Human oriented Information Presentation

Context

Effective Communication and Representation of Information

Applicability

- Preparing and executing presentations and talks
- Modeling of objects or data
- Creative writing
- Taking notes
- Capturing ideas, Brainstorming
- Designing Web Sites and providing easy access to information of the site

Problem

If human specific abilities in information retrieval are not considered, information consumption is inefficient.

Forces

- The capacity of information, which can be perceived at a time, is restricted.

  Research elaborated that perceiving and remembering of information is restricted to about seven – plus or minus two – items of information at a time. This phenomena is called "chunking limit" (Miller, 1956).

- Representing information items in an one-dimensional form can not visualize semantic nearness of information items.

  In common representation forms like Table of Contents, Lists, Indices, etc. items of information are organized linear, i.e. one-dimensional. Cross relations, relational proximity between a group of items can not be represented one-dimensional.

- Human information perception is associative and based on spatial cues and geometrical patterns. Thus linear and only text-based forms of information representation are not optimal suited for human information consumption.

Solution

All information should be presented in information units, which contain no more than seven – plus or minus two – separate items.

If there is a non-linear relationship between information items, like a hierarchical order or nearness of a single item to multiple other items, a two-dimensional representation is preferable.

Information items should be associated with a particular spatial location. Using predefined or suggestive symbols assist effective perception. Relations between items should be visualized by lines or arcs, which can be labeled additionally.

The "chunking limit" should be considered: each entity representing an item should not be related to more than seven (plus or minus two) other entities.

If the limit of seven is going to be exceeded, sub-chunks should be grouped. In case of software design, entities containing sub-chunks are e.g. modules or categories.

In general, if the complexity of information increases the limit of items, which can be perceived at once, decreases. Thus representation of complex information should be done using chunks of five to seven items.

Rationale

Miller, a psychologist, studied in the 1950s the short time memory. He investigated for example how many numbers a person can remember reliably a few minutes after having been told these numbers.

Miller presented his results in an article titled "The Magic Number Seven, Plus or Minus Two" (Miller, 1956). He found out that human consumption and remembering of information is restricted to seven plus or minus two separate items of information. The phenomenon is called the "chunking limit".

Chunking seems to be the way our internal "associative memory" organizes information storage and retrieval. This method of organizing is related to our spatial perception.

Storing and retrieving items of information is more efficient, if those items are associated to a spatial location and optional to an additional geometrical shape.

A two-dimensional representation allows to express contextual nearness and multiple relations by means of spatial nearness.

In the 1960s Prof. Joseph D. Novak developed *Concept Maps*. The base idea of *Concept Maps* is that "Meaningful learning involves the assimilation of new concepts and propositions into existing cognitive structures" (Novak, 1977).

Buzan developed a similar technique (cf. Buzan, 1993): *Mind Maps*. The centre of a *Mind Map* consists of a word fixing the main idea or concept. Around the central word a couple – recommended are 5 to 9 – of related words / ideas are grouped. Each "child word" can have relationships drawn as lines or arrows to another group of words.

Examples

- *Mind Map* Example

  Figure 1 shows the *Mind Map*, which was used to work out this Pattern.

  Because the information visualized in this *Mind Map* has a certain complexity, less than seven items are used to specify the main concept. Therefore the main concept – represented by the Pattern's name – has only the following five branches:

  - Context
  - Problem
  - Solution
  - Consequences
  - Inclusion

  The item *Inclusion* comprises the sub-categories *Known Uses* and *Related Pattern*. These two sub-categories are seen here as two closely related items. Both help the reader to classify and integrate this Pattern: on the one hand side the relation to practical usage is shown as well as one the other hand the relationship to other Patterns is pointed out.

  A two-dimensional representation allows to visualize the nearness of the two items *Inclusion* and *Context*. In the linear form of the Pattern description – like this paper itself – *Context* is the first item where the item *Inclusion* resp. *Known Uses* and *Related Pattern* are at the opposite end.

  The *Mind Map* form visualizes, that the items or Pattern elements *Context, Problem, Solution, Consequences and Inclusion* form the "inner circle" – the main topics of a Pattern – where the other items / elements give more detailed explanations.

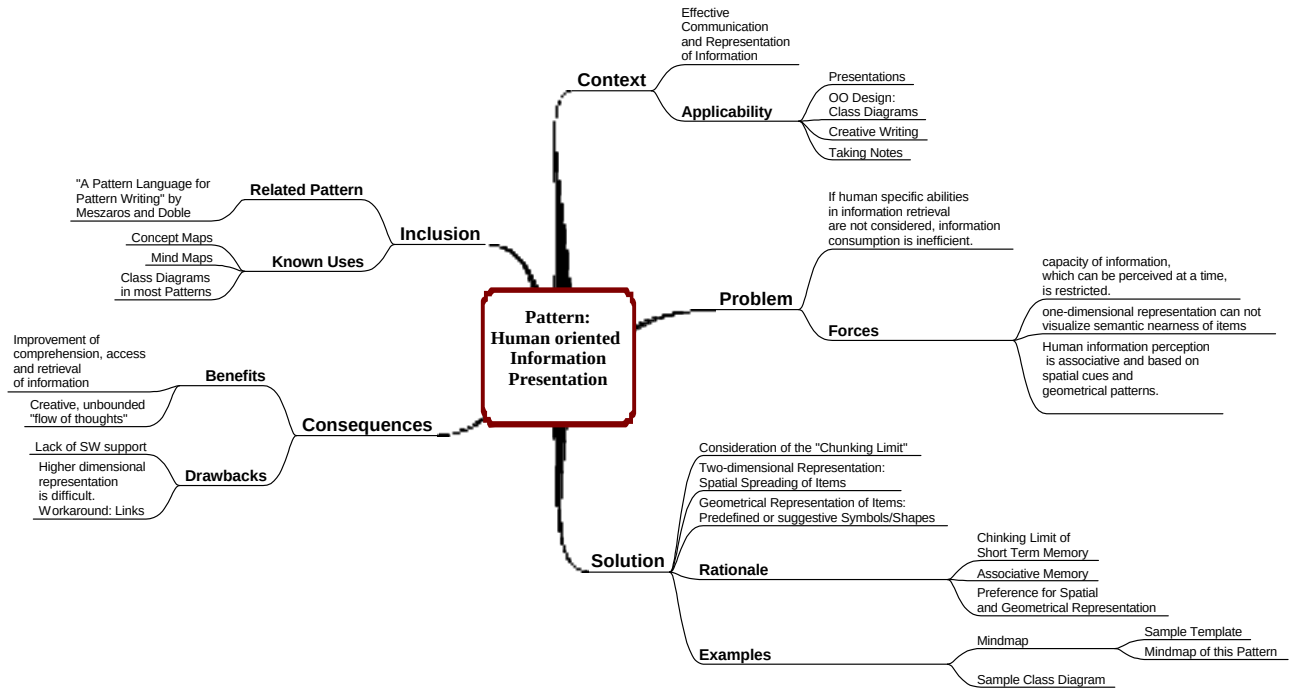

Fig. 1: *Mind Map* of this Pattern

- *Concept Map* Example

  Figure 2 shows a *Concept Map* developed by a student to capture some knowledge about the physics and biological roles of water.

  This *Concept Map* was developed in studies published by Novak and Gowin (1984). In this *Concept Map* concepts are shown as ovals and instances as rectangles.

- Class Diagram of the *Model View Controller* Pattern

  This Pattern can be applied in object oriented design. As an example, figure 3 shows the class diagram from the *Model View Controller* Pattern (Buschmann *et al.*, 1996).

