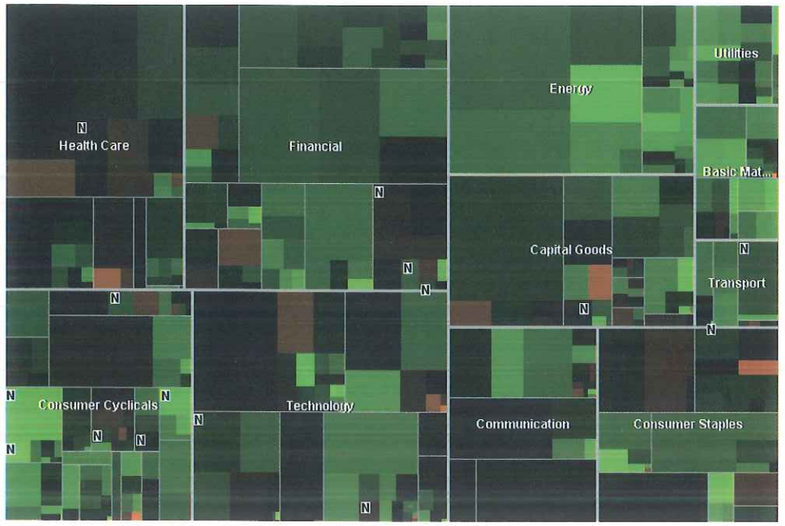


FIGURE 3.94
The Smartmoney .com website showing the status of companies within a number of sectors

Distortion and suppression techniques to be discussed in Chapter 4 may also be appropriate. Figure 3.95 provides an example showing how the selection of attribute limits can control the view provided by a tree map, and illustrates once

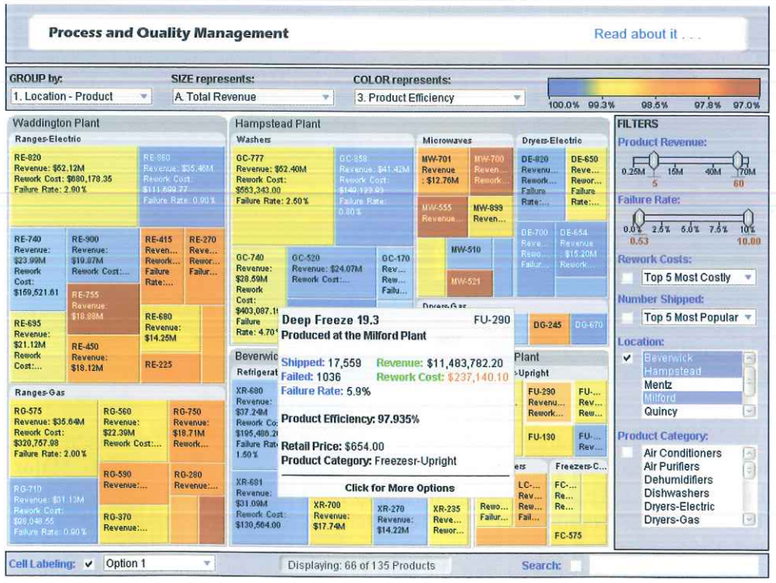


FIGURE 3.95
A tree map presentation of economic information, allowing filtering according to attributes
(Permission from HIVE)

again the potential offered by combinations of techniques (see, for example, Csallner *et al.,* 2003).

10

Hyperbolic browser

An ingenious technique whereby an entire tree can be kept within the confines of a circular area on a conventional display screen was invented in 1994. Without going into the sophisticated mathematical detail involved (Lamping *et al.,* 1995; Lamping and Rao, 1994, 1996), the method is based on a hyperbolic geometric transformation which leads to all nodes of the tree being located within a specified area: the resulting appearance is the form shown in Figure 3.96. The designated root node is initially in the centre of the display, its immediate subordinate nodes are distributed around it at a particular distance, but as the number of levels separating a node from the root increases, the separation between a node and its parent decreases and the size of the node also decreases, in such a way that all nodes fall within the circular display area. A practical limit to the display of all nodes is imposed by the resolution of the display: drawing of the tree stops below one-pixel resolution.

