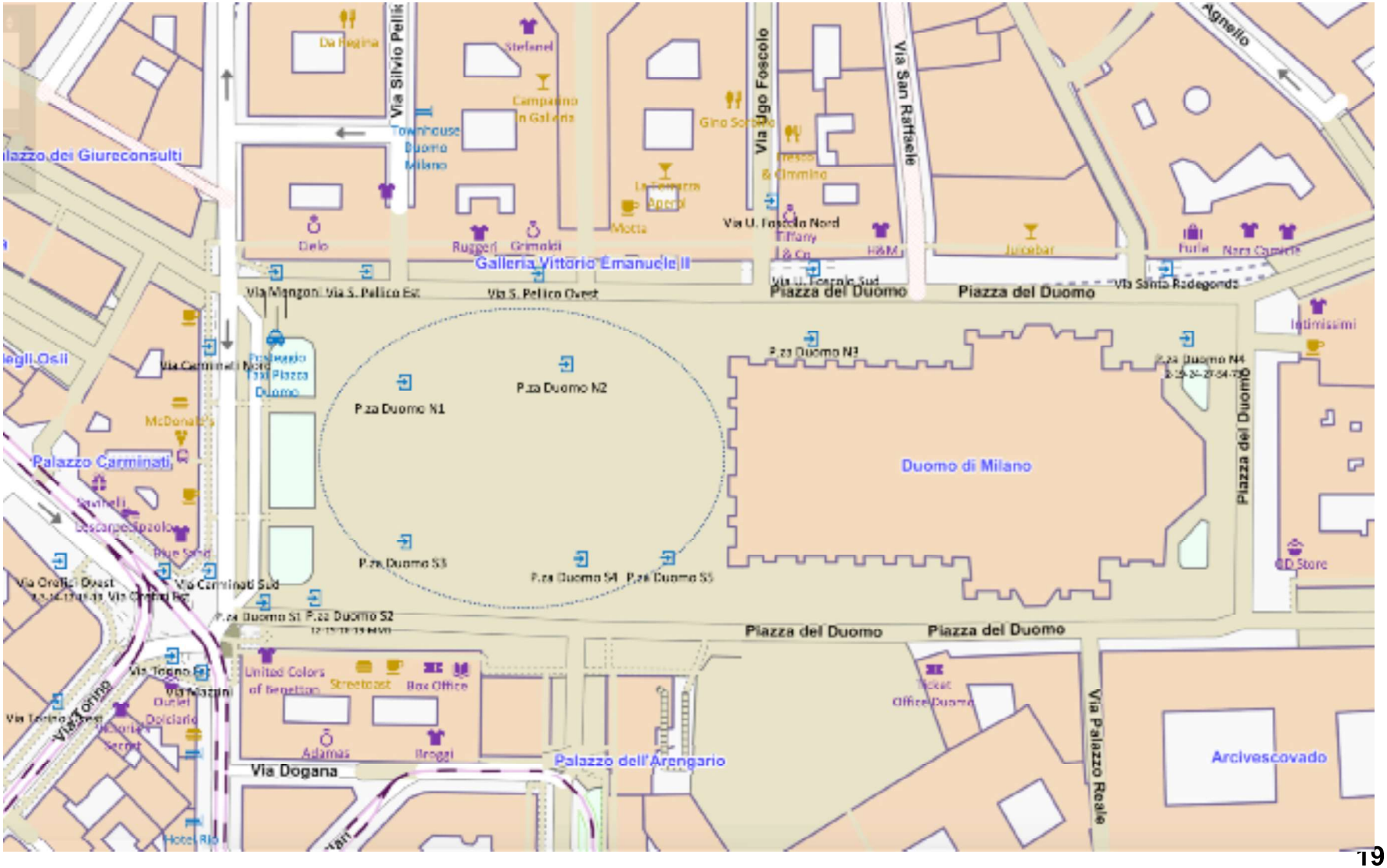
Macintosh OSX distortion

The perspective wall (file system)

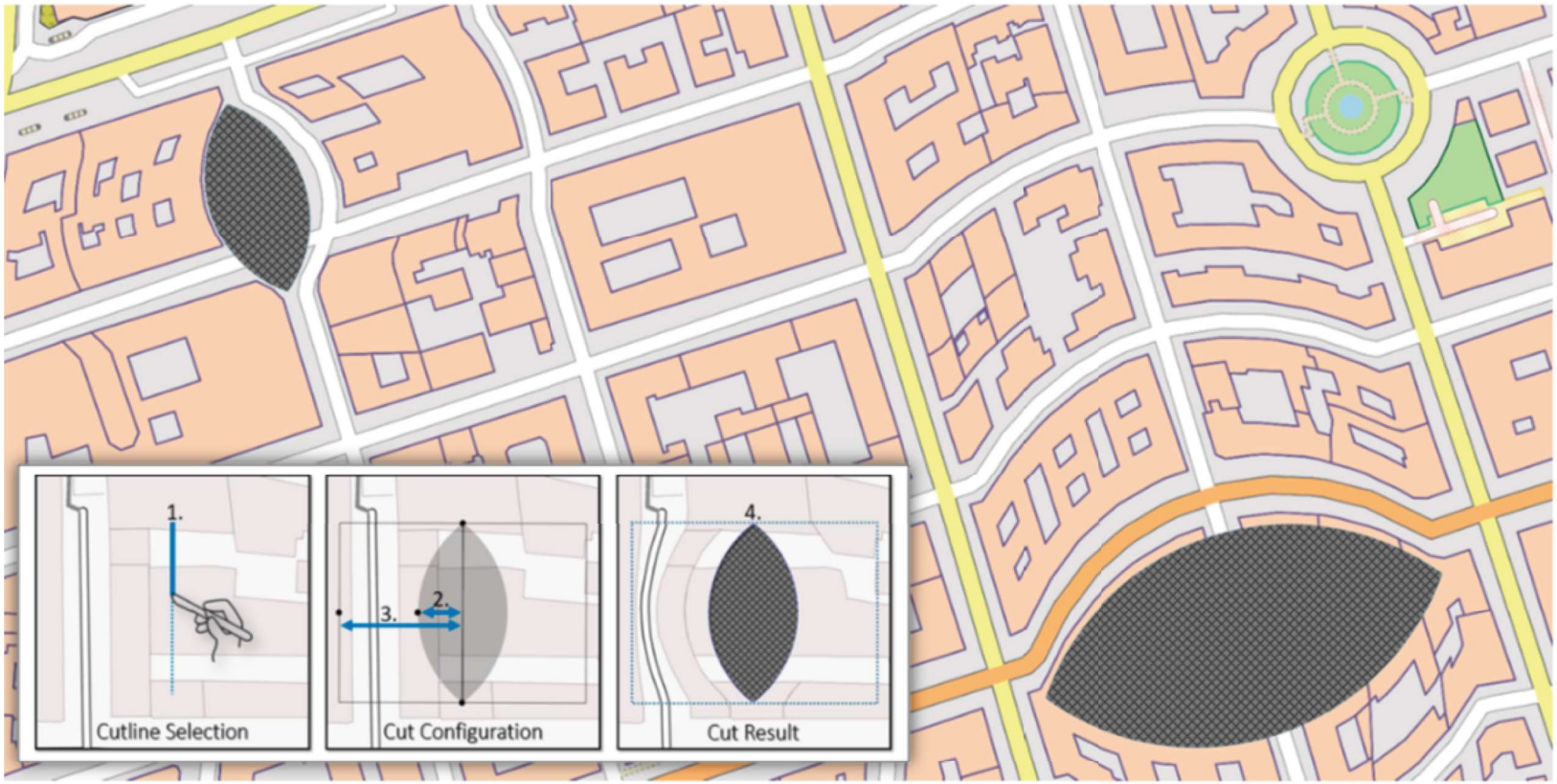
- Bifocal display + 3D



Distortion: Milan Duomo subway 22 exits!



SurgeryCuts



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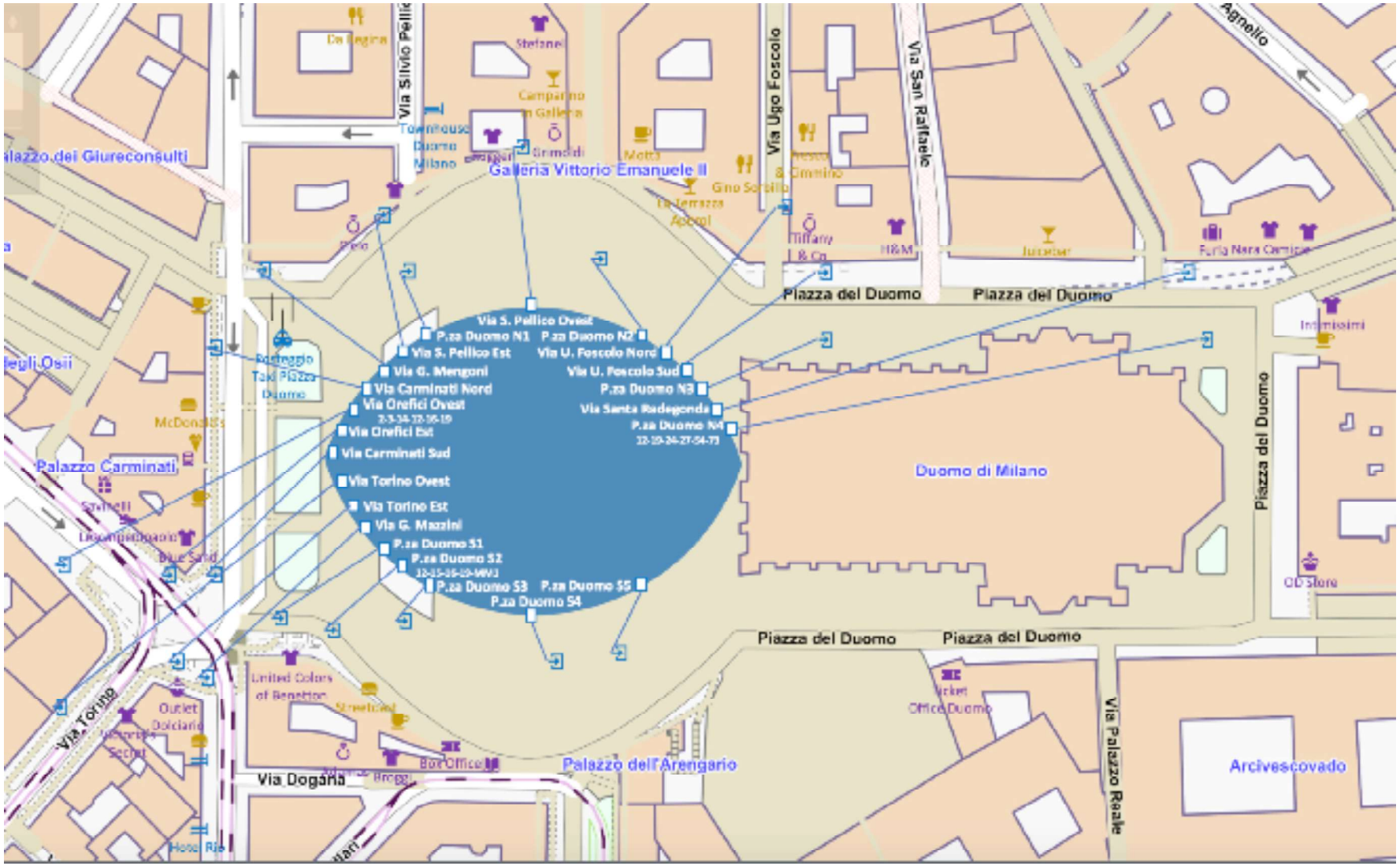

