Modeling as Thinking Process:
The Leverage is Thinking Role, not Thinking Skill

Sy-Feng Wang

Assistant professor

Department of Business Administration,

Soochow University, Taipei, 100, Taiwan

sfwang@mail2.scu.edu.tw

ABSTRACT

In group modeling, how to design the group discussion process to elicit knowledge and to create the shared new knowledge (the model) is a very important key issue. Different modeling phases need different combinations of cognitive tasks and the thinking abilities. However, this paper argues that the more easy way (may also more powerful way) to induce some kind of thinking skill, is to use thinking role's playing. The method of Edward de Bono's the "six thinking hats" seems has the very potential to facilitate the group modeling process. How to use the six thinking hats to facilitate group modeling was discussed. One case was demonstrated in the end of the paper.

1. INTRODUCTION

In group modeling, how to design the group discussion process to elicit knowledge and to create the shared new knowledge (the model) is a very important key issue (Vennix, 1996). A number of research emphasis different modeling phases need different combinations of thinking abilities in order to enhance the modeling quality. For example, Richmond (1993) proposed seven thinking skills, which seem match different modeling phases. Vennix et al. (1994) suggested different modeling phases need different combinations of three types of cognitive tasks (eliciting information, exploring courses of action, and evaluating situations) and the thinking abilities in those tasks (e.g. divergent thinking, convergent thinking, judgement and choice).

Although different modeling phases need different thinking skills, however, this paper argue that the more easy way (may also more powerful way) to induce some kind of thinking skill, is to use thinking role's playing.

For example, due to the need of divergent thinking, researchers suggest the use of Nominal Group Technique (NGT) to avoid the "group thinking" dynamics. However, in the Action Science's point of view, the underlying mechanism of "group thinking" is Model I behavior. Use NGT may avoid "group thinking," but can not reduce the ego defense, that is, what I say equal my ego, anyone challenge my opinion is challenge me.

The Model I mechanism also stop group's learning. However, the research of lateral thinking suggested that the thinking role's playing could avoid the "group thinking" and "ego defense" in the same time (Bono, 1985).

This paper suggests that the method of the "six thinking hats" seems has the very potential to facilitate the group modeling process. How to use the six thinking hats to facilitate group modeling was discussed. One case was demonstrated in the end of the paper.

2. THE SIX THINKING HATS

Edward de Bono (1985) developed the method of the six thinking hats. The purpose of the six thinking hats is to unscramble thinking so that a thinker is able to use one thinking mode at a time – instead of trying to do everything at once. The analogy is that of the color printing in making a map. Each color is printed separately and in the end they all come together. For team discussion, the six thinking hats method is designed to switch thinking away from the normal argument style to a mapmaking style. This makes thinking a two-stage process. The first stage is to make the map. The second stage is to choose a route on the map. If the map is good enough, the best route will often become obvious. As in the color printing analogy, each of the six hats puts one type of thinking on to the map.

Each of the six thinking hat has a color: white, red, black, yellow, green and blue. The color provides the name for the hat. The color of each hat is also related to its function.

White Hat White is neutral and objective. The white hat is concerned with objective facts, information and figures.

Red Hat Red suggests anger (seeing red), rage and emotions. The red hat gives the emotional view. The red hat also means intuition.

Black Hat Black is gloomy and negative. The black hat covers the negative aspects – why it cannot be done.

Yellow Hat Yellow is sunny and positive. The yellow hat is optimistic and covers hope and positive.

Green Hat Green is grass, vegetation and abundant, fertile growth. The green hat indicates creatively and new ideas.

Blue Hat Blue is cool, and it is also the color of the sky, which s above everything else. The blue hat is concerned with control and the organization of the thinking process, also the use of the other hats.

The first, may be the most important, value of the six thinking hats is that of

defined *role-playing*. Schein (1988, p.42) argued that the first and foremost problem when a person enters a new group is the problem of choosing a role or identity that will be acceptable to the person himself and viable in the group. The role alignment is a very important issue in team building and group dynamics. Each thinking hat is a role. When someone put on a hat, he plays the role defined by the hat. Because he is playing a role, what he says is not equal to his ego. The main restriction on group thinking quality is ego defense. That is why we need "suspending assumption" in the dialogue process (Bohm, 1996). The hats allow us to think and say things that we could not otherwise think and say without risking our egos.

The role-playing of the six thinking hats established the rules of the game. Team discussion is then like to play a game. Arie de Geus says that organizational learning occurs in three ways: through teaching, through "changing the rules of the game", and through play (Senge, 1990, p.315). The six thinking hats establish certain rules for the "game" of group thinking and discussion. That game is fun and effective. People can real "playing" and then induce learning.

The second value of the six thinking hats is that of *attention directing*. One of the important reasons of the "group thinking" dynamics is that team's members reactively responds to the first opinion. The attention is directed by that first opinion. If team's thinking want to be more than just reactive, then we must have a way of directing attention to one aspect after another. The six hats give us a means for directing attention to six different aspects of the matter.

Moreover, the hat's metaphor is convenience to ask someone or team to switch thinking role. Hat is easy to put on and put off. You can ask someone or team to be negative or to stop being negative. You can ask someone or team to be creative. You can ask someone or team to give his purely emotional or intuitive response.

Given the value of role-playing and attention directing, the six thinking hats make team can focus members' energy on one aspect for one moment, and then switch to other aspect for next moment. As Vennix et al. (1994) suggested different modeling phases need different cognitive tasks and different thinking abilities in those tasks. The six thinking hats may have the most potential to help the model builders to focus their thinking direction in different modeling phases.

3. MODELING FACILITATED BY THE SIX THINKING HATS

Richardson and Pugh (1981) define seven stages in building a system dynamics model: problem identification and definition, system conceptualization, model formulation, analysis of model behavior, model evaluation, policy analysis, and model use or implementation. Roberts et al. (1983) suggests an almost identical set of six

stages. Vennix et al. (1994) summarizes the steps and stages in model building as shown in Table 1.

Table 1. Stages and steps in model-building

Stage	Steps
Problem formulation	• Define time horizon • Identify reference mode • Define level of aggregation • Define system boundaries
Conceptualization	• Establish relevant variables • Determine important stocks and flows • Map relationships between variables • Identify feedback loops • Generate dynamic hypotheses
Formulation	• Develop mathematical equations • Quantify model parameters
Analysis/evaluation	• Check model for logical values • Conduct sensitivity analysis • Validate model
Policy analysis	• Conduct policy experiments • Evaluate policy experiments

Source: Vennix et al. (1994)

Vennix et al. (1994) suggested that, the process of constructing a system dynamics model involve a wide variety of conceptual activities: eliciting information, exploring courses of action, and evaluating situations. Those three cognitive tasks need different thinking abilities: divergent thinking in eliciting information, convergent thinking in exploring courses of action, and judgement and choice in evaluating situations. Moreover, these three conceptual activities are not parallel to modeling stages. Different modeling phases need different combinations of three types of cognitive tasks.

It is obviously that different modeling stage or steps need different cognitive activities and thinking abilities. However, how to induce team members' adequate cognitive activities is not a simple question. This paper argues that the more powerful way is to emphasis on thinking role, not emphasis on thinking skill.

As suggested by researches of thinking (Bono, 1985) and by area of organizational psychology (Schein, 1988), when people is assigned by one role, he is easily to play the role, think as the role think, interact by the game rule. That means, if

we want the team members to use one thinking skill, just ask they to play the roles who perform that thinking skill.

The method of the six thinking hats is a general thinking framework; it can easily combine with system dynamics modeling process. Table 2 is one possibility to use the six thinking hats to facilitate system thinking process or system dynamics modeling process.

Table 2. Modeling facilitated by the six thinking hats

Stage and hat	Steps and guideline
1. Problem formulation	
1.1 White Hat (1): objective information thinking	• Do not define the problem by answer, such as: the problem is we lack… the problem is we need… the problem is we have too many… the problem is we have too less… • Everyone offer the relative information, variables, concepts and frameworks about the concerned issues. Do not judge other's opinion.
1.2 Yellow hat (1): positive attitude, encourage diversify perspective	• Think as if the proposed variables are related to concerned issues. Think what are the relationships. • Let us to think what is that framework can tell us.
1.3 Blue hat (1): jump out, what system is the concerned issues should within	• What framework or procedure can help us to map variables, e.g. flow, actor analysis, sector analysis, stock variable analysis. • What system is the concerned issues should within? • What time horizon is the concerned issue should be. • What reference modes are the concerned issues should have. • What system boundary is the concerned issue should have. • What perspective we are looking at the concerned issues.
1.4 Red hat (1): intuition and emotion are legal	• Do you have any complain to others, or to other department? • We always feel that… • Use one metaphor to describe other department. • In many situations, we must doing so, we have to doing so. • My intuition told me that variable will be very important.

1.5 White hat (2): transfer the red hat to white variables	• Transfer the "red hat" to white variables objectively. • What is the reality constrains, limitation and goal about the concerned issues.
1.6 Black hat (1): constrains, limitation, goal	
1.7 White hat (3) transfer the black hat to white variables	• Transfer the "black hat" to white variables objectively.
2. Conceptualization *2.1 Blue hat (2):* classify, framework	• Classify the mapped variables into clusters (high level variables) • Establish the framework (e.g. flow, loop) to integrate the clusters' variables • Map relationships between the clusters' variables
2.2 White hat (3): map relationships between variables	
2.3 Blue hat (3): Generate dynamic hypotheses	• Generate dynamic hypotheses from the preliminary conceptual model
3. Formulation *3.1 Black hat (2):* check the model carefully	• Check the model's detail • Develop equations and parameters if in simulation model
4. Analysis/evaluation *4.1 Blue hat (4):* *4.2 Black hat (3):* using mental simulation to abstract the model to thinkable form	• What are the dominant forces or the dominant loops in the model? • Can the model explain the pattern of behaviors? • Use systems archetypes to abstract the model and it's behaviors. • Describe the model by telling one story.
5. Policy analysis *5.1 Green hat (1):* generate creative idea	• Suspend judgement. • Brain storming. • Encourage move from one idea to next new idea. • Select ideas from results of brain storming • Transfer ideas to policies
5.2 Blue hat (4): select ideas	• Test policies by the model

5.3 Yellow hat (2): *5.4 Black hat (4):* *evaluate policies from both sides* *5.5 Green hat (2)* how to execute the policies	• Evaluate policies with yellow hat first (positive view) and then black hat (negative view). • Use creative thinking to find the methods to execute the policies.

Just as the modeling process is interactive and subtle, how to use the six thinking hats to facilitate the modeling is also interactive and subtle. In different situations, different combinations of different hats are needed. Table 2 is a summary, not a fixed procedure. This paper will demonstrate one case as followed.

4. CASE

The case occurred in one business group, which is named CH institute in this paper. The CH institute have four corporate, one is construction firm, one is building firm, one is architect associate, one is kitchenware and bathroom material firm. These four firms were divided from one corporate some years ago. They are all belongs to the same stockholder. For 3-4 years, these four firms had more and more communication problems. The interactions between the CH firms were not smooth.

The author was invited to train their general managers and senior managers with the discipline of the Systems Thinking. All the 15 managers had read Senge's book "The fifth discipline" before training. After 10.5 hours training (3 times, 3.5 hours per time), a 3.5 hours workshop was designed to discuss the interaction between CH institute's four firms.

In the beginning of the workshop, after announced the purpose of this workshop, each firm was asked to use negative feedback loop as representation to plot one heavy-used regulation policy in their firms. The task was finished in 5~7 minutes.

After this first task, the white hat was then used. Subjects plot their regulation policies separately in the same white board, then explain the policies to others. After four negative feedback loops were all explained, subjects are asked to think about some relevant variables, which were important to connect these four negative loops. However, this procedure was not going very smoothly. Some ideas and information were generated, but it is far from to link these four loops meaningfully.

The blue hat was then used. The facilitator asked them to think other framework to deal with the firm's interaction issues. After a few minutes of silence, one subject (who is a senior planner in the head office, he had learned system thinking for one year) suggested every firms introduce their core business activities and introduce the

relationship between their activities. Other subjects accepted this suggestion.

Two companies then begin to present their core activities. Some new variables and relationships were then mapped. However, during the presenting process, the author found that when present about the relationship between firms, the presenters had some subtle emotion hidden in their word-use, voice and body language.

The red hat was then used. Whenever the author felt about emotion, the facilitator then interfered the presentation, asked the subject: do you had any complain to another company? The subject's colleagues were also asked the same question in the same time. In this stage, the game rule of red hat was repeated and repeated by the facilitator. That is, emotion is legal. The metaphor of Beer Game was also repeated as the theoretical base of the game rule.

If subjects complain to another company, the discussion focus will switch to that company. The members of that company would be asked the questions like that: Do you have any idea or any defense about others' complains? Do you have any emotion want to say? Do you have any complain to other companies?