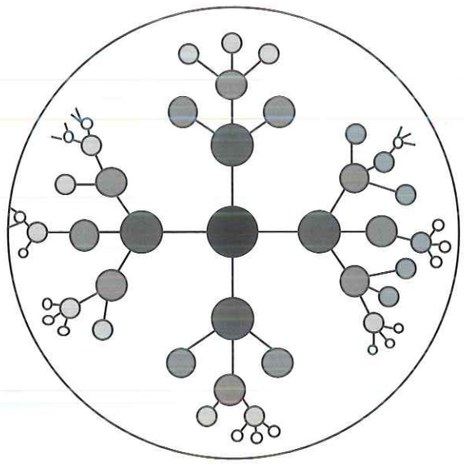
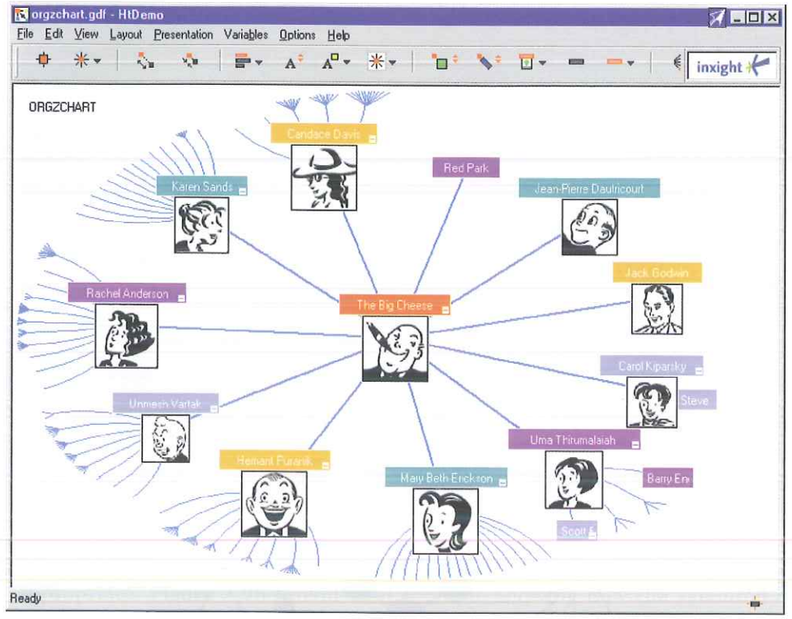
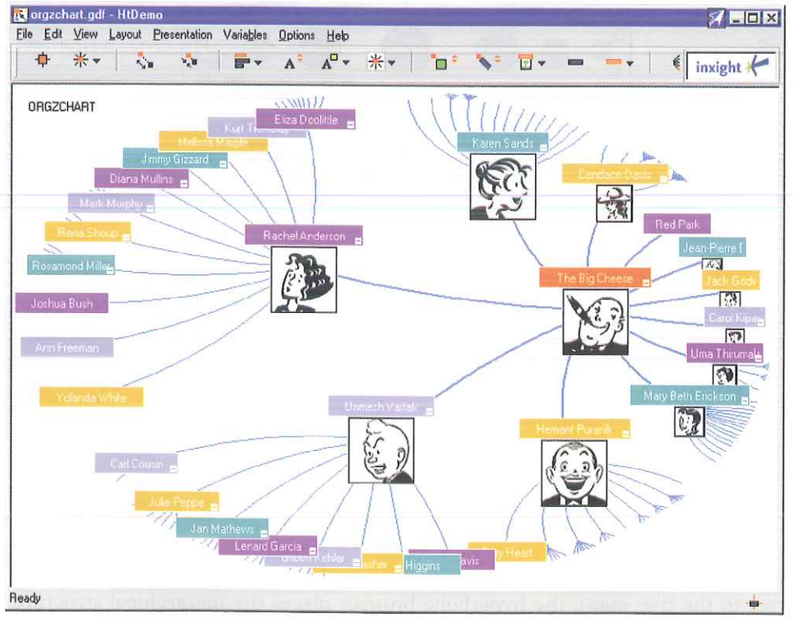


FIGURE 3.96
A sketch illustration of the hyperbolic browser representation of a tree. The further away a node is from the root node, the closer it is to its superordinate node, and the area it occupies decreases

It is the interactive nature of the hyperbolic browser that is its principal advantage. Any node of interest can be moved smoothly towards and into the central position, whereupon its subordinate nodes follow in roughly the same direction. Thus, by *smooth* movements of the tree within the available display area, relevant regions of interest can easily be explored. Figure 3.97(a) shows a hyperbolic display for the employees in an imaginary department: interactive movement of Rachel Anderson towards the centre pushes her superior away from the centre and reveals the employees who report to Rachel (Figure 3.97(b)). In turn, the movement of Eliza Doolittle towards the centre would reveal details of the people who report to her. As with the cone tree (but in contrast to the tree map), the hyperbolic browser places the hierarchical structure



(a)



(b)

FIGURE 3.97
(a) The reporting structure of the employees of a company. (b) One employee of interest, Rachel Anderson, has been moved towards the centre, revealing her subordinates

in evidence. But again in contrast to the tree map, the leaf nodes are not primarily in evidence unless dragged towards the centre. The application of the hyperbolic browser to the Library of Congress is illustrated in Figure 3.98.