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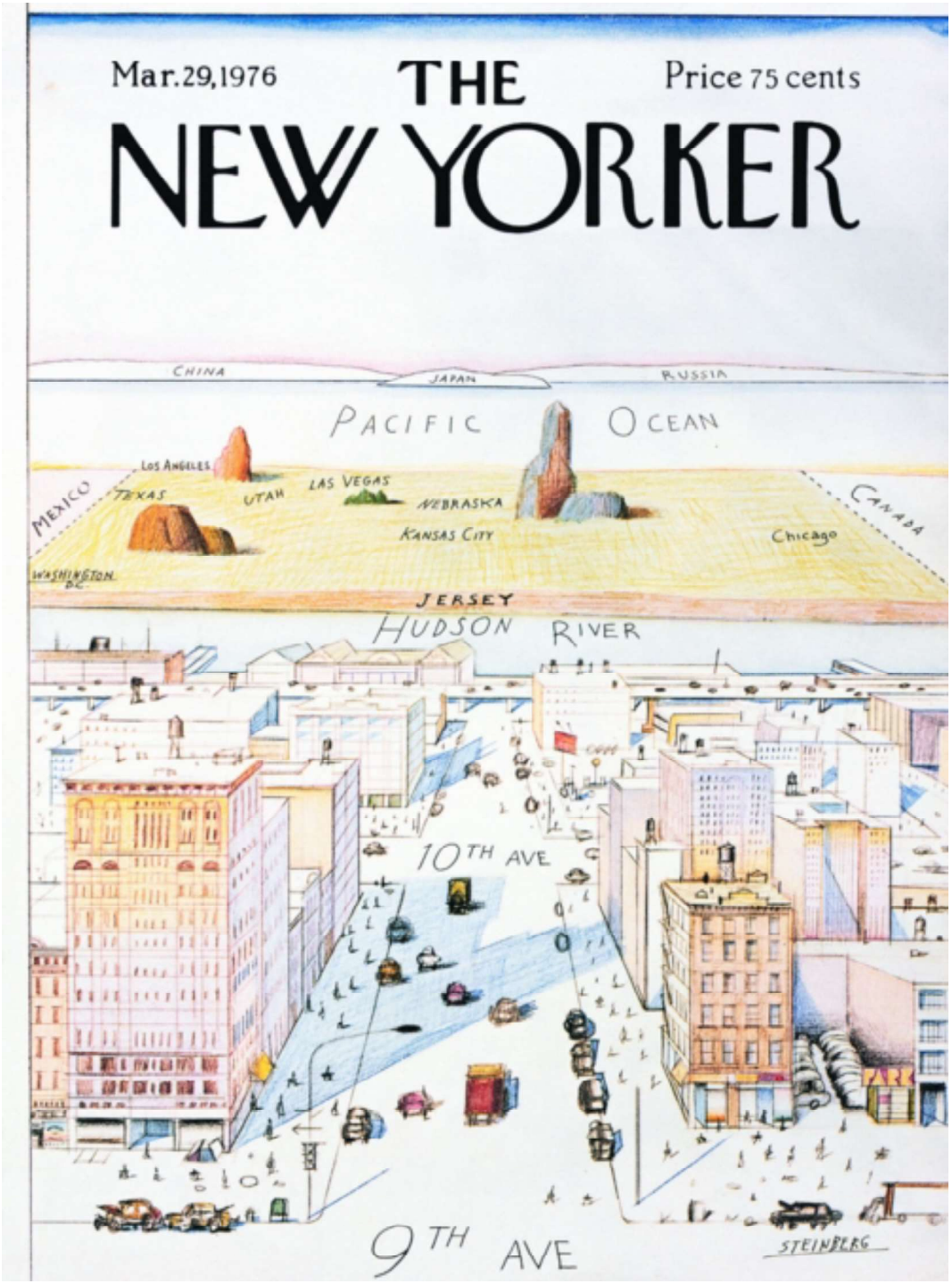
Suppression

Saul Steinberg

A view of the world from 9th Avenue

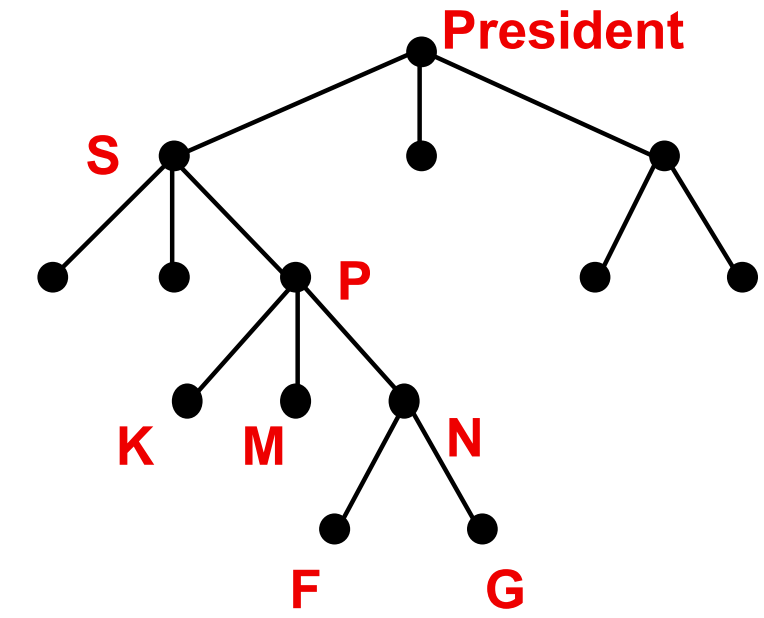
Distortion + Suppression

Presenting only **relevant** data

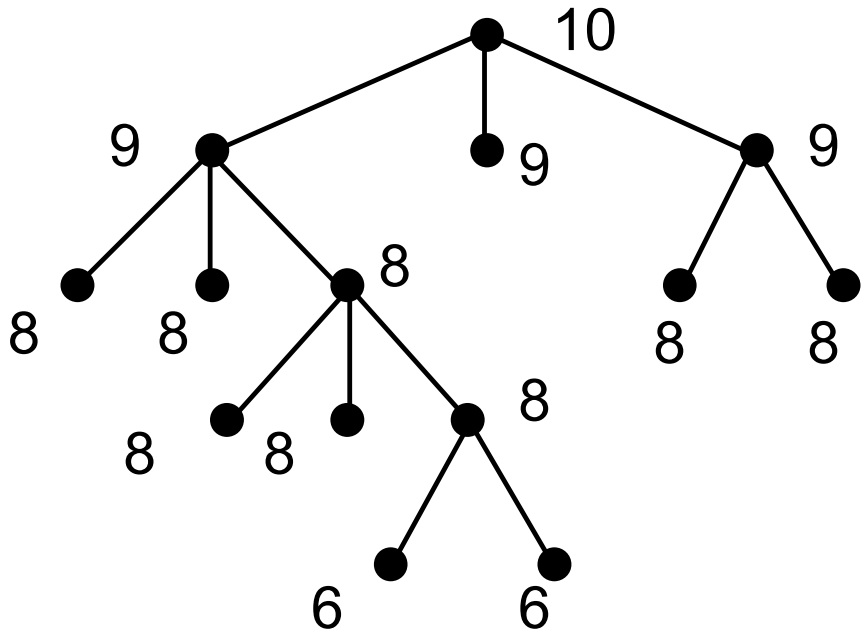


Relevant data (?)

- An example of a formal definition
- Degree of interest (Doi) = f(API,D)
  - API = a priori importance
  - D = distance

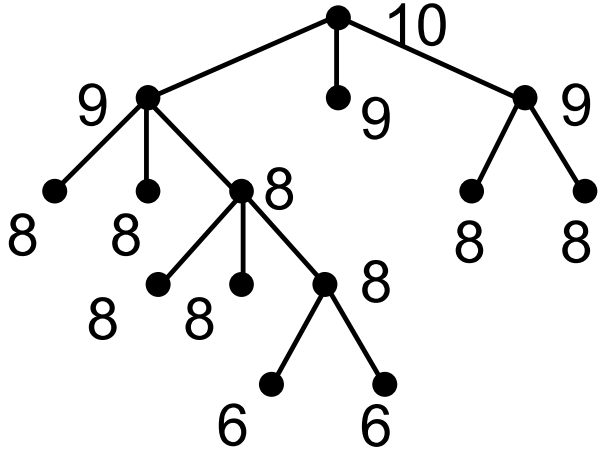


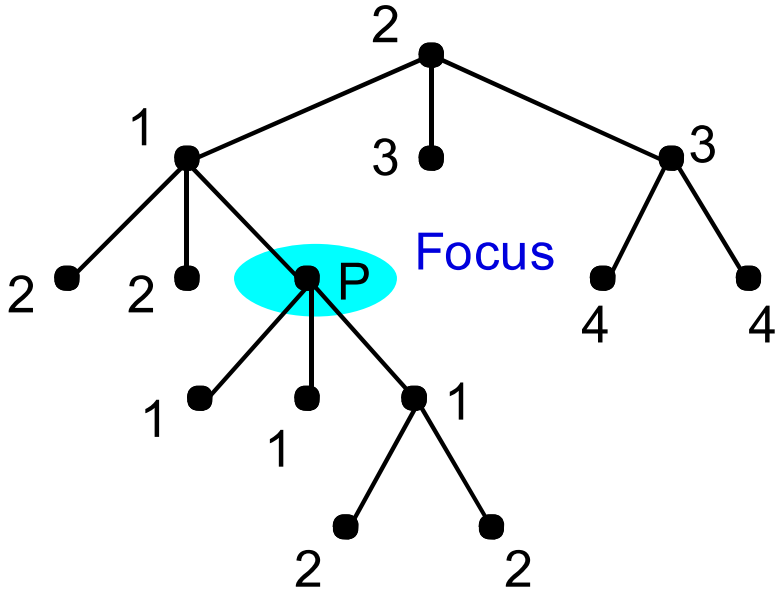
Organization tree of a company



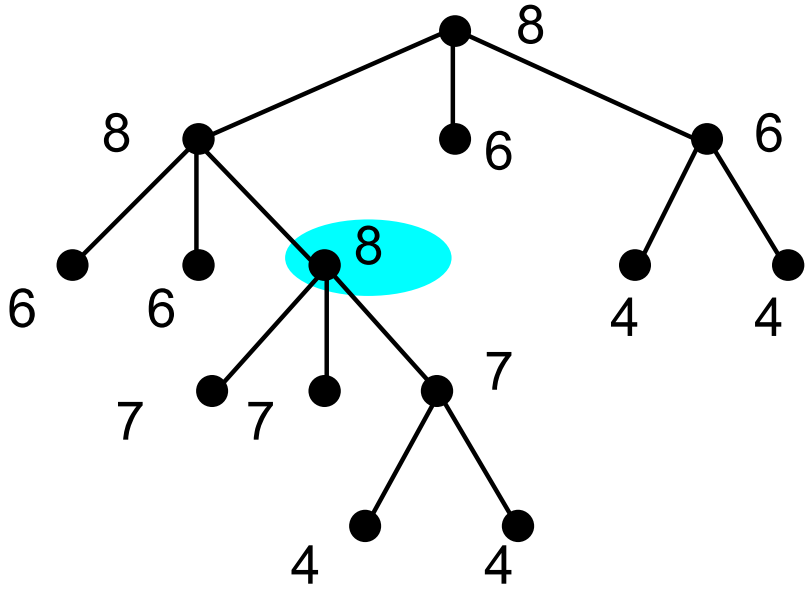
A priori importance

Relevant data (?)





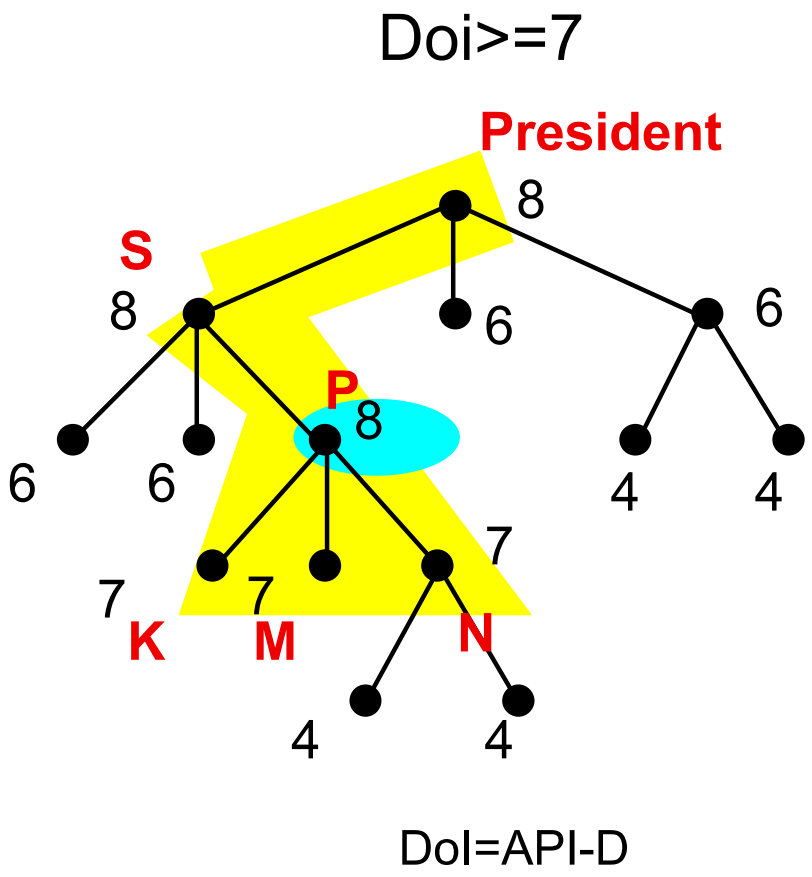
Distance from the focus

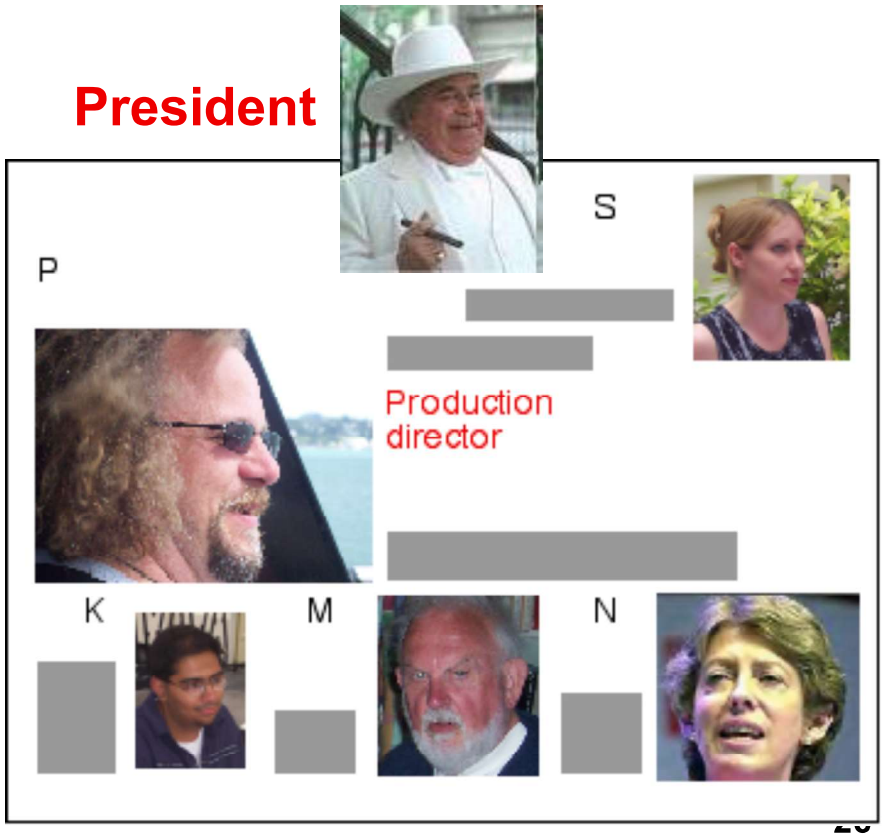


DoI=API-D

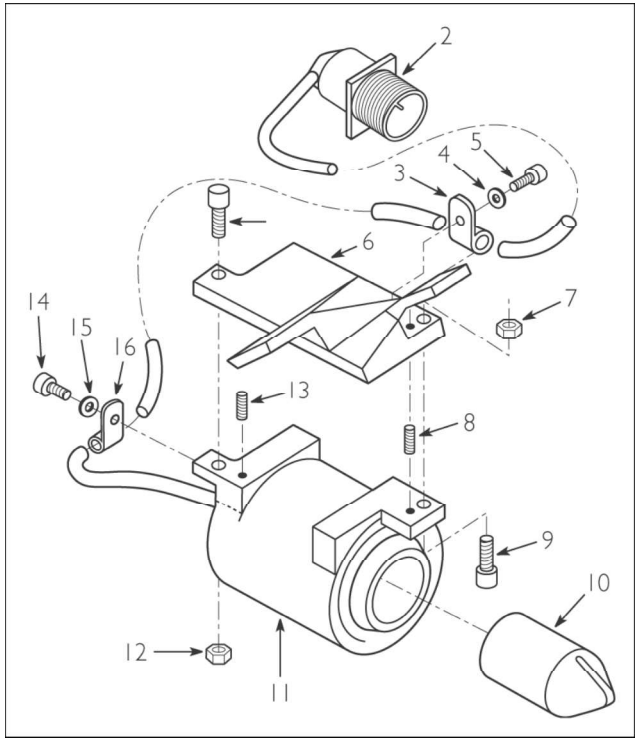
Relevant data (?)

- Defining a Doi threshold define context

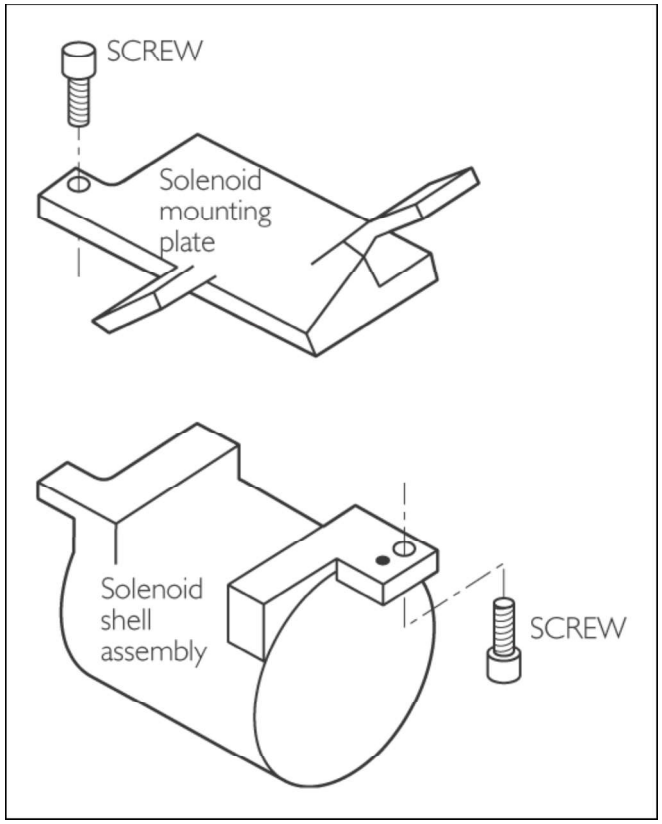




Relevant data

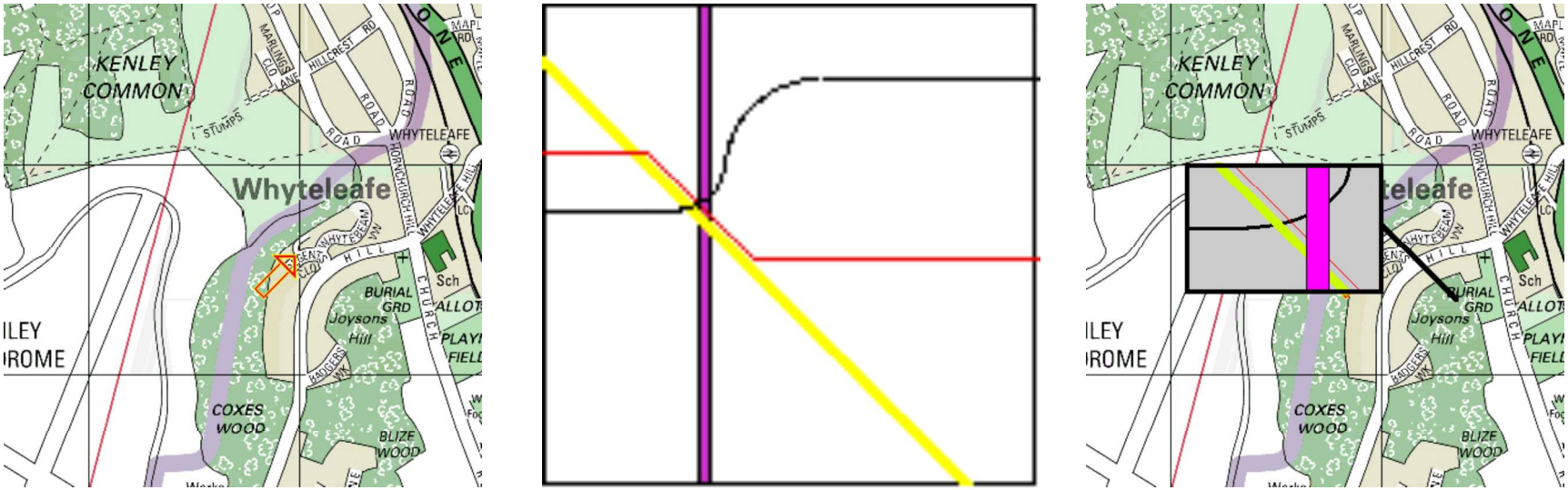


Part of an engineering drawing



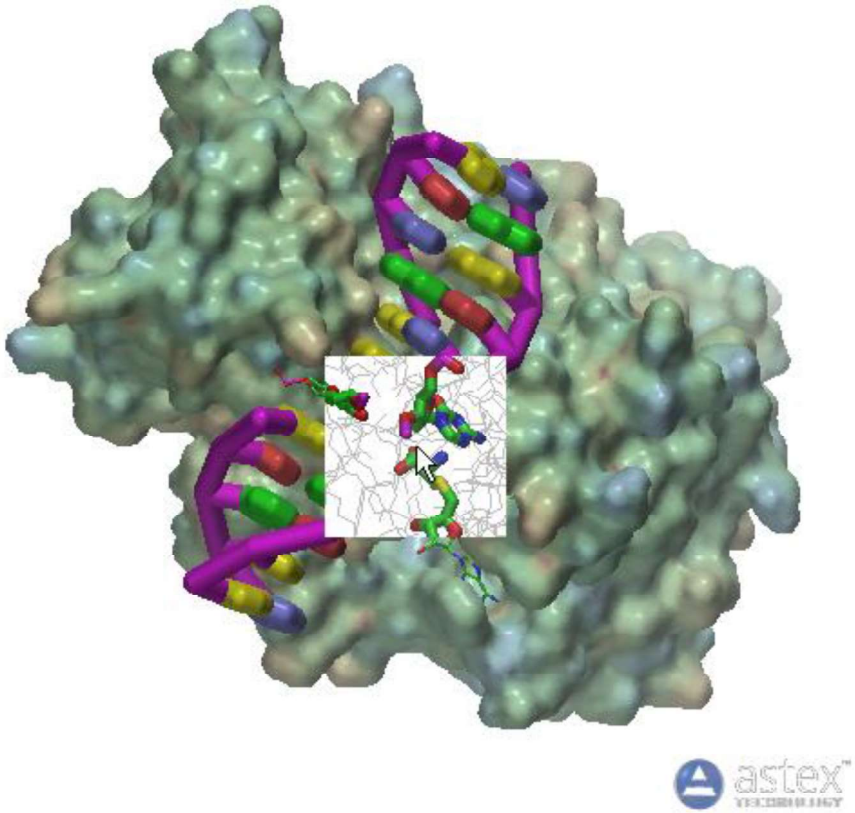
The drawing simplified in the context of a suspected fault

Suppression through layers: magic lens



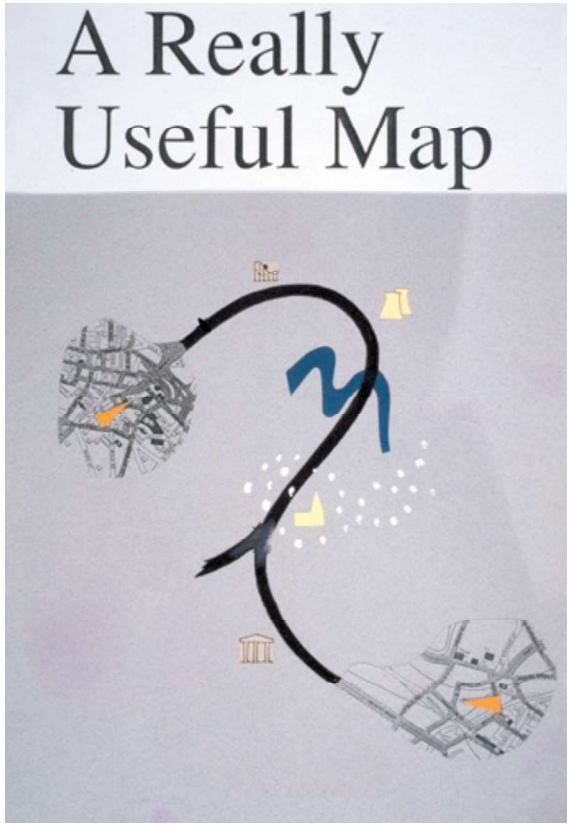
Magic lens. (a) shows a conventional map of an area, (b) shows the location of services (gas, water and electricity pipes) in the same area, and (c) a (movable) magic lens shows services in an area of interest, in context

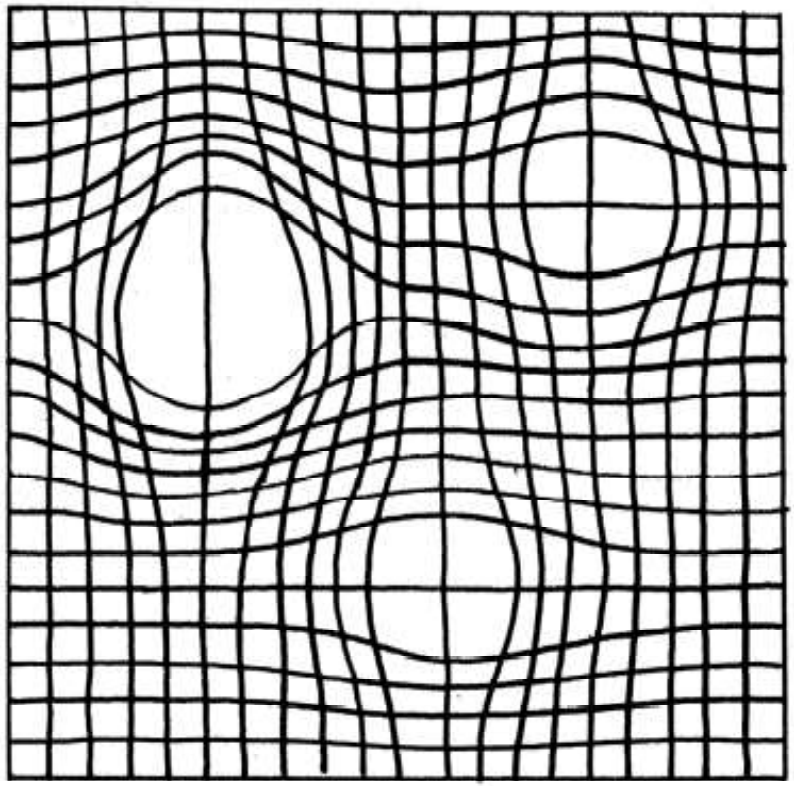
Suppression through layers: magic lens



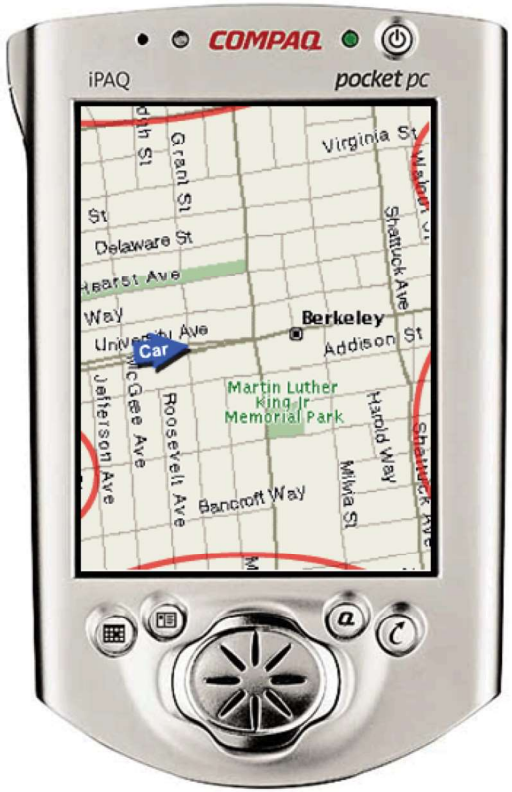
A molecular surface of the protein transferase. The magic lens window allows a view of the atomic structure bonding to be shown, thereby providing a view inside the protein