With the time passed, the discussion become more and more hot. In the beginning of this stage, some subjects were hard to express their emotion. However, in the later, they involve to the discussion deeply.

In this red hat stage, two more hats were used to facilitate the process: blue hat and white hat. The white hat was used to transfer the red hat emotion to value-free variables and relationships between variables. The blue hat was used to control the discussion to cover all the interactions between these four companies. That is, in the discussion, member's heart was red hat, but the mind was white hat, the brain was blue hat. The role of the facilitator was to balance those three hats (another function of blue hat).

After the above stage, all the team members feel one similar mental model and one image. The mental model was their interaction story represented by variables, relationships and loops. The image was that: there was no bad fellow, they were all the prisoners of the system. One subject says that we should record today's process by videotape, and spread this tape to allover the companies.

This workshop almost goes through the modeling stage of *problem formulation* and *conceptualization*. Although the use of the six thinking hats is not exact the same with Table 2 suggested, however, the spirit is similar.

After the workshop, the author builds a formal model using the tool of the causal loop diagram (the modeling stage of *formulation*). That model was feedback to the subjects. The training of systems thinking was going on. After the unit of system archetypes was taught (4~5 months). The model was discussed again.

In the beginning of the discussion, the modeling stage of *Analysis/evaluation* was

taken the main position. The model was examined by its' structure and its' behavior. Systems archetypes were used to abstract the model and it's behaviors.

With the discussion go through, the blue hat was used again. The system boundary and the problem identify was discussed. Under the help of the model, subjects gradually talk more aggregate level of the interaction issues between companies. Suddenly, one subject created one metaphor (one function of green hat) to describe the interaction. He call the current interaction is separation between husband and wife. Years ago, those four firms were four functional departments in the same company. This organization structure can be called as "couple". The couple wants divorce into four independent firms. However, their real operation was not pure independent profit-center. They were not real divorce. They just separation. There are many confused relationships between the couple. That made the operation more difficult and inefficiency.

From this metaphor was proposed, the discussion was then focus on the design of inter-organizational structure. The model was then become the policy laboratory to test different structure by mental simulation (the modeling stage of *Policy analysis*).

However, due to the time limit, the yellow hat and the black hat were not used to facilitate the policy evaluation process. But this paper argues that these two hats are powerful to facilitate the policy evaluation stage.

After one year, the CH institute had decided to restructure the inter-organization structure. The reason of restructuring was also due to the economic stagnancy. We were not sure about the effect of restructuring, however, the process seem had it's value.

5. CONCLUSION

In group modeling, how to design the group discussion process to elicit knowledge and to create the shared new knowledge (the model) is a very important key issue. Different modeling phases need different combinations of cognitive tasks and the thinking abilities. However, this paper argues that the more easy way (may also more powerful way) to induce some kind of thinking skill, is to use thinking role's playing. The six thinking hats seem has the very potential to facilitate the group modeling process.

REFERENCES
Bohm, D. (1996) On Dialogue, Routledge, London.
Bono, E.D. (1985) The Six Thinking Hats, Penguin Books, UK.
Richardson, G. and Pugh, A. (1981). Introduction to System Dynamics Modeling with DYNAMO, Productivity Press, Portland.
Richmond, B. (1993). Systems Thinking: Critical Thinking Skills for the 1990 and

Beyond, System Dynamics Review, 9(2), pp.113-134.

Roberts, N., Anderson, D., Deal, R., Gareet, M., and Shaffer, W. (1983). Introduction to Computer Simulation: A System Dynamics Modeling Approach, Productivity Press, Portland.

Schein, E.H., 1988, Process Consultation Volume I: Its Role in Organization Development, 2nd Ed., Addison-Wesley Publishing, USA, Mass.

Senge, P.M. (1990) The Fifth Discipline: The Art and Practice of the Learning Organization, Doubleday, New York.

Vennix, D., Anderson, D.F., Richardson, G. and Rohrbaugh, J. (1994). Model Building for Group Decision Support: Issues and Alternatives in Knowledge Elicitation, In Morecroft, J.D.W. and Sterman, J.D. (eds.), Modeling for learning, Productivity Press, Portland, pp.121-146.

Vennix, J.A.M. (1996). Group Model Building: Facilitating Team Learning Using System Dynamics, John Wiley & Sons, England.