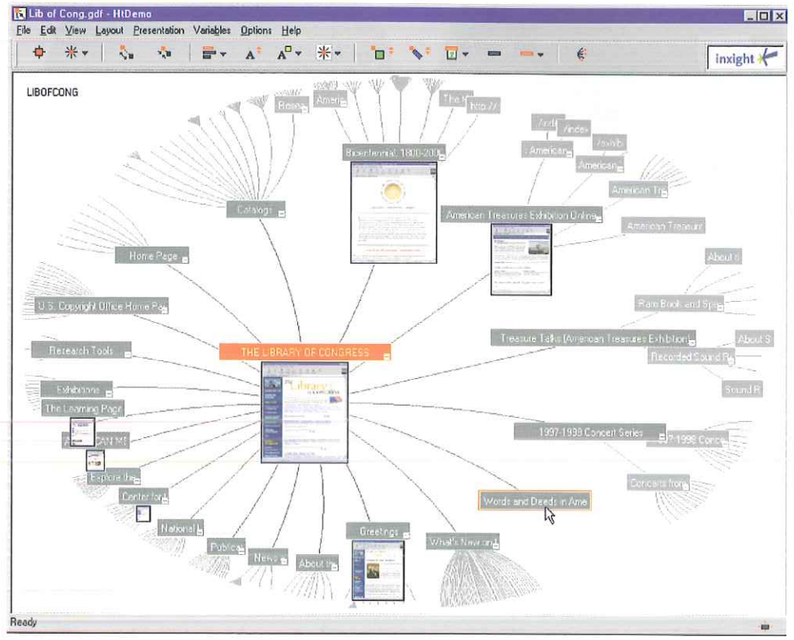


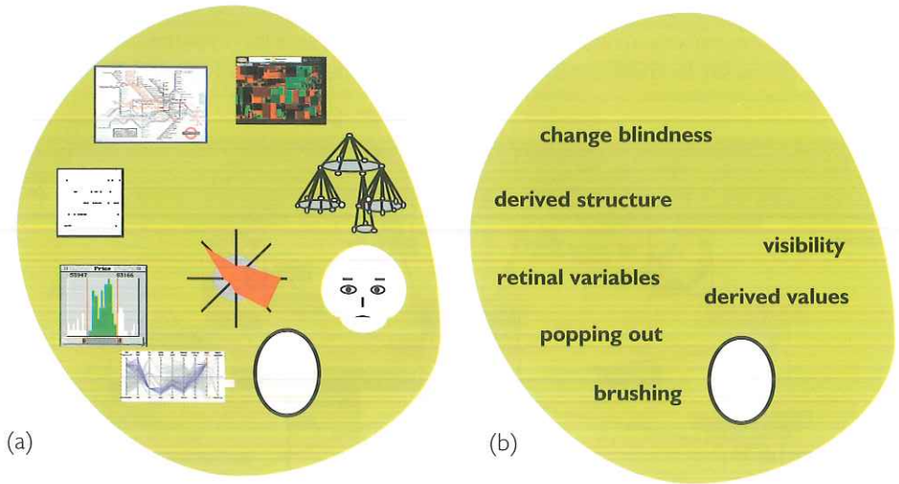
FIGURE 3.98
Representation of the Library of Congress by the hyperbolic browser

3.3 Support for design

The design of even the simplest visualization tool involves creativity. And, like the conventional artist who works in oils, the interaction designer has a number of palettes available. On one (Figure 3.99(a)) are some techniques drawn from an extensive collection that can be used for the representation of values and relations, each having its own advantages and disadvantages. On another (Figure 3.99(b)) is a collection of concepts of potential value when selecting a representation technique appropriate for a given application.

But two other palettes are needed before effective interaction design can occur. One, to be discussed in the following chapter, has to do with *presentation*, concerning the manner in which representations can be presented within the constraints of limited display area and time. The other, the subject of Chapter 5, concerns *interaction* – again, concepts and techniques are available for selection by the interaction designer to complement the benefits to information visualization offered by representation and presentation.

