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Research on Knowledge Visualization in the Age of Image Reading

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Abstract

This research analyzes the visual form of knowledge visualization, starting from the social phenomenon in the age of map reading. In order to achieve the goal of knowledge information being communicated more efficiently. Combining people's cognitive processes, the visual needs of users for the interpretation of knowledge visualization information were analyzed, and the task of designing visual forms for knowledge visualization was analyzed in relation to semiotic theory. In order to communicate new knowledge more efficiently, designers need to constantly improve and innovate the visual form of knowledge visualization according to the cognitive needs of users. This research make contributes to future research by proposing innovative design methods for the visualization of knowledge information in response to the current situation.

Keywords

Knowledge Visualization; Cognitive Processes; Visual Forms; Visualization.

1. Introduction

With the rapid development of society, more and more knowledge and information are coming into people's lives, and people are eager to obtain as much knowledge and information as possible in the shortest possible time, which makes graphic and intuitive expressions more and more favored by the public. A large amount of data confirms that 83.3% of information acquired by humans is visual, 11.0% is auditory and 1.5% is tactile, which shows that the visual sense plays a dominant role in people's access to information. These factors have contributed to the growing interest in knowledge visualization research in the academic and media sectors in recent years.

Knowledge visualization, as one of the important branches of visualization, is developed on top of data visualization and information visualization, which generally intends to find patterns in data in order to gain new knowledge. Knowledge visualization, on the other hand, focuses more on the visualization of existing knowledge in order to facilitate its dissemination among individuals or groups and deeper research [1]. The dissemination of knowledge can generally be divided into inter-individual dissemination, individual-to-group dissemination, and group-to-group dissemination. Among them, the individual's own knowledge visualization is used as a learning tool for knowledge grooming, mostly as an individual knowledge expression for self-directed learning, and is generally designed without consideration of its dissemination, so its form is more prominent in personalization The form is therefore personalized. When an individual or a group disseminates knowledge to a group of recipients different from the designer, as in the case of some knowledge visualization designs on the internet that are popular in nowadays picture-reading era. The focus is not only on the accurate representation of knowledge, but also on the effectiveness of its communication, making the visual information of knowledge universal so as to meet the cognitive needs of the majority of recipients.

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2. Cognitive Process of Knowledge Visualization and Task Objectives

Human cognition of knowledge visualization is the process by which people process various visual representational elements in knowledge visualization in order to achieve understanding cognition[2]. The cognitive process of knowledge visualization begins with receiving visual symbolic information from the objective physical world through the visual senses, such as dots, lines, surfaces, pictures, words, colors, etc., which were followed by sifting through this detected information and sorting out the main information. The information detected is then interpreted, learned and remembered according to the receiver existing memory experience knowledge. Finally, the processed information is processed at a deeper level and transformed into a knowledge concept, thus achieving a full mastery of the knowledge "by example" [3]. The communication of knowledge visualization is a process that starts from perception and ends with the transformation of the information into a knowledge concept.

The visualization of knowledge is a process of perception, understanding and mastery, and the visualization of knowledge has a variety of objectives depending on the cognitive needs at each stage of the process:

(1) When the receiver of information receives information at the initial stage, the visual impact of visual symbols and their formal beauty are the key to making the receiver interested in further interpretation. In the era of knowledge information is so huge, in order to attract readers, each media will also adopt various visual forms of language to express all kinds of knowledge, when a kind of knowledge has a variety of visual expression forms, it will produce comparison and competition, the visual language has better interesting, impact, beauty is often better to attract and keep the attention of the receiver. The visual form of representation therefore plays a dominant role in knowledge visualization.

(2) In the information screening stage of the receiver, reducing the interference of redundant information is the key to this stage. The root of knowledge visualization lies in the accurate and efficient communication of knowledge and information. Therefore, the cognitive burden of the information recipient should be reduced, which also emphasizes the logic in knowledge visualization, the hierarchy of information should be clearly prioritized, and the interrelationship between the hierarchy should be clear[4].

(3) When the receiver interprets and learns from the filtered information, it is necessary to mobilize the memory knowledge generated from previous experiences to assist the current cognitive behaviors, so the universality and connectedness of the visual symbols play an important role at this stage. Visual symbols bring the relationship between the referent and the referent closer and more specific is the key to helping the receiver interpret the information at this stage[5].

(4) Before the recipient can transform the knowledge that has been received into a concept, something needs to be constantly remembered and repeatedly understood. This requires the recipient to be able to write down the visual information of the knowledge visualization for a short period of time so that it can be called up at any time and the knowledge can be repeatedly remembered[6]. Therefore, the visual symbols of the information have to be somewhat visual and relevant in order to be more likely to impress the receiver.

3. Analysis of Visual Forms of Knowledge Visualization

Visual form plays a key role in knowledge visualization. Combining the above cognitive analysis of knowledge visualization and the extraction of task objectives, the visual form approach for knowledge visualization could be analyzed:

(1) The visual form should correspond to the expressed content. In the design of knowledge visualization, visual expression is used as a form to assist the communication of knowledge

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information content. The main point of knowledge visualization is to convey knowledge to the information receiver, so the visual form should achieve the unification of the energy and reference of visual symbols. The external expression should be clear in its inner expression, and the interfering elements should be excluded to the maximum extent, so that the content expression is clear and unambiguous. The external representation of visual symbols consists of individual visual symbols and combined symbols, which are also the surface form and the deep form of the visual form. The individual visual symbolic elements contain points, lines, surfaces, shapes, colors, textures, words and other superficial forms, while the combined visual symbols are the spatial relationships of vision, as well as the logical relationships of visual rhythm, echoes and contrasts. Both the superficial visual symbolic elements and the deeper combined visual symbolic elements implicitly involve their internal meanings.

The meaning expressed by a single visual symbolic element is a blend of its own conventionally understood meaning as well as meaning within the whole. For example, when interpreted purely in terms of color symbols, people tend to have a universal tendency to interpret different colors by using their previous memory knowledge, the universality of which comes from the influence of people's common living environment. For example, red evokes fire, pepper, blood, and giving a sense of passion, hotness, intensity, urgency, speed, etc. Orange evokes sunlight, wheat fields, and so gives a feeling of brightness, grandeur, maturity, sweetness. Blue evokes the ocean, like the sky, giving a feeling of profundity, eternity, sanity and calmness. When color is integrated into the design of the overall visual form, it can be better integrated with the content to be expressed based on people's empirical interpretation of it, aiding the recipient of the information to have a fuller perception of the knowledge visualization.

In knowledge visualization, the spatial relationships formed by the combination of visual symbols are more intuitive and logical in expressing the knowledge content. A clear and accurate visualization must have a strong logical correlation of information. The spatial structure of visuals generally has a linear structure, a circular structure, a reticulation structure. Figure 1 shows the spatial structure of visualization.

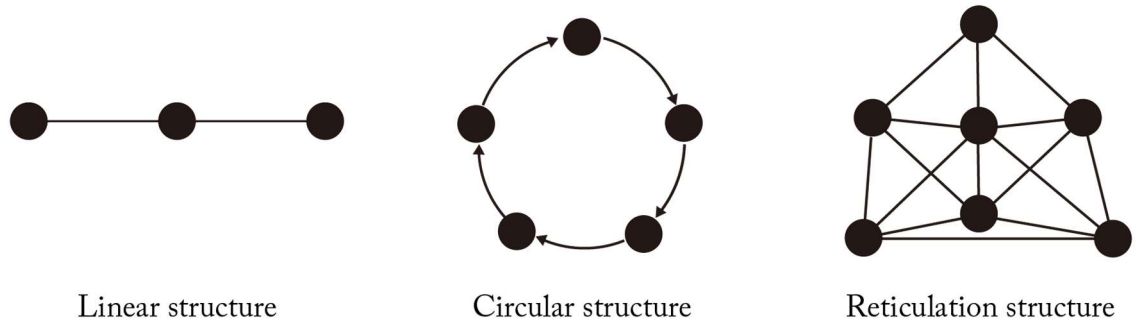

Figure 1. The spatial structure of visualization

Linear structures are generally used to express the sequential flow of things, the cause-and-effect relationship between events. Such visual structures are flowcharts, hierarchical diagrams, arrow diagrams. Circular structures are used to express the changes in a cyclical system, and take the form of spiral diagrams, ring diagrams. They are often used to communicate knowledge about life cycles, food chains. The mesh structure, on the other hand, is a representation of a complex knowledge system, with branching information unfolding from the central focus of the information, and the content of each branch is also interconnected, and is often used in

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visualizations such as mind maps to summarize and sort out knowledge information, generally in the form of radial diagrams, spider web diagrams, etc.