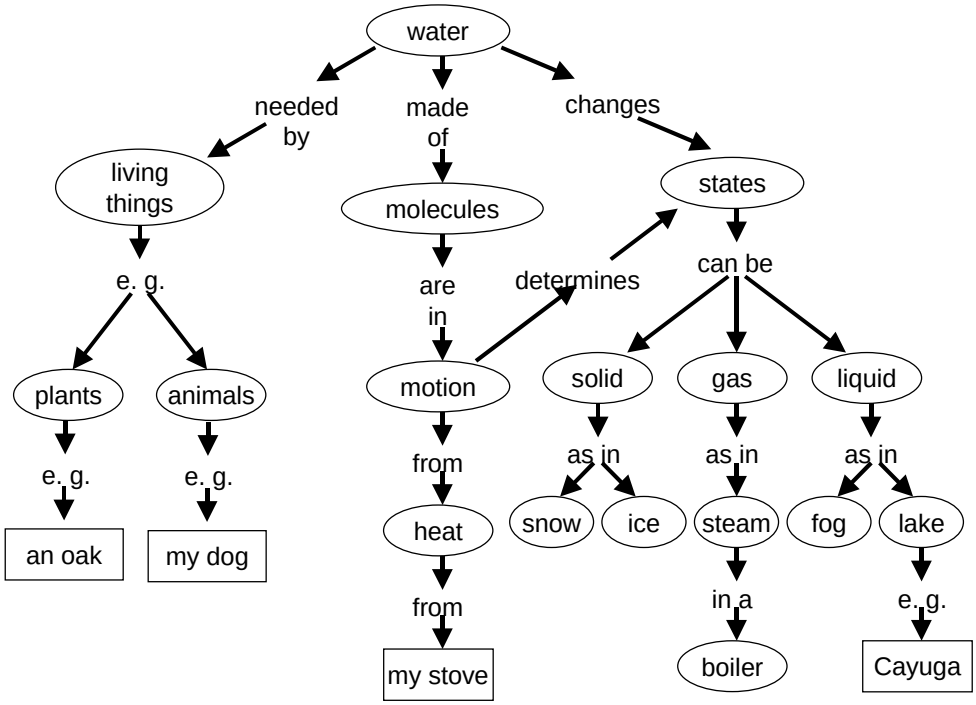

Fig. 2: *Concept Map* of student's knowledge about "Water" (after Novak and Gowin, 1984)

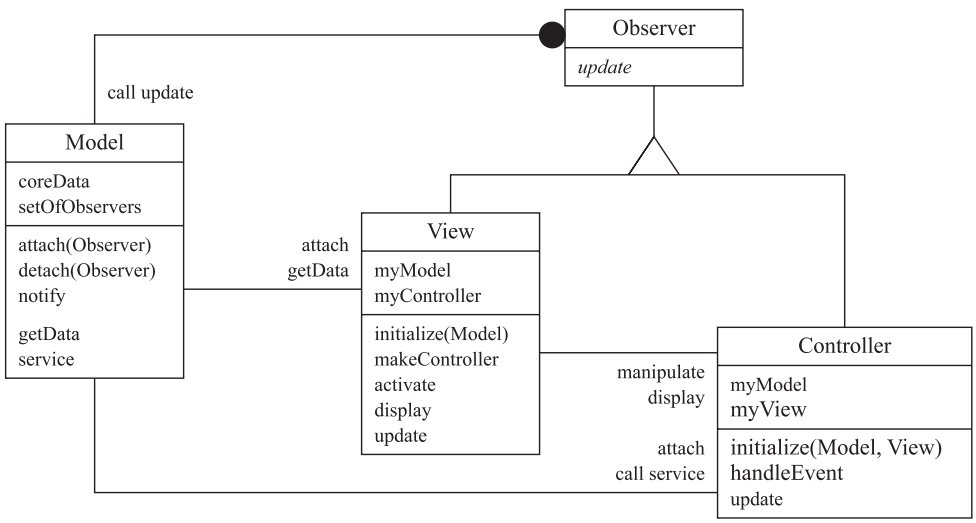

Fig. 3: *Model View Controller* Class Diagram

Consequences

Advantages

- Chunking items of information improves comprehension and the ability to access and retrieve information.
- Visualization of information as two-dimensional maps allows information items to be associated to symbols and a spatial location.