Distortion + suppression





Link between representation & presentation



Representation & presentation to provide context for a small display

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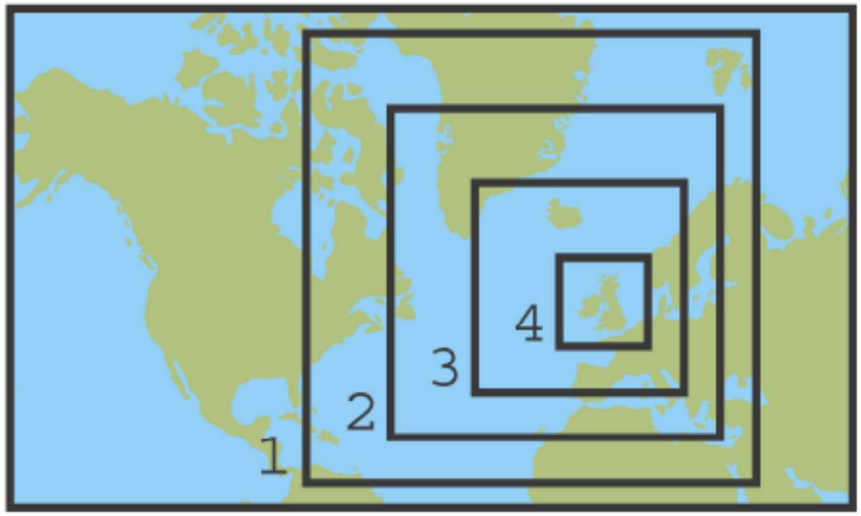
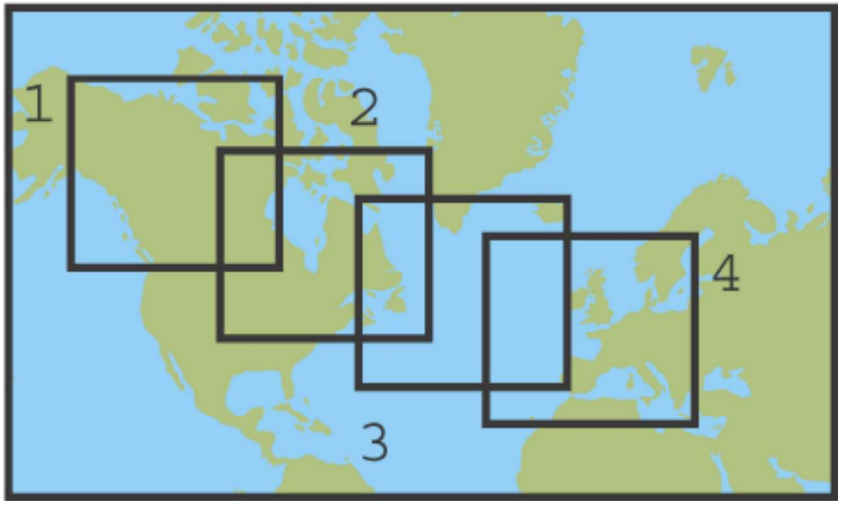
Zoom and pan

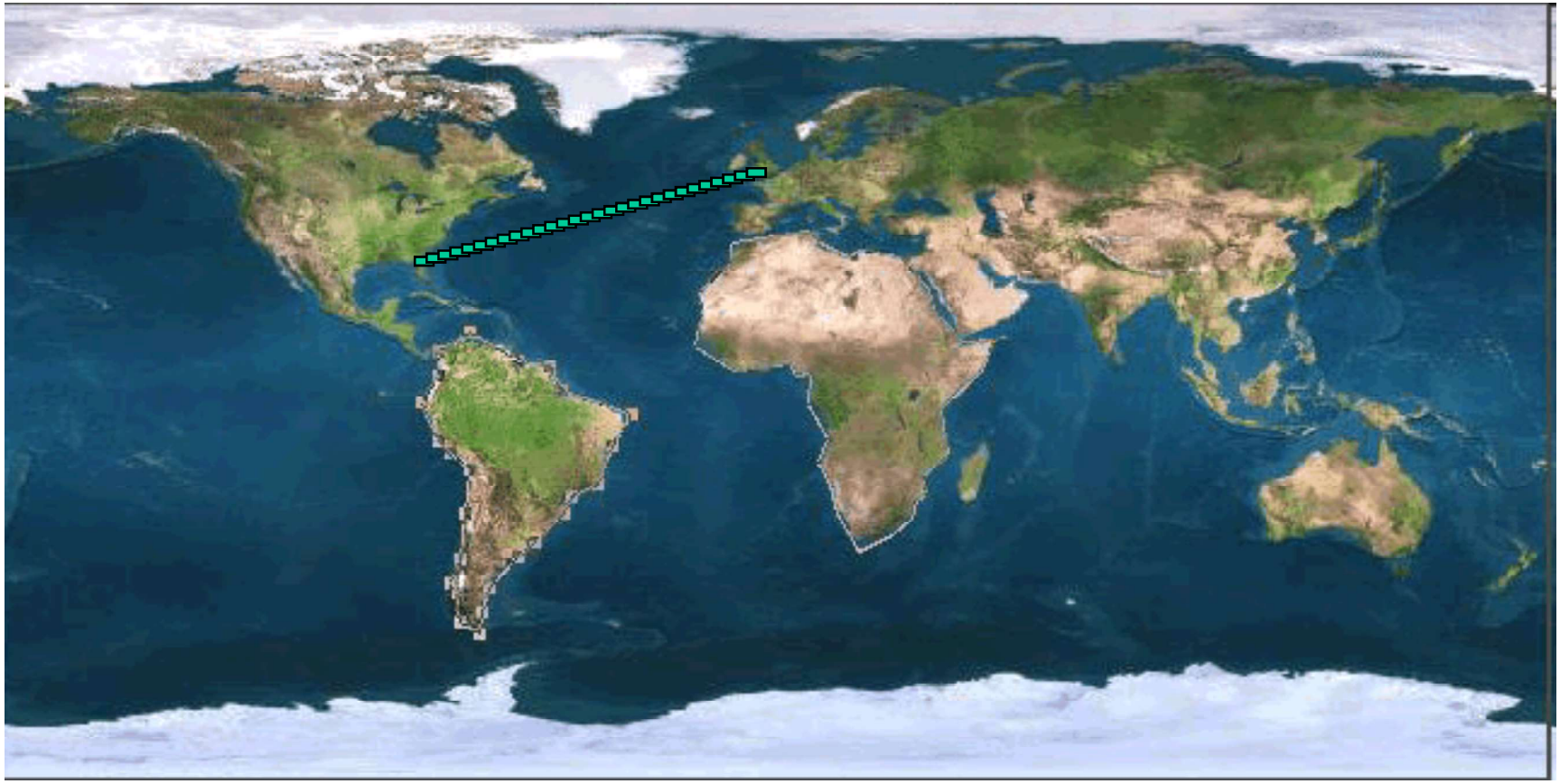


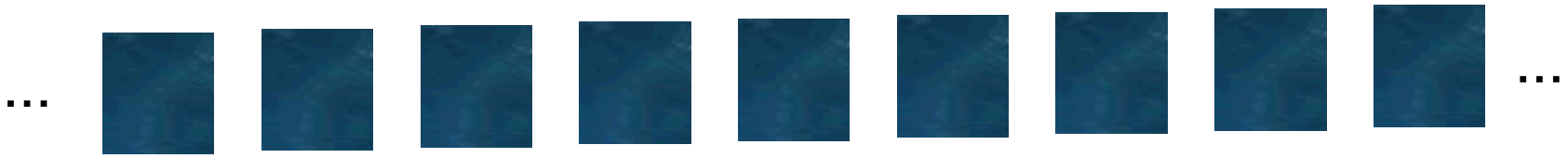


In both cases we have to care about the context

NY to London

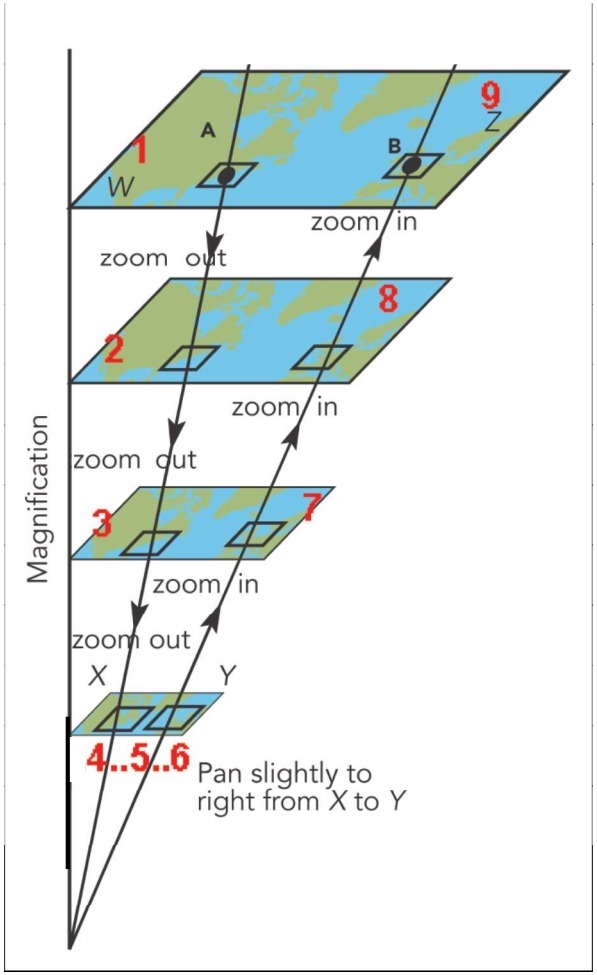
Long, boring panning (unless you like blue ...)





Combining zoom an panning

NY London

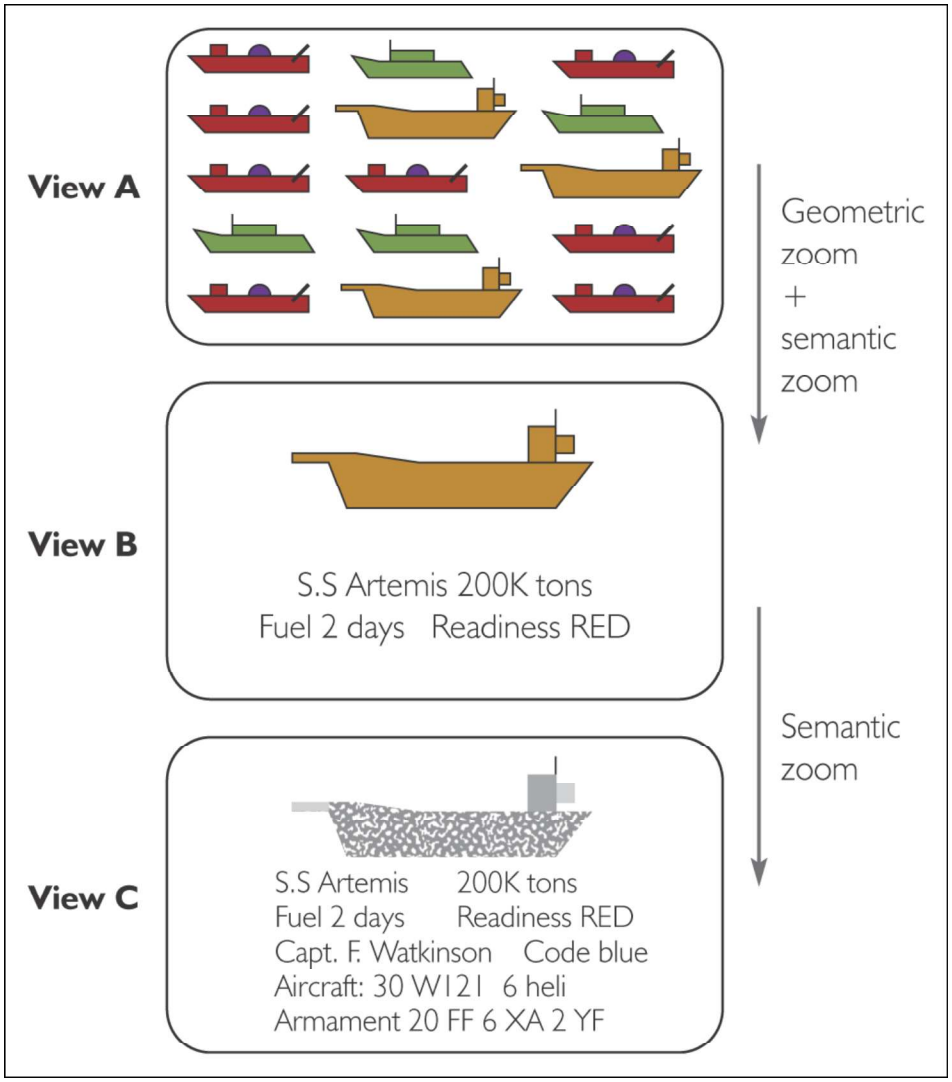


What a complex interaction !