(2) The visual form of knowledge visualization needs to be both unified and differentiated. As a visual language, visual symbols need to be known by a wide range of groups, with wide, straightforward and easy-to-understand nature. It is necessary to minimize overly personalized and stylized interfering information to avoid misunderstanding by the recipients of the information. At the same time, in this era of map reading, the diversity and interest of knowledge visualization is also the key to attracting a wide range of users, so the visual form should not be too uniform and lacking in differentiation, otherwise it will make the information receiving group lose interest in the interpretation of the knowledge visualization work, fail to efficiently convey the information, or even fail to achieve the purpose of knowledge dissemination, making it lose the meaning of visualization. Therefore, the success of a knowledge visualization can be measured by the ability to find differences in the visual form of the visualization and to increase the attention of users.

(3) As an expression of visual art, visualization should follow its objectivity as well as its emotionality, using the artistic technique of metaphor to make the receiver of the information interested in browsing and understanding its content, and to feel an atmosphere and emotion it conveys, and to help understand it more quickly, also in line with the psychological needs of people in the era of map reading who wish to obtain key information quickly. Visual metaphors are divided into passive metaphors and active metaphors. Passive metaphors usually refer to the process of knowledge record or communication, as different people have different cognitive abilities, and the limited cognitive ability of people sometimes cannot be expressed in words or other forms, so they have to use the carrier of similar things to convey their knowledge content[5]. For example, magnetic fields in physics are invisible and difficult for most people to cognize directly, so they are often metaphorically represented as lines with a direction magnetic lines of induction to visualize knowledge, facilitating the dissemination of knowledge and cognition, as well as further research. Active metaphors are more commonly used in the visual design of today's widespread knowledge visualizations, in order to more vividly represent the knowledge that the designer has acquired and to make it clearer and more accurate to the recipient. In this design, emphasis is placed on the clever and accurate selection of the metaphor that corresponds to the content to be conveyed, as well as on the cognitive ability of the recipient and the means of communication.

4. Conclusion

In this day and age of such vast amounts of knowledge, knowledge visualization is used as a service to assist information recipients to reduce the cost of learning new knowledge and to interpret, remember and master new knowledge more efficiently. Designers can make knowledge visualization more useful by analyzing the process of human cognitive behavior to generalize and summarize more effective visual representations, thus maximizing the efficiency of the recipient's access to information.

With the continuous development of the map-reading era, the continuous enrichment of visual graphic expressions and the involvement of more and more high-technology in people's lives, people will gradually lose interest in the purely graphic visual forms, so in the future knowledge visualization, more groundbreaking and innovative designs should be carried out on the basis of the traditional visualization. We can find the following design characteristics:

(1) In the process of knowledge visualization, more sensory means can be involved, mainly visual, to assist and stimulate the recipient to perceive, understand and remember the content of the information conveyed more quickly and effectively. With the help of virtual reality technology, knowledge information can be conveyed to the recipient in various forms, such as

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visual, auditory and psychological touch, so that users can deepen their perception of knowledge.

(2) Knowledge visualization not only allows the designer to participate in its visual expression, but also allows the recipient to improve and create its visual expression while receiving and interpreting the information, increasing the interactivity of knowledge visualization and allowing the recipient to participate in the design of visualization, which is conducive to improving the user's experience and enriching the expression of knowledge visualization, making it rich in visual unity and Differentiation.

In a conclusion, this research make contributes to future research by proposing innovative design methods for the visualization of knowledge information in response to the current situation.

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