

# **Visualization of users' requirements: Introduction of the Evaluation Grid Method**

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## **ABSTRACT**

During the last decade, a new type of approaches have emerged in Japanese environmental psychology. These approaches have characteristics that they are aiming to clarify users' requirements for the environment as the design questions to be solved, compared with the traditional approaches aiming to clarify the environment-human relationship to provide actual design solutions. As an example of these new approaches, the Evaluation Grid Method (EGM), a semi-structured interview method developed by the author based on Kelly's Personal Construct Theory is introduced.

In the EGM, by asking the reasons of why an environment is more preferable to others recurrently, together with leading questions (laddering), each participant's requirements to the environment are elicited structurally as well as phenomenologically. Also by cumulating each participant's requirements, the extensive structure of the requirements to the environment embraced by people is produced.

In this paper, a detailed procedure and the outcome of the EGM are presented on the elicitation of workers' requirements for the office environment. Also recent applied examples where the EGM research was applied as a design aid in architectural as well as industrial field will be introduced.

## **1 INTRODUCTION**

To make design-supportive research helpful for designers, the aim of the research should be clarified and the research method should meet that aim. Taking the environmental design as a problem-solving activity, two different types of difficulties are identified, i.e. one in setting appropriate goals of the design and the other in finding actual solutions for achieving the goals (Sanui and Inui 1990). Corresponding to these types of difficulties, there are two different types of research.

The first type is to clarify users' requirements for the environment as the design questions to be solved and the second type to clarify the environment-human relationship to provide actual design solutions. The most distinctive differences between the types is the role of participants (subjects). In the first type research, participants themselves are the objectives of the research, while in the second type research, the main interests set on a research are parameters which constitute an environment (stimuli) and the participants here are the tools to measure the human response to the set of stimuli.

Since the early stage of Japanese environmental psychology, majority of the research

studies conducted were the second type. In those studies the relationships between a particular human perception to the environment such as "perceived spaciousness" or "perceived brightness" and physical attributes of the environment were the main concern. This type of research study could provide recommended set of physical attributes (numerals) with which designers could know what he/she has to do to obtain a certain kind of perception (Kose and Sanui 1990).

Such contribution making design more efficiently quite fitted to the social expectations placed on the research activities in the period of Japanese high economic growth. However, during the last decade, corresponding to the social paradigm shift from efficiency to quality, the first type of difficulties in environmental design has become closed up.

This type of difficulties in environmental design can be reduced much if designers are allowed direct communication with potential users as in the case of designing custom-built houses. However, direct communication between designers and users is generally very difficult as in the case of designing multiple housings. As a consequence, designers tend to force their personal goals on users, or, in a more modest way, just adopt the existing noncommittal type of design.

The underlying common aim of new approaches, therefore, is to provide the knowledge of users' evaluation to designers so that they can set up appropriate goals of design from experts' point of view to maximize users' satisfaction.

## **2 THE EVALUATION GRID METHOD**

To clarify people's requirements to the environment, without having any hypothesis, a quantitative approach such as questionnaire is unsuitable. Because, in a fixed format questionnaire, information obtainable through the research is within the limit of that questionnaire and cannot touch upon unwritten issues, no matter how large is the number of subjects. Therefore, as the first stage of research, to obtain hypothesis, a qualitative approach such as open-ended interview is necessary.

### **2.1 Shortcomings of the Existing Methods of Open-ended Interview**

The strength of the open-ended interview is its phenomenological nature that it can elicit users' opinion or sense of values by their own words. However, at the same time, the majority of the methods applied in the business field including a so-called group interview or depth interview fall short of as follows:

First, the quality and the quantity of information elicited from an interview relies on the personal ability of an interviewer. But the number of well trained interviewers is limited. As a consequence, probability of getting only frustrating outcome of a research is not so small. Second, there is not any methodological protection against a bias on the outcome caused by the subjectivity of interviewer. In fact, there is no guard for the unconscious bias no matter how carefully an interviewer conduct an interview. Third, the output of an interview tends to be redundant and disorganized. In the business

situations, a so-called executive summary is mainly used to avoid this redundancy, then, again, there arises a problem of intervention of analyst's subjectivity.

## **2.2 The Personal Construct Theory**

The evaluation grid method has been developed by the author (Sanui and Inui 1986) based on the repertory grid method derived by Kelly from his personal construct theory (Kelly 1955). The basic notion of the personal construct theory advocated by Kelly is that people are always trying to understand the environment and the events on their personal construct system which has been formed through their personal experiences, and that, on the basis of their understanding of the situation, people anticipate the events. Here, the term "construct" means a unit of understanding such as "the window size is large-small" or "the room is bright-dark", with which a bunch of information from the environment obtained through the sensory organs is formed into a total figure of the world. Among these constructs, there are causal relations such as "since the window size is large, then the room is bright". The whole system of understanding formed by these constructs and the relations among them are called as "construct system".

The repertory grid method is a face-to-face interview method, originally designed for clinical situations to clarify participant's construct system. The basic notion of this method is "if you want to know somebody's way of understanding, ask that person". However, since it is difficult for ordinary people to answer to a straightforward question, such as "Tell me the components of your understanding of the world", this method, instead, elicits their constructs by asking similarities and differences among elements (stimuli). In other words, this method makes use of the characteristics by which people can verbalize their personal constructs in comparing elements. There have been various empirical research studies using the original repertory grid method even in environmental psychology (Stringer 1974, Honikman 1976). However, through a pilot research conducted by the author on the evaluation of housings, the method was found too powerful in eliciting constructs. Nearly 200 constructs were elicited after a two hour interview, which means the method is hardly applicable as a design support tool.

## **2.3 The Evaluation Grid Method**

The evaluation grid method (EGM) has been developed because of its efficiency in application. By the original repertory grid method, there are too many constructs elicited some of which may be just for distinction rather than for the evaluation of environment. Considering the aim of eliciting people's requirements for the environment, we need to concentrate on only those constructs which are associated with the evaluation of an environment.

Another improvement was made by adopting leading questions called laddering proposed by Hinkel in 1965 (Fransella and Banister 1977) to elicit higher/lower level of constructs relevant to the construct originally expressed. This improvement to make use

of hierarchical nature of requirements enables to avoid a flattering design. Thus, if only requirements at lower level, i.e. detailed and concrete requirements, are provided by a participant, designers are forced to follow the requirements. But once requirements at higher level are shown together, there can be a room for designers to explore better solutions.

A general outline of the EGM is shown in Figure 1. In addition, the procedure shown in the figure is just an example and details such as the combination of elements should be arranged according to the objects and the purpose of the research.

An essential feature of the EGM is that the elicitation of constructs concerning the evaluation is selectively done by asking participants why a certain element is more preferable to the other according to their own judgment. This is different from the original repertory grid method which asