Information Visualization

- Visualization - Use graphical means to show complex data sets
- Make use of the remarkable human perceptual ability (e.g. find a city on a map rather than on a list)
- Many ways to show relationships
- Pointing can allow rapid selection and feedback (the eye, hand, and mind seem to work smoothly and rapidly)
- Strategy to use:
  - Overview first
  - zoom and filter
  - then details on demand

Data Types

- 1-Dimensional
  - data in sequential order: textual documents, program source code, lists of names
  - value bars (scroll bars), bifocal displays (more detailed information in the focus area and less in the surrounding area)
- 2-Dimensional
  - Planar or map data includes geographic maps, floor plans, newspaper layouts
  - Example: Geographic Information Systems, Spatial displays of document collections
- 3-Dimensional
  - Real-world objects such as molecules, the human body, buildings
  - Users must cope with understanding their position and orientation when viewing the objects
  - occlusion problem
  - Virtual Reality displays

- Temporal
  - Time lines are widely used: medical records, project management...
  - Items have a start and finish time and items may overlap
  - Tasks include finding all events before, after, or during some time period
- Multi-Dimensional
  - Most relational and statistical databases
  - items with N attributes become points in a N-dimensional space
  - problems: occlusion and disorientation
- Tree
  - items with each item having a link to one parent item (except root)
  - Most Common use - File Managers
- Networks
  - data needs linked to an arbitrary number of other items
  - Example: A graphical representation of the World Wide Web

Information Visualization Tasks

- Overview
  - Gain an overview of the entire collection
  - Need of a strategy (zoom-and-replace, “fisheye” view)
- Zoom
  - Zoom in on items of interest, Allowing a more detailed view
  - Zoom factor: magnification from the overview to the detail view
- Filter
  - Filter out uninteresting items
  - Allows user to reduce size of search
- Details-on-Demand
  - Select an item or group and get details when needed
  - Useful to pinpoint a good item

- Relate
  - View relationships among items
  - Example: Set directors name, and view all movies with that director
- History
  - Keep a history to allow undo, replay, and progressive refinement
  - Allows a mistake to be undone, or a series of steps to be replayed
- Extract
  - Extract the items or data
  - Save to file, print, or drag to another application

Hypertexts and Hypermedia

- Hypertext = network of nodes containing information that are connected by links (pointers, cross-reference, citations).
- Hypermedia = a superset of hypertext, including graphics, video, animation, sound.
- principles of hypertexts:
  1. There is a large body of information organized into numerous fragments.
  2. The fragments relate to one another.
  3. The user needs only a small fraction of the fragments at any time.
- but often in reality:
  - Too many links
  - Long chains of links to reach relevant material
  - Too many long dull articles
  - Lack of tables of contents or overviews

Guidelines

Know the users and their tasks: consult with users and test your design

Ensure that meaningful structure comes first: develop a *high concept* of the body of information that you are organizing

Apply diverse skills: information specialists (trainers, psychologist, graphic artists), content specialists (users, marketers) and technologists (system analysis, programmers)

Respect chunking: each chunk should deal with one topic, theme or idea. If a chunk reaches 10,000 words... consider restructuring! Screen are small and hard to read: lengthy linear texts are not pleasant

Show interrelationships: too few links bore readers; too many links overwhelm and distract.
But consider the purpose of the page: pages which are meant to be read thoroughly should have few links (commonly 2 to 20), but an index page will have hundreds of links

Ensure simplicity in traversal: design the link structure so that navigation is simple and consistent

Design each screen carefully: each screen should be grasped easily, use compact layout, to minimize scrolling

Require low cognitive load: do not require the user to memorize terms or code

How to Organize the "Home Page"?

Authoring strategies for creating the introductory article include:

- Executive overview: the "home page" summarizes the content of the hypertext and contains links to the major concepts
- Top-down: the links in the home page are to major categories only, which are then in turn refined
- Menu: the home page has a detailed table of content
- Search strategy: the home page contains a search facilities to move across the hypertext

Links on the WWW

- Navigation: structure of the site and traversing patterns
- Links: mechanism by which users move from one place to another
- Successful link structures can help users navigate the site more effectively
- The success of a link depends on:
  - how well the user can predict where the link will lead
  - how well the user can differentiate one link from other, nearby links
- Link layout can affect user's success:
  text links in a bulleted single-column format, explicitly describing the content of the page they lead to (e.g. "How to book a flight") perform better
- Text is important: sometimes terms which are meaningful for the designer are not for the user
- Image links: they may help, but they provide no visual clue that they have already been traversed

Webpage Design

- Compactness and branching factors (number of links):
  - long pages with no link only if users are expected to read the entire text sequentially
  - in general use some form of fragmentation
  - goal: have meaningful structure, that guide the users, but not excessive fragmentation
  - higher branching factor is OK only for indexes
  - compact, vertical alignment to reduce scrolling
- Sequencing, clustering, and emphasis: the first link in the page is perceived as the most important
- Support for universal access: small/large displays, monochrome/colour, slow/fast transmission, browsers not supporting some features (e.g. frames)
- Good graphical design
- Navigation support (site maps and session history)
- Query Previews: search actions can be split into:
  - rapid rough search
  - query refinement to narrow search