

Title	スプリングモデルを用いたアイデア触発のための思考支援システムの構築
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A Thinking Support System for Idea Inspiration using Spring Model

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This thesis proposes a thinking support system for idea inspiration. The system visualizes data extracted from texts on a network and represents them in two dimensional metric space. In this system, an interactive interface is provided in order to give a user many points of view.

In recent years, research on creativity support using a computer is promoted. It is generally classified into two kinds of creativity support. One is divergent thinking support which generates pieces of idea, and the other is convergent thinking support which put his or her ideas into shape and refine on these ideas. In some senses, divergent thinking support is more difficult than convergent thinking support.

Young insisted that a divergent thinking support system has three classes: secretarial level, framework paradigm level and generative level. The tools of the secretarial level which do incidental task are very popular these days. These tools have a good effect. For example word processors, CSCW, database and so on. These tools perform in a limit manner and hard to say that they are thinking support systems. In the real situation we need more active support. Conversely the tools of generative level function to directly generate a piece of idea. However these tools have no effect, because it generates many useless ideas. Though technique which narrow search space down to the end that it do not get useless ideas, this approach is not effective until today. Recently much attention has been paid to the tools of the framework paradigm level. These tools give a person a trigger to extend idea without generating a idea. The system proposed in this thesis is a tool of the framework paradigm level.

First of all, we have to understand what idea is. In the past, Young pointed out a principle of idea as below.

- Idea is a new combination.
- Ability to create a new combination is raised by the ability to discover relevance between things.

To sum up showing trigger to extend idea is to present similarity relation among objects. Up to now many tools which give a person a trigger have been proposed. These tools usually use

material on network in order to show similarity relation. The problem of these system is that these tools are not equipped with powerful interactive interface in order that user's point of view can reflect to the system. This interactive interface is important, because it makes user enable to get more various points of view to reach new idea via this interface.

For example, Keyword Associator constructs associate dictionary from netnews and searches relevance keywords or texts using this dictionary. But it is difficult for user to get similarity relation of each texts or keywords, because it shows these relations as a list. Furthermore this tool does not have a mechanism to feedback user's request and can not show different similarity relation.

Lately, a document retrieval system which arranges research papers as objects to two dimensional metric space was proposed. This system is equipped with a mechanism to visualize user's point of view. This system uses a static method like the dual scaling method for analyzing keyword vectors. It can visualize all objects, but for a request of adding or deleting objects, thinking flow is divided into some parts, because rearrangement does not be gradually change. Furthermore this tool cannot directly show similarity relations between texts or keyword, and then does not appeal the intuition of a person.

Toward this problem, our system adopts a so called spring model to strengthen interactive interface and to directly and dynamically visualize similarity relations. Spring model is often used for producing a layout of the graph. In this model, a spring is set between vertices. A natural length of a spring is an ideal length between vertices. Then vertices is moved so as to reduce the whole kinetic energy. This model can effectively support in comparison with other previously proposed tools. I implemented an experimental system whose name is DW (Dancing Word), and assess it in the view of a thinking support system through some experiments.

The outline of the system is as follows. This system uses texts from netnews and abstracts of master thesis in our university. This system extracts keyword information from these texts, and generates a keyword vector for each text. Then it calculates similarity relation between texts and keywords, based on these keyword vectors, and visualizes similarity relations in two dimensional metric space. Furthermore a user can request this system to add, move and delete each object. At this time it can gradually be arranged after the request. The system can show a process when it visualizes a new arrangement. Then the user can feel the pull and push between objects and the speed of objects moving. In addition, it can generate a lot of different arrangement for same objects, because this arrangement is quasi-optimal solution.

I carried out three experiments which are on the level of essential technique ,on the level of utilizing and on the level of thinking to assess the effectiveness of the system. Some students are allowed to use the system, and an access history is taken to investigate how the users operate the system for the purpose of an experiment on the level of utilizing. Some questions are made to the subjects to examine functions of the system for the purpose of a experiment for testing the effectiveness on the level of thinking.

In the experiment for the level of essential technique, this system is tested whether it can performed real time execution. For that reason it make tables, which is results for searches, in advance for each keyword. As the result, execution time is improved by these tables.

On the experiment for the level of utilizing, subjects choosed a visible mode where a process, that the system rearranges space, is shown. In the visible mode rearrangement is slower than doing on the invisible mode. The system seems to reduce mental resistance by dynamically visualizing with the spring model. Though there is a little difference between persons, subject indicated that the functions of moving, deleting and adding is useful in practical. Then I

ascertain that interactive interface have an effect.

On the experiment for the level for thinking, It is clear that the ideas generated are affected by a motivation of each person for the given theme, and similarity relation. Though the effectiveness of the system is influenced by quality of texts, I found out that the system gives a person a trigger to extend idea.

This thesis proposed a thinking support system for idea inspiration using a spring model. Through three experiments, the proposed system is shown to be effective for giving a person a trigger to extend idea. In future I try to merge other thinking support systems which support brain storming and KJ method. I have to continue to verify the effect of the system, and need to adapt the result for the system.