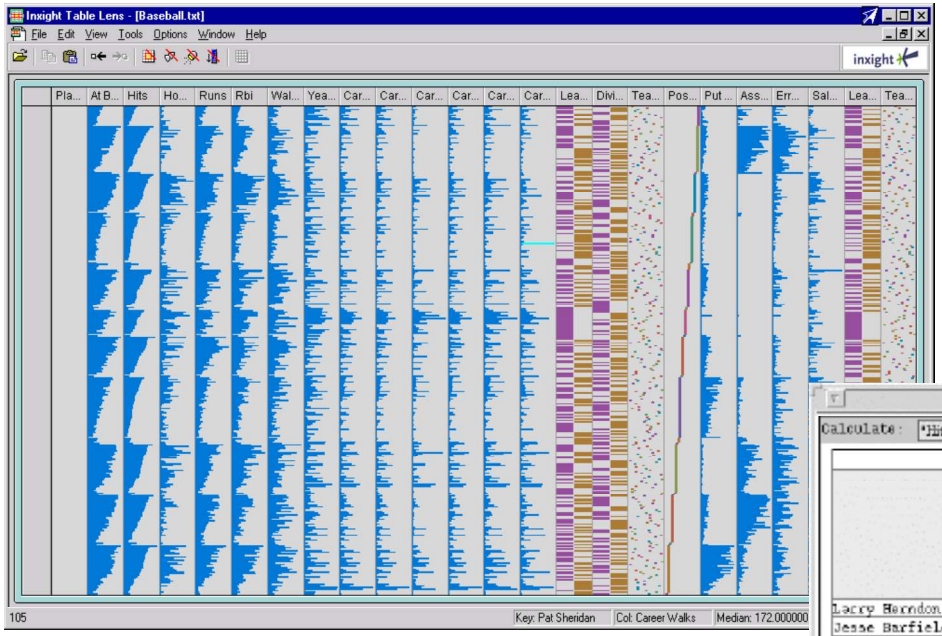
Who do act this way?

video 05

Geometric & semantic zoom



Space limitations : semantic zoom



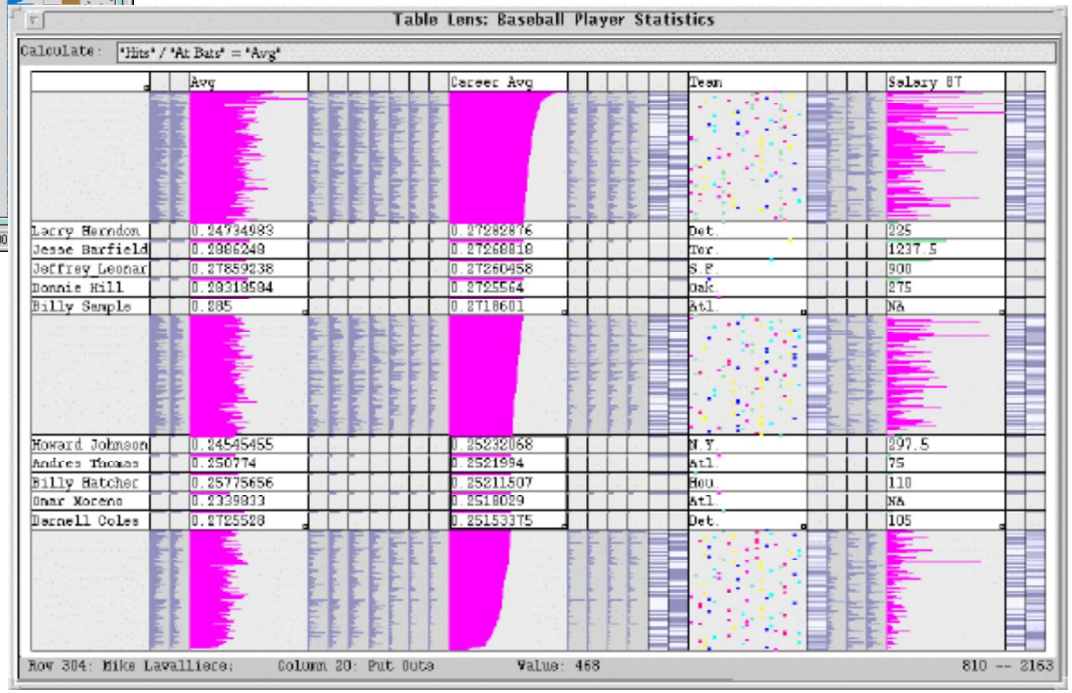
The table lens

Data (histograms) about baseball players:

- •number of 'hits'
- •ball speed

Interaction

- • sort



Expansion to show names and numbers

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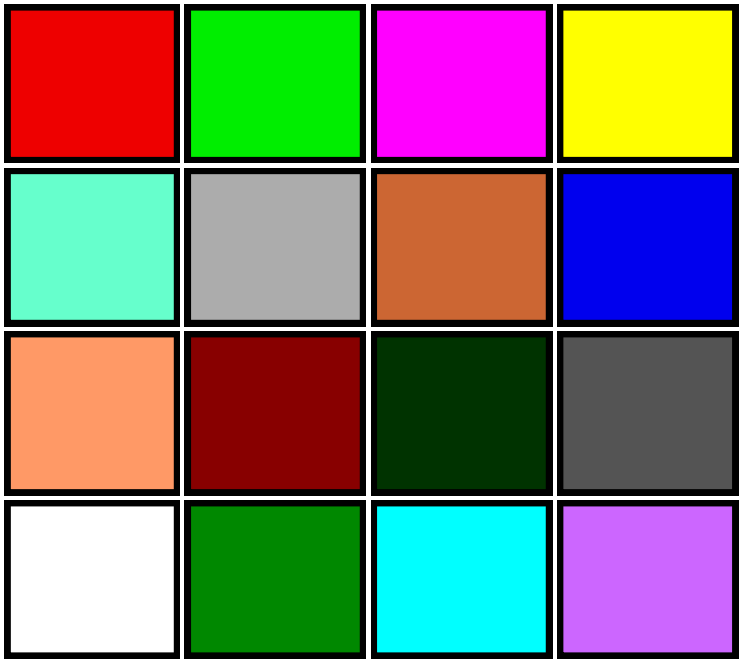
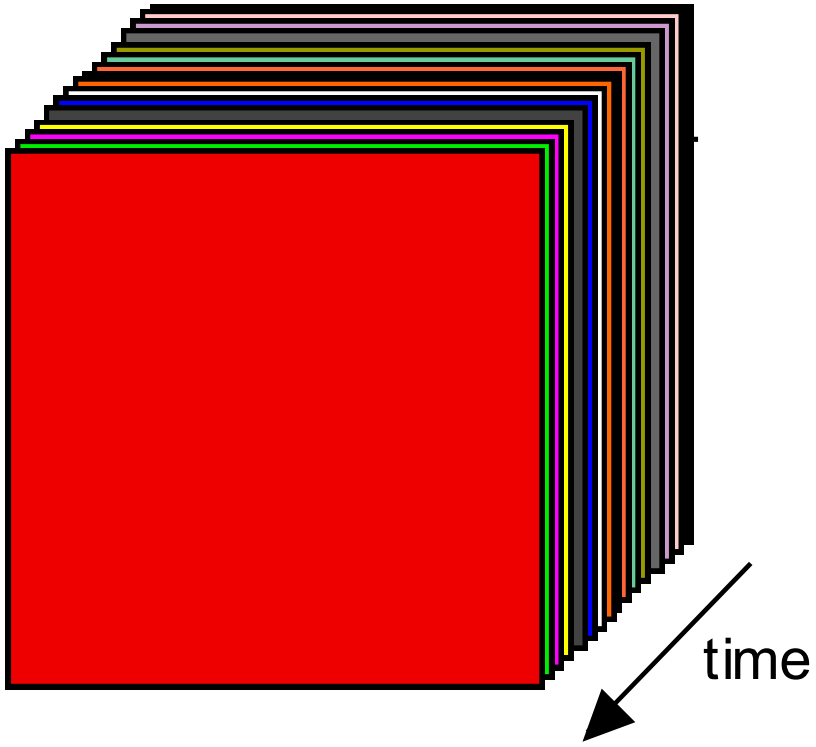
Time limitations

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



Concurrent presentation

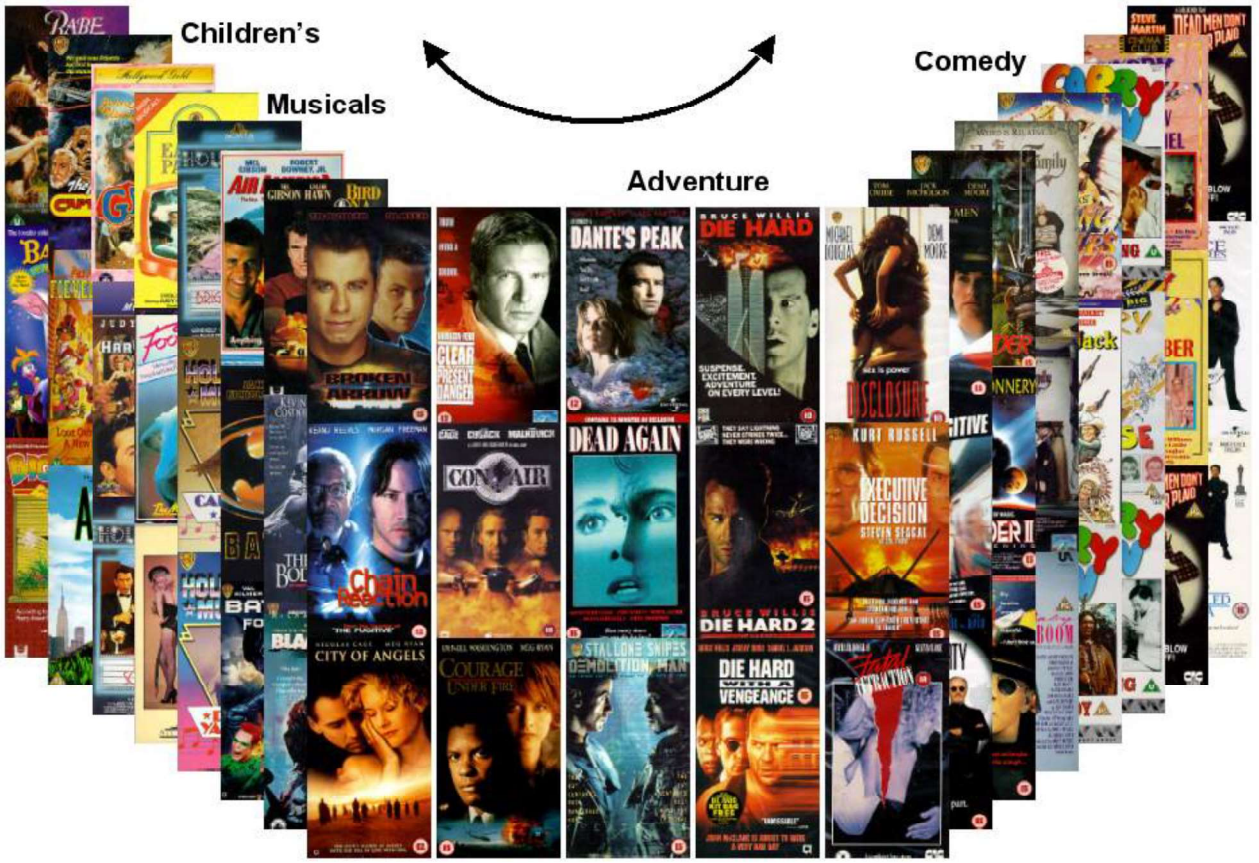


Serial presentation

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)