Drawbacks

- One-dimensional ways of representation are widely supported by software tools like word processors. Meanwhile there are graphical editors for *Mind Maps* available, too. Nevertheless, using computer programs too early in a creative process inhibits creativity.
- Paper or graphical editors allow two-dimensional locating of information items. Higher dimensional representation is difficult. To solve this problem, researchers developed e.g. Virtual Reality applications which allow three-dimensional locating of items assigned to geometrical objects. In case of a two-dimensional representation, links between items can express and visualize nearness and specific relations. Links furthermore can be labeled to name and describe the relationship.

Inclusion

This Pattern element comprises the sub-elements *Known Uses* and *Related Pattern*. The section *Known Uses* contains examples of applying this Pattern in praxis. Relationships to other Patterns are content of the section *Related Pattern*.

Known Uses

- *Mind Maps*

  Figure 4 shows an example of a *Mind Map*. This example of a *Mind Map* was created with a software tool from *Inspiration Software*. The *Mind Map* shown in figure 4 is one of several templates, which help to develop own *Mind Maps*.

For this *Mind Map* template the following description is given:

"How to use this template

1. Start with a central idea and type it into the Main Idea symbol.
2. Brainstorm ideas branching from the central idea.
3. Show relationships between branches with textured lines and colors.
4. Leave your mind as free as possible.
5. Use key words to represent ideas.

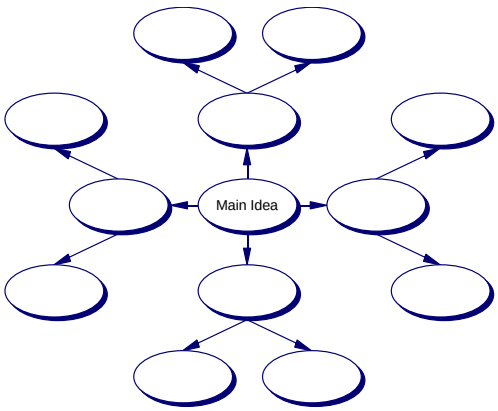

Fig. 4: "Idea Map Template" © Inspiration Software, Inc.

Benefits of using the Idea Map template

Idea mapping will help you explore an idea freely without the constraints of a superimposed structure. Moreover, a visual environment promotes making new connections and insights in a way that linear text does not."

(Inspiration Software, Inc.)

- Class Diagrams

  Almost all class diagrams in Patterns, like those presented in (Gamma *et al.*, 1995) and (Buschmann *et al.*, 1996), contain about five – plus or minus two – classes.

  It seems, that proven generic solution in object oriented software design can be expressed in terms of the co-operation of about five plus or minus two classes/objects.

  Of course, a solution of a single Pattern can be applied together with related solutions or one solution includes others.

  Nevertheless, obviously the "chunking limit" influences the way we perceive and retrieve experience information and – as the consequence – how such experience can be represented and communicated.

- Overview Maps

  Several Pattern languages and catalogues provide a graph or map as an overview and to visualize the relationships between Patterns. An example is the "Design Pattern Relationships" graph in (Gamma *et al.*, 1995).

Related Pattern

Meszaros and Doble (1998) wrote "A Pattern Language for Pattern Writing". Within tis Pattern language the Pattern ***Single-Pass Readable*** deals with the problem that a "person in search of a solution may need to look at many potential solutions. How do you help the reader understand your Pattern in the least amount of time, in order to facilitate this search?" (Meszaros and Doble, 1998). The solution part of the Pattern presents several techniques to solve the problem, like choosing *Evocative Pattern Names* and providing *Findable Sections* as well as *Skipable Sections*. Meszaros and Doble refer to the "chunking limit" and suggest reduction to the most essential concepts and terms, especially in introductory Patterns of a language.

References

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