

Model of Image Thinking Based Development of Glossary

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Most part of the human knowledge is stored in the text form notwithstanding an increasing role of computer technologies in the research-technical revolution. The symbol-verbal knowledge format has remained a standard for the modern science and education regardless of a type of information bearer. One of the problems of e-education is faster relaxation of attention, hence reduced perception of the text information from a computer monitor in comparison with a traditional textbook. Upgrading quality of computer monitors has not completely solved the given problem yet, and moreover it does not take into account opportunities of information presentation by means of a computer.

Modeling of the image thinking aimed at the demonstration of separate words as symbolic image signs is one of the possible ways focused at improving of an electronic text [1]. In this case a simple narrative sentence or a text syntagma can be considered as an analog of event where images are united among each other by means of associative links [2]. Extending a traditional hypertext with paradigmatic connections by opportunities of syntagmatic knowledge as additional associative links between images is the idea of the approach. Formalization of principles of developing glossary as a dictionary of subject area images is stated as an assignment proceeding from the requirements of general model of the image thinking.

The approach offered is based on modeling of the artificial intelligence by means of introspection and combination of the well-known results of such sciences as physiology, psychology, linguistics, and neuropsychology. The postulates mentioned below are included into a concept model of the image thinking. Possible technical solutions of the image dictionary or subject area glossary must not contradict these postulates.

At first one should underline a principle of self-learning of living intelligence bearers. It is known that a baby is taught in everything from zero according to the simple principle formulated in the Ancient Rome as “gradual development and constancy”. A good base is necessary for perceiving any new knowledge [3], which is why one should “raise” the

image dictionary to the required level through guided tutelage beginning from general notions to special terms.

A lack of erase information operation is a substantial distinction between the natural memory and artificial one [1]. If a person meets a new image, he will never ignore it as in some cases it may cause certain consequences. One can not delete an available image, negative for instance, since cases of subconscious supplanting lead to pathological effects in psychology as Z. Freud once stated. “Stretching” image in the consciousness and “attaching” positive net of links with other images could be the only treatment. The above said principle of the memory organization can be described in a simplified form as “everybody is allowed, nobody is released”.

The third main postulate is relevant to the mechanism of refueling the image dictionary. When perceiving a new image a person is known to subconsciously activate his reference reflex. The development of links’ net of a new image with existing images in the memory is one of the tasks of the reflex. In other words, processes of classification and/or recognition of images take place. Any new image could not be principally independent since it “accumulates” maximum possible number of links with other images at the time of entering the system. As a result, a recurrent nature of image definition is displayed – “a person is judged by his friends - tell me who is your friend, and I will tell who you are”.

The following principles of developing glossary of images by including texts of educational matter into the system are suggested with regard to the above stated requirements of the image thinking model.

1. Training texts (educational doses) and their constituent phrases (syntagmas) are presented in the system as the following relations

$$Text - RE \subset Text - Id \times Bi - Te \times Title \times Author \times Time, \quad (1)$$

where *Text-Id* – unique text code, *Bi-Te* – binary code of educational dose, *Title* – title of text, *Author* – author of text, *Time* – time of introducing a dose in the system, and

$$Event \subset Event - Id \times Bi - Sy \times Text - Id \times Text, \quad (2)$$

where *Event-Id* – unique syntagma code, *Bi-Sy* – binary code of educational phrase, *Text* – verbal phrase definition.

2. The image dictionary itself is demonstrated in the following relation

$$Image \subset Bi - I \times Object - Quality \times Object \times Notion \times Method \times Method - Quality, \quad (3)$$

where *Bi-I* – binary code of image and verbal definitions: *Object-Quality* – quality of object, *Object* – object, *Notion* – notion, *Method* – method, *Method-Quality* – quality of method.

3. Elementary construct of a sentence is associative pair of images presented as the following relation

$$Assoc - Twice \subset Bi - I_1 \times Bi - I_2 \times Twice - Id \times Force^+ \times Force^-, \quad (4)$$

where $Bi - I_1$ – binary code of the first pair image, $Bi - I_2$ – binary code of the second pair image, $Twice - Id$ – unique pair code, $Force^+$ – value of power of direct link between images, $Force^-$ – value of power of inverse link between images.

4. Introducing of educational information in the system is implemented by means of including data about pairs in such relations as a type of link

$$Link \subset Link - Id \times Link - Type, \quad (5)$$

where $Link - Id$ – unique code of link type, $Link - Type$ – verbal definition of link type and interrogative pronoun

$$Inter - Pronoun \subset Pronoun - Id \times Link - Id \times Pronoun, \quad (6)$$

where $Pronoun - Id$ – unique pronoun code, $Pronoun$ – verbal pronoun definition.