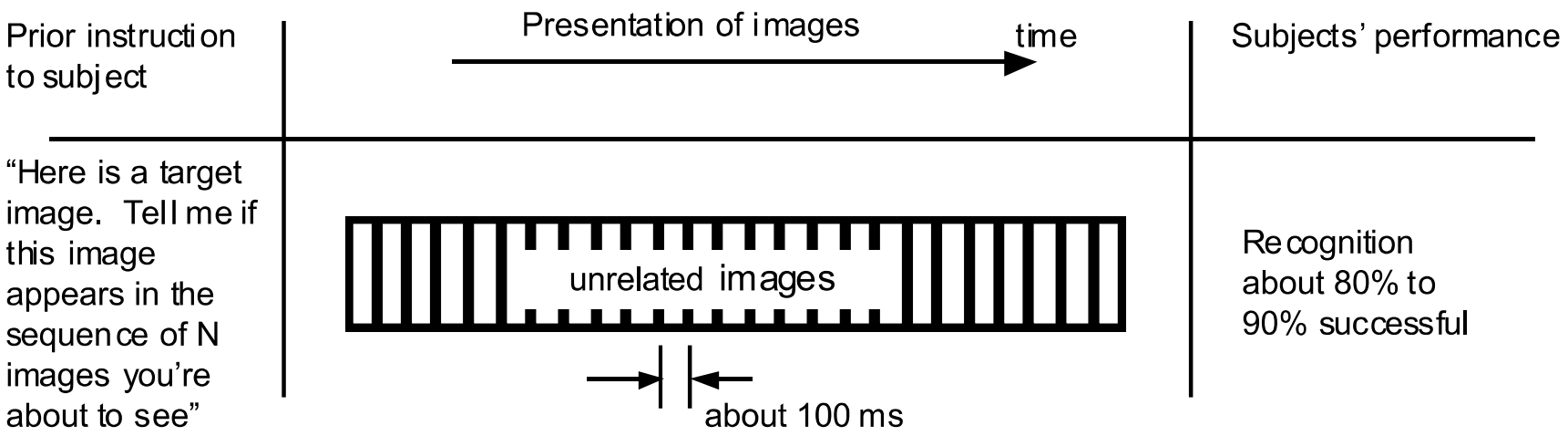
Browsing video posters



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

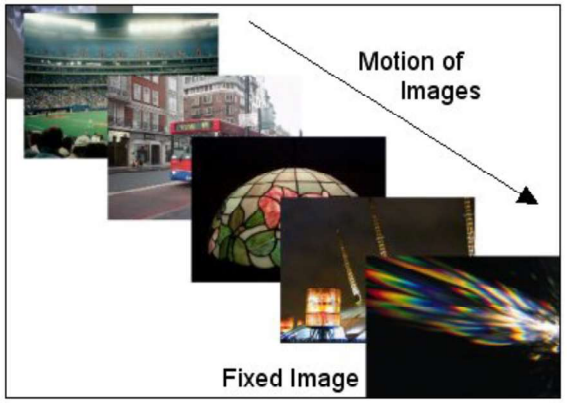


Space and time...

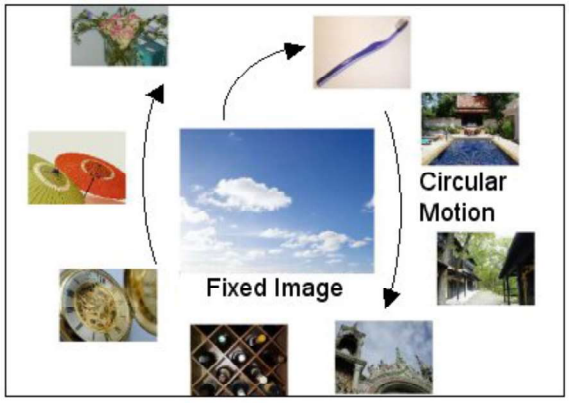
Mode A: Slideshow

Mode B: Mixed

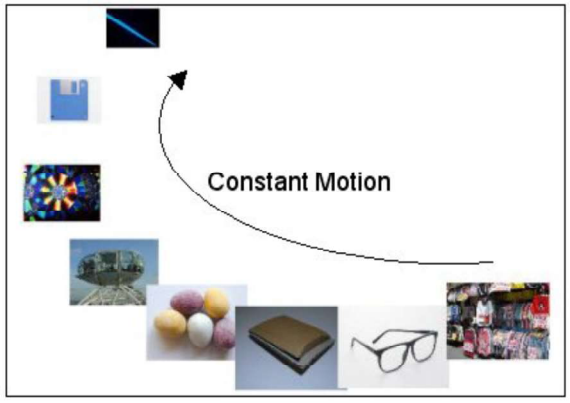
Mode C: Tile



Mode D: Diagonal



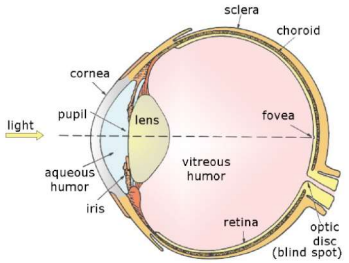
Mode E: Ring



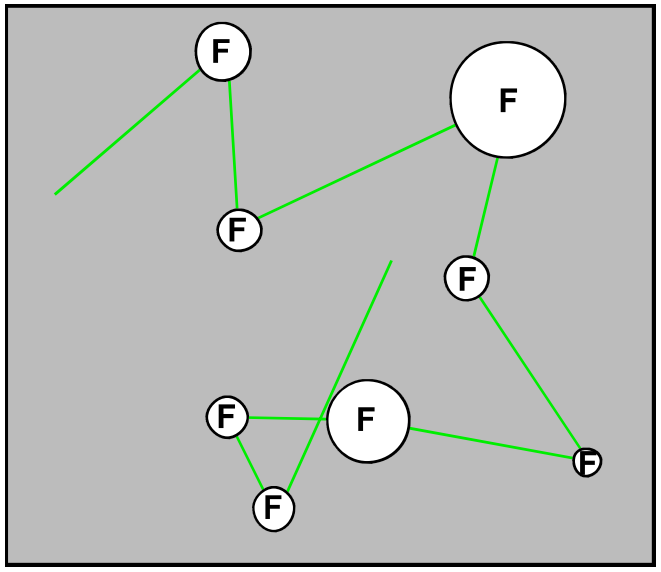
Mode F: Stream

Videos... A B D

Do you remember the 1° fovea?



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



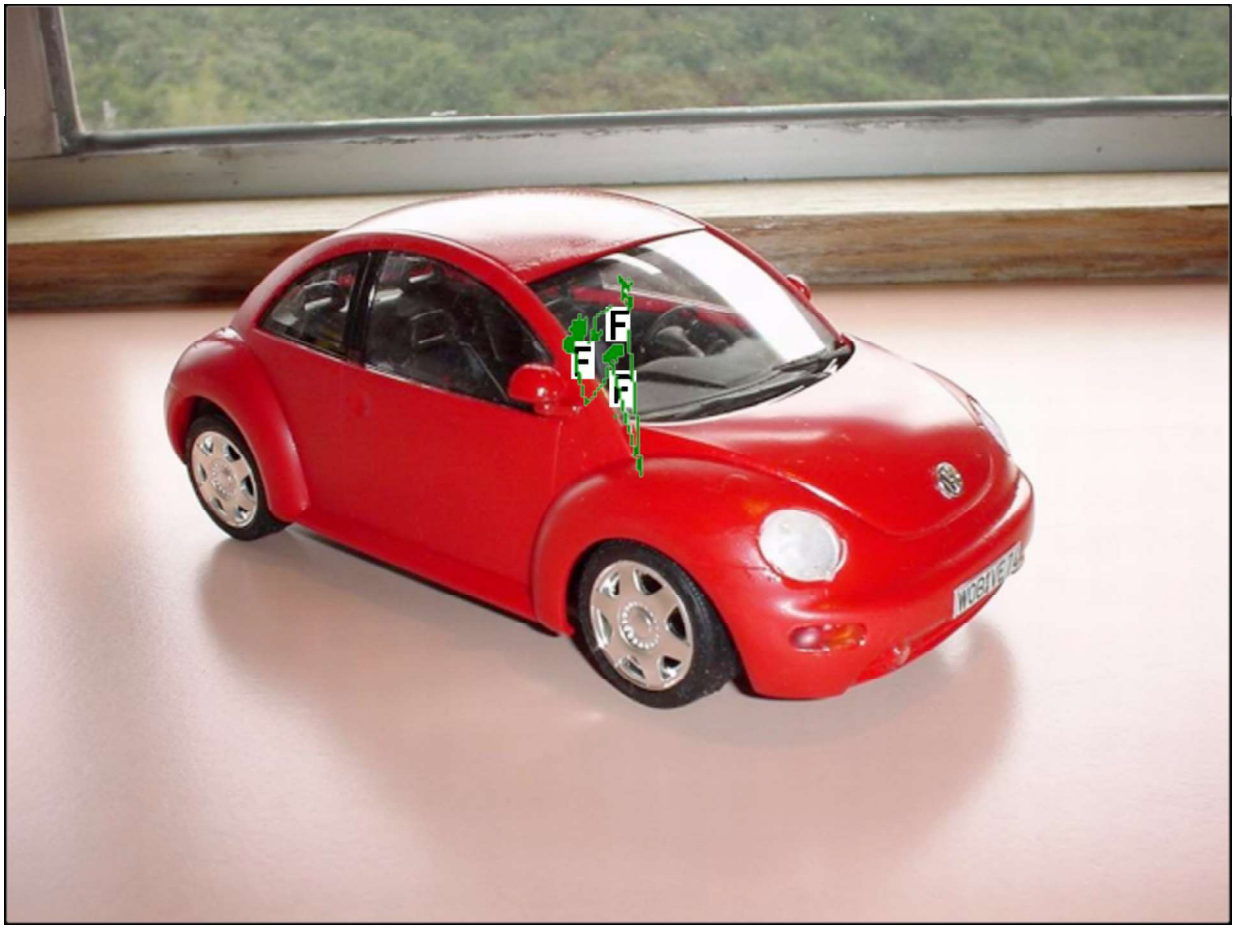
A simple representation of eye-gaze behavior.
The rapid saccades are shown green, the fixations (F) of varying duration by circles of proportionate size