RE 3.99
s'
e for the
tion
er:
nniques,
cepts



(a) (b)

Exercises

The value of many of these exercises can be enhanced by discussing the results in open class.

Exercise 3.1 (Review)

Make a list of all the methods you can recall for encoding data visually and write brief comments about the circumstances in which they are particularly valuable. Comment upon whether, in their static form (i.e. without interaction), they support object and/or attribute visibility and correlation.

Exercise 3.2

Five students have taken exams in eight subjects and for each subject a mark out of ten has been assigned. Make a list of the questions that might be asked of this data by (a) a student, (b) a parent, (c) a subject teacher and (d) the headteacher. Aim for a total of at least ten questions. Write the questions on Post-its and stick them on the wall for reference during Exercise 3.3.

Exercise 3.3

The performance of the students mentioned in Exercise 3.2 is as follows:

5 STUDENTS (A, B, C, D AND E) SIT 8 EXAMS. THE MARKS OUT OF 10 ARE AS FOLLOWS:

Art	10	1	5	3	2
Science	1	10	5	4	8
History	8	5	7	1	1
Sport	2	9	5	10	4
Physics	–	1	2	3	1
English	2	8	6	8	5
Chemistry	4	1	1	1	4
Mathematics	10	1	5	4	2
	A	**B**	**C**	**D**	**E**

Without using a computer, sketch one static representation of this data: no interaction with the representation is to be considered. Then see whether it answers any of the questions identified in Exercise 3.2.

For the questions identified in Exercise 3.2, and whose answer cannot easily be found, see whether you can make a useful modification to the representation, still without employing interaction.

Exercise 3.4

Compose a mosaic plot representation of the Titanic data (Table 3.1) but using a different sequence of steps (for example: survival -> gender -> class -> adult/child). List the observations that can readily be made from these representations. Are they different from those triggered by the representations derived in Figure 3.61?

Exercise 3.5

The London Underground map contains no distance or journey-time encoding. With sketches, suggest how this data can be represented. Would it be useful? What other data could usefully be encoded?

Exercise 3.6

At first sight, Florence Nightingale's 'rose plot' appears to have much in common with a star plot. Distinguish between the two, commenting upon the significance that can, or cannot, be associated with the enclosed area of a star plot.

Exercise 3.7

By means of sketches, suggest alternative ways in which the 'hits' returned by Google could be represented.

Exercise 3.8

For your school or university or department (real or imaginary), design a representation of scholastic achievements (e.g. marks in 12 subjects in five year groups) that will show not only the general level obtained but also (1) the way in which the achievements are changing (i.e. first derivatives), (2) the proportion of students obtaining better than a pass mark and (3) the number of students taking a particular subject. Design the representation so that it can be printed on a card that slides easily into the pocket (e.g. one-third of A4).

Exercise 3.9

Study and understand one of the following representation techniques that have not been discussed in this chapter, and prepare a ten-minute presentation in which its features are described and critically evaluated:

(1) Keim, D.A., Hao, M.C., Dayal, U. and Hsu, M. (2002) Pixel bar charts: a visualization technique for very large multi-attribute data sets, Information Visualization, 1, 1, pp. 20–34.

(2) Havre, S., Hetzler, E., Perrine, K., Jurrus, E. and Miller, N. (2001) Interactive visualization of multiple query results, IEEE, Proceedings Information Visualization, pp. 105–112.

(3) Yang, J., Ward, M.O. and Rundensteiner, E.A. (2002) InterRing: an interactive tool for visually navigating and manipulating hierarchical structures, IEEE, Proceedings Information Visualization, pp. 77–84.

(4) Havre, S., Hetzler, B. and Nowell, L. (2000) Theme river: visualizing theme changes over time, IEEE, Proceedings Information Visualization 2000, pp. 145–154.

(5) Geons, as described in Colin Ware's book *Information Visualization: Perception for Design* (2004).

Exercise 3.10

Suggest possible static (not interactive) representations for human relationships (including marriage, births, deaths), test them on real examples and identify the advantages and disadvantages of each.

Exercise 3.11

Bus, metro and train routes are typically represented by lines between nodes. However, with some large cities (London, for example) there are so many routes that it is not easy to plan a journey, especially if it involves intermediate changes. Explore the potential of adding, to the node-link route representation, some overall directional indicators to give a 'first glance' suggestion as to which route might be appropriate.

Exercise 3.12

Select one of the folders on your laptop which contains at least two levels and draw a tree map representation of its contents.