5. There are two ways of selecting an interrogative pronoun between images of a pair. If one chooses at first a link type from 7 tuples of $Link$ relation (attribute, predicate, subject, adverbial modifier of place and time, adverb, object), then the selected type serves as a filter, and a number of possible $Inter - Pronoun$ decreases. On the other hand, if one chooses at first a question as a tuple from $Inter - Pronoun$, then for the sake of control a user is automatically demonstrated a corresponding type of link from $Link$.

6. It is optional for user to choose each pair word in the menu compiled from the words of the current sentence $Event$, and indicate a role of the corresponding image in the syntagma (quality of object, object, notion, method, quality of method). Words are presented as the following relation

$$Words \subset Word - Id \times Word \times Pronoun - Id \times Bi - I \times Role - Id, \quad (7)$$

where $Word - Id$ – unique word code, $Word$ – word itself, $Role - Id$ – unique code of word role in syntagma, and roles are shown as a relation

$$Role \subset Role - Id \times Role - Type, \quad (8)$$

where $Role - Type$ – verbal role definition.

7. A range of the most resembling words in visual aspect is composed from existing images in the image dictionary $Image$ with the purpose of attaching the selected pair word to the image. The rules of syntax are taken into consideration while compiling the range [4]. For instance, if a predicate is concerned one should include attributes $Method$ or $Notion$ to the range. A user is offered to select an option in the menu, and correct a corresponding article of the image dictionary or introduce a new one in the case of need.

8. Final development of the glossary data base is fulfilled by *Construct* relation where peculiarities of using similar associative image pairs are fixed in different relations:

$$Construct \subset Construct - Id \times Pronoun - Id \times \begin{matrix} \\ \\ \\ \end{matrix} \quad (9)$$

$$Twice - Id \times Logic \times Event - Id$$

where *Construct-Id* – unique code of syntagma construct, *Logic* – is a pointer to direct (1) or back (0) type of link between images of pair. While introducing a new entry in *Construct* table one should simultaneously add to the appropriate entry in *Assoc-Twice* table either 1or *Force*⁺ field or *Force*⁻ field depending on direct or inverse order of operating of the given associative link.

The operating prototype of the system is programmatically realized on the basis of technology of Python + SQLite. Data Scheme of image glossary is showing in fig.1.

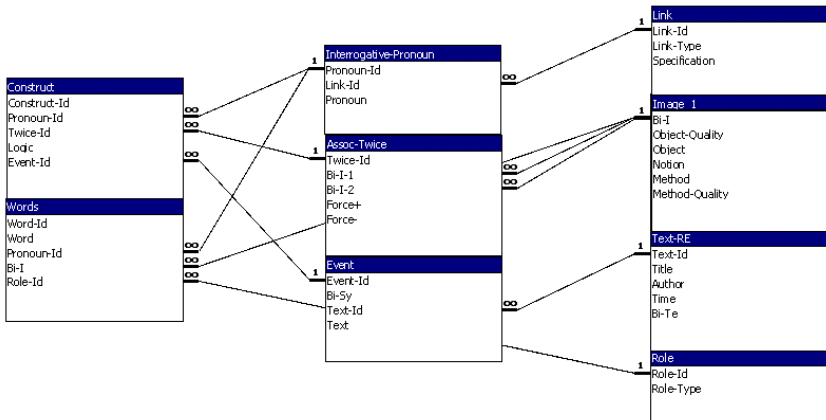


Fig.1. Data Scheme of image glossary.

This Data Scheme is considered to relation model (1)-(9) of image glossary and answers requirements from the side of conceptual model of image thinking [1].

It should be also noted that *Image* and *Assoc-Twice* relations are very important in the suggested related model since they jointly create associative net of images and bear the main semantic load. All the rest of relations actually model the chain of events or long-term memory [1]. The availability of two *Image* and *Assoc-Twice* tables in one file as a system kernel, its separate administration, and parallel on-line approach to it are suggested with the purpose of providing multi-user approach to the image glossary.

The fundamentals of approach on developing a “clever” content for electronic textbooks are outlined in the article. The principles of creating image glossary extending an ordinary hypertext with associative links of syntagmatic type are considered on the basis of the concept model of the image thinking. The formal related model of glossary being filled as a result of processing texts with educational stuff is offered. It should be admitted that new opportunities of the proposed approach are achieved through the increase of labor-intensiveness of introducing educational texts in the system. However relatively not very large amount of the educational content of the e-courses does not permit considering such restriction to be critical.

Literature References

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