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

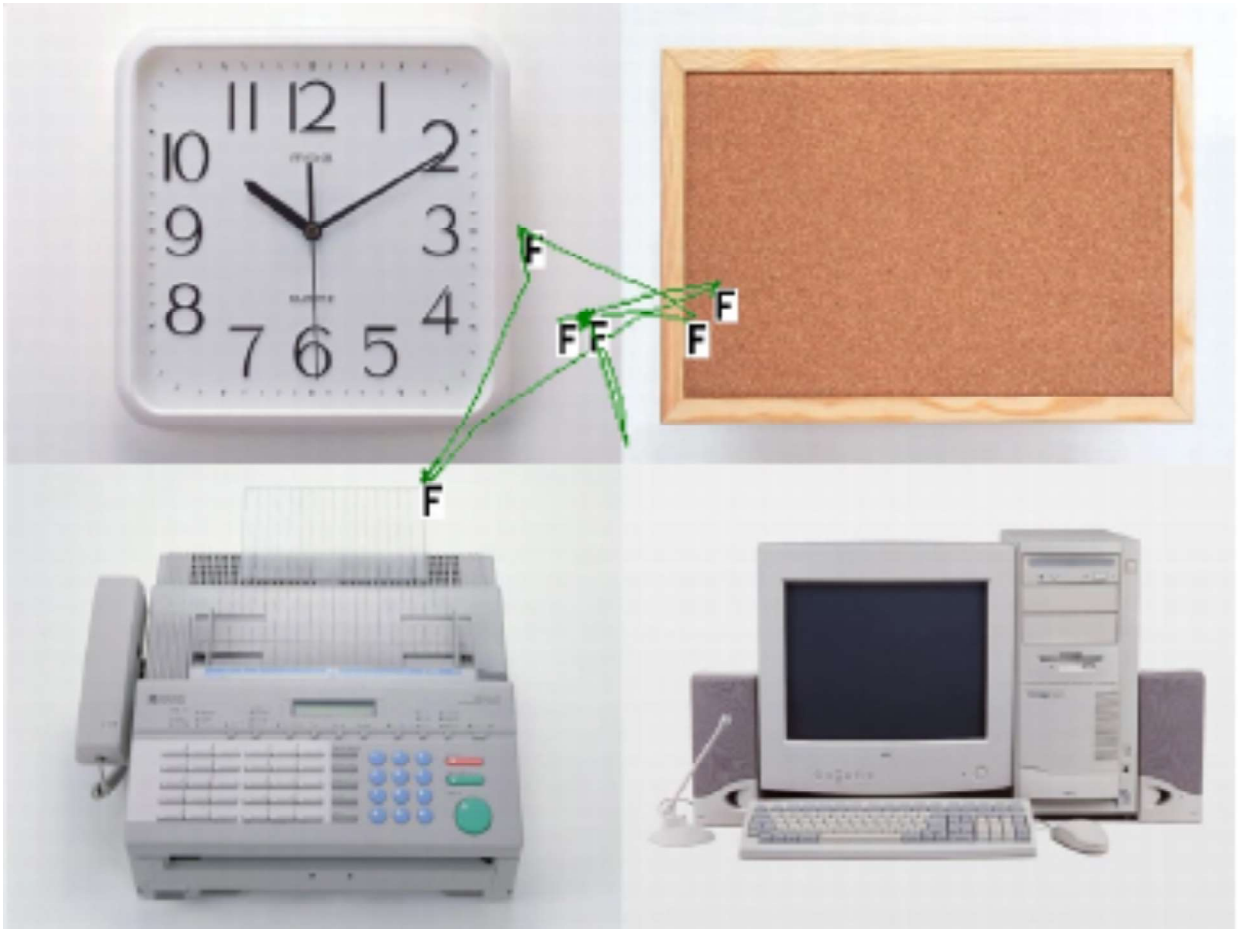
Eyes gazes: A) slide-show

Mode A: Slideshow



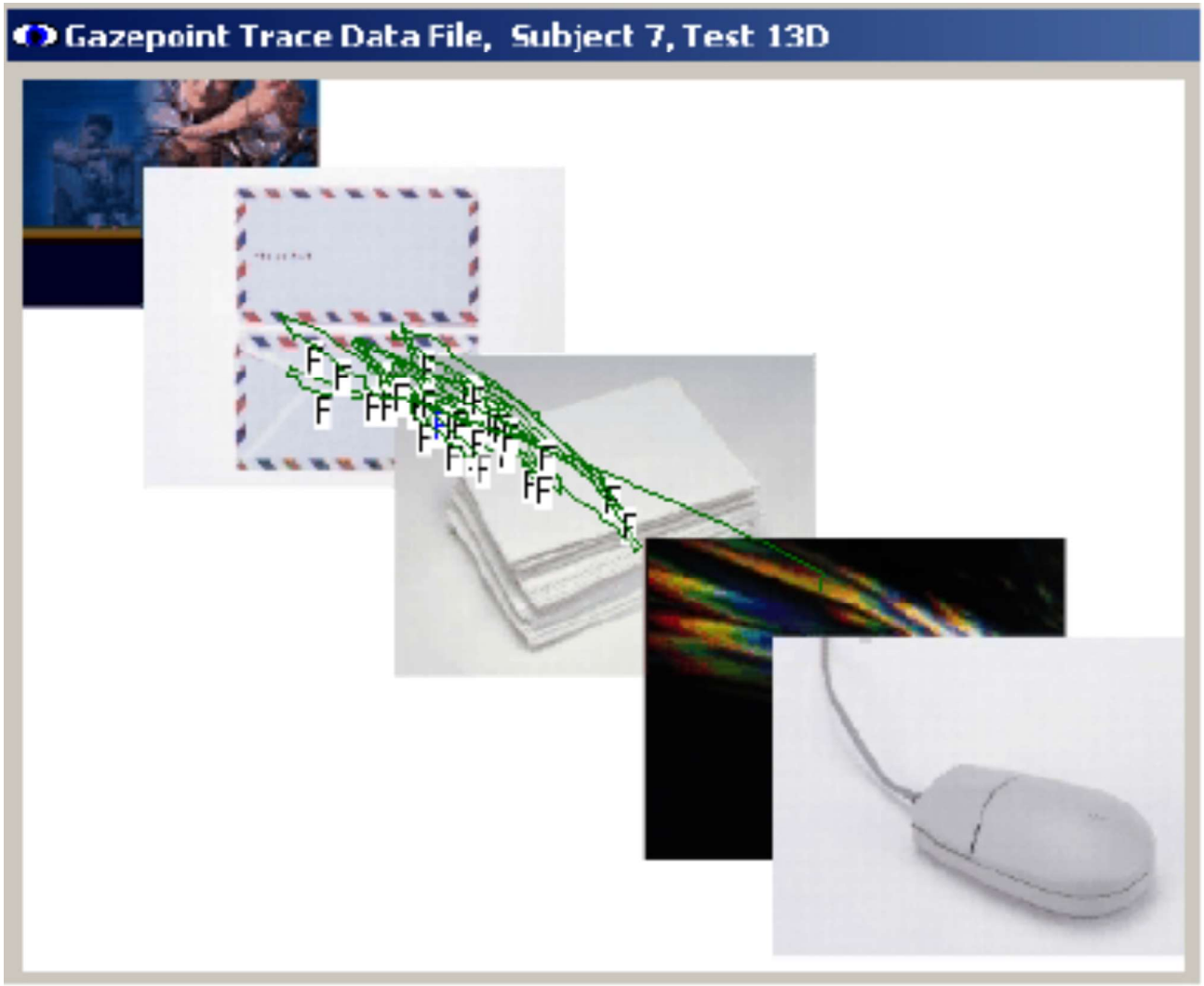
Eyes gazes: B) mixed

Mode B: Mixed

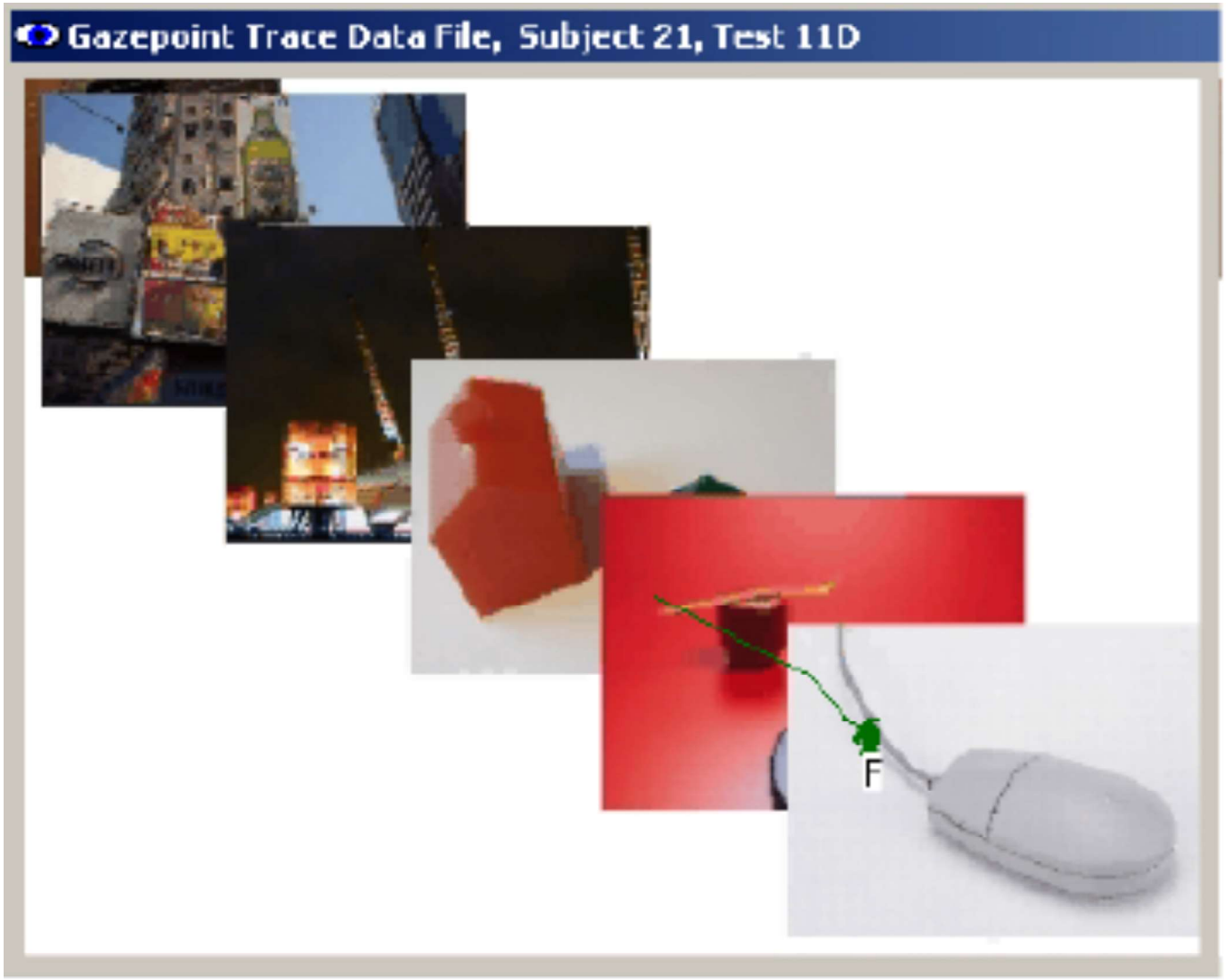


Eyes gazes: C) tile

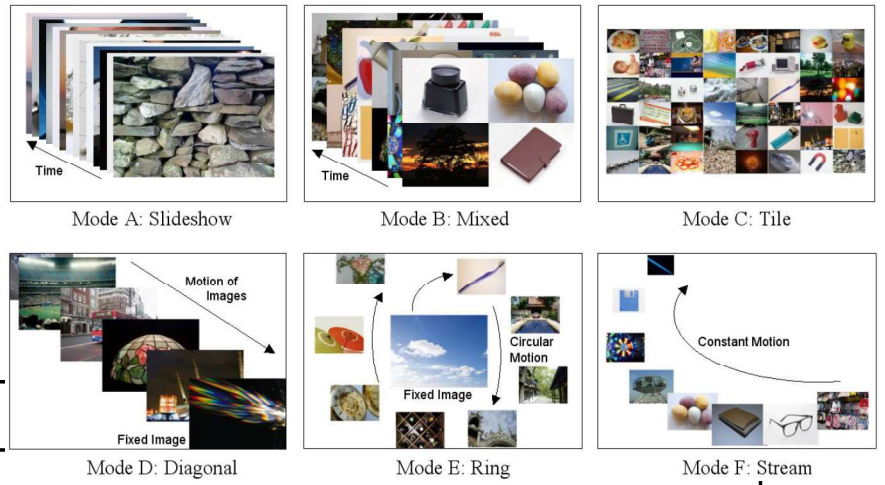
Eyes gazes: D) diagonal (liking it)

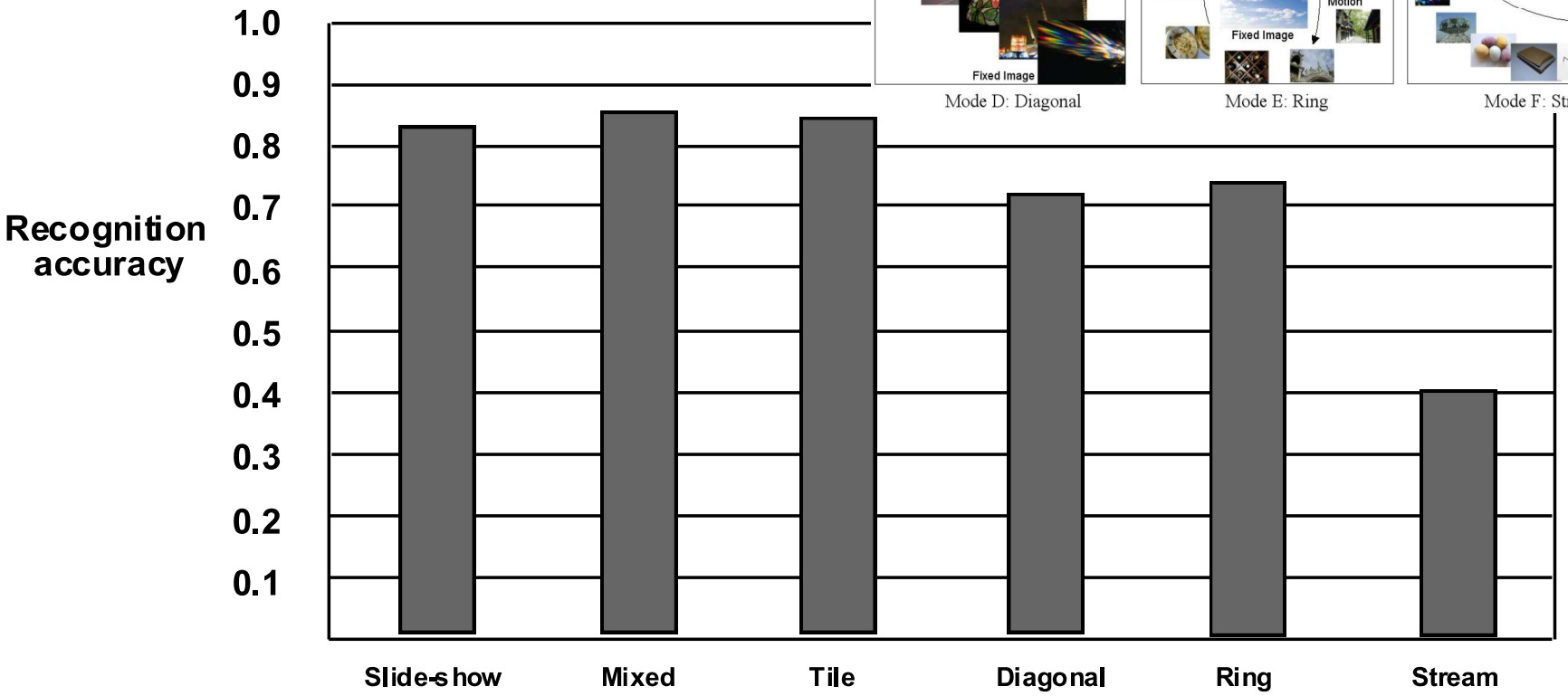


Eyes gazes: D) diagonal (disliking it)



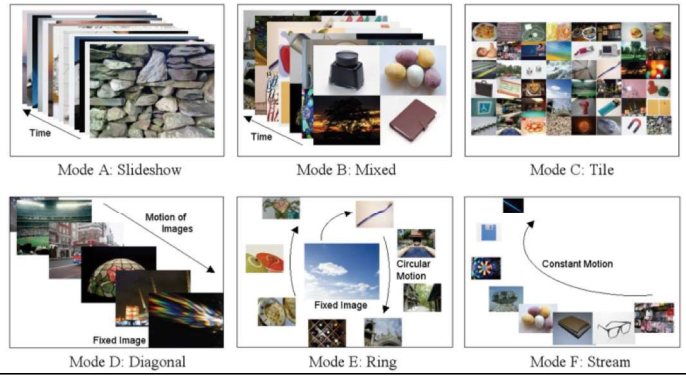
Accuracy

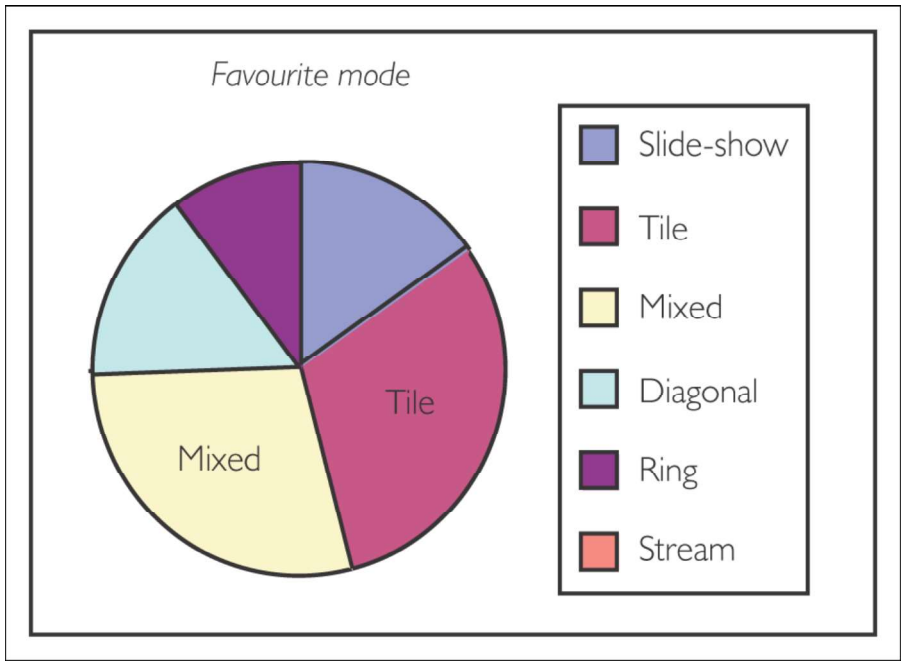


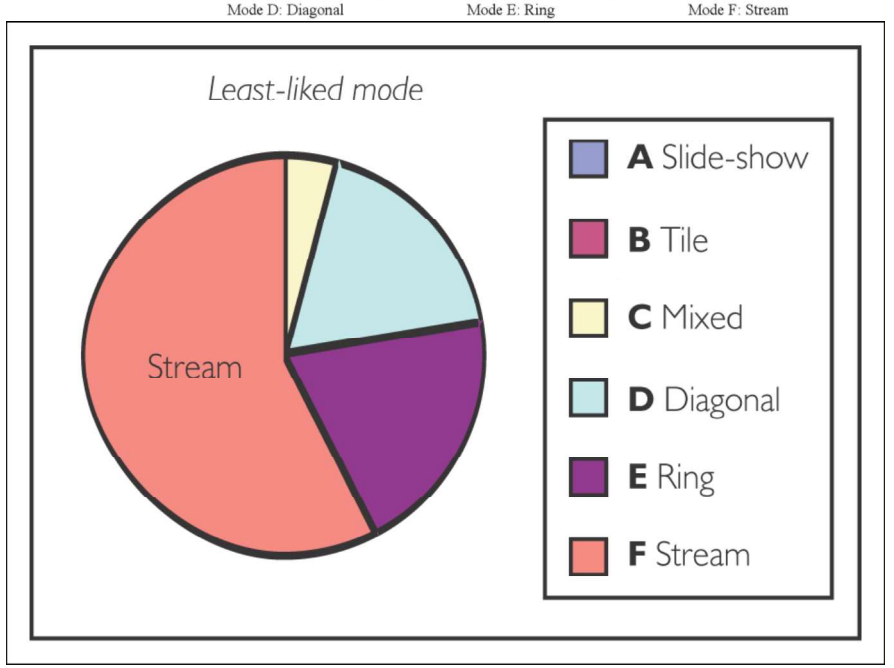


The accuracy with which the presence or absence of a target image was reported for the six presentation modes

Matter of opinion...







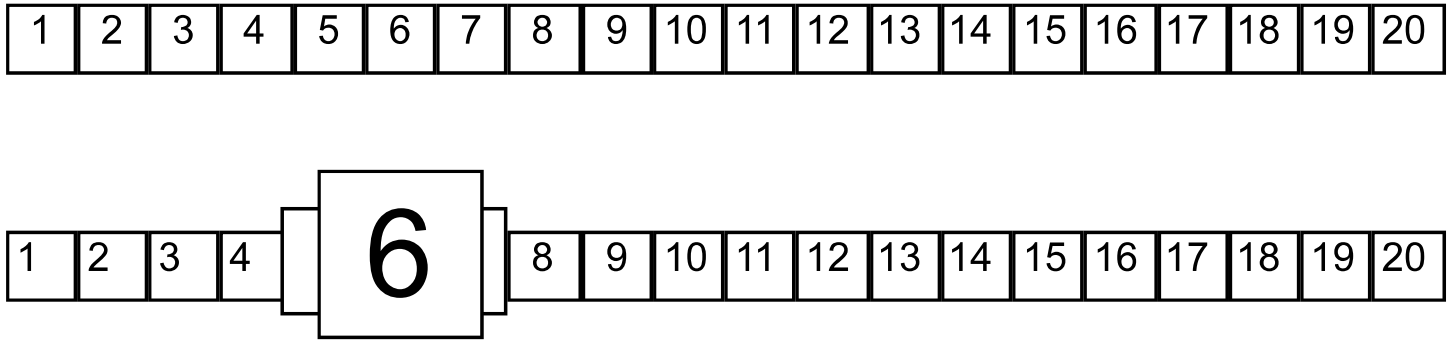
The slide-show, mixed and tile image presentation modes account for three-quarters of the preferred modes

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

BUT they use the awful pie chart !!!!

Interaction !

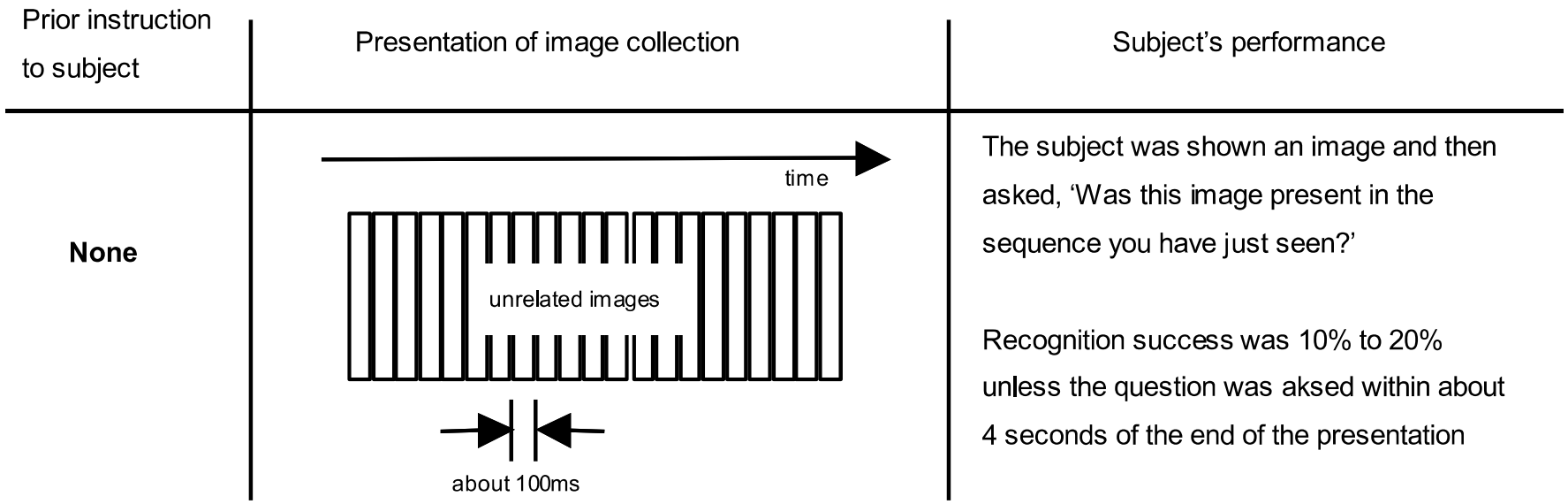
- Control the speed
- Expand images



Macintosh like interaction...

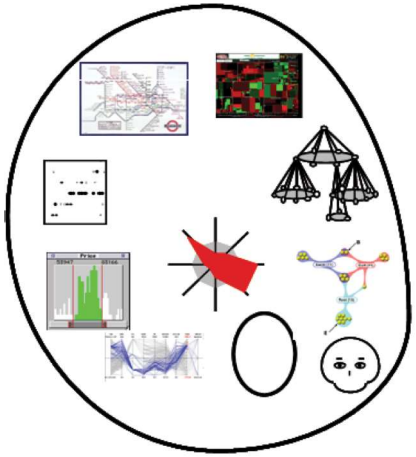
Still on human visual performance

- Another experiment

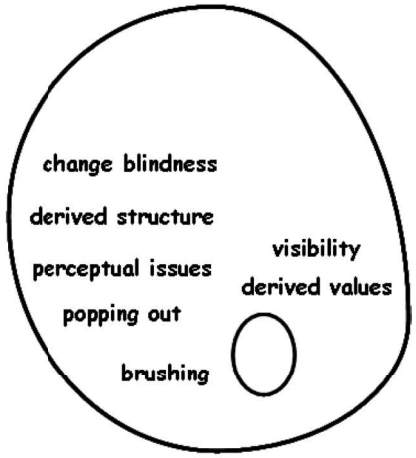


4 seconds?
Conceptual short-term memory (sound and images)...

Interaction design

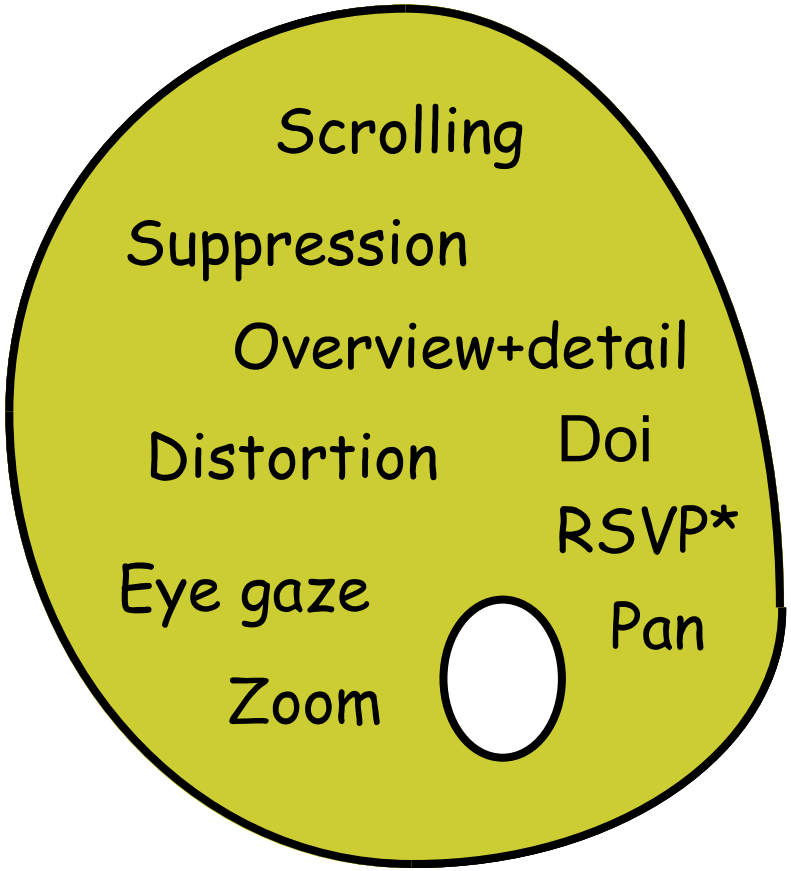


Techniques



Concepts

A third palette for designing Infovis applications



*Rapid Serial Visual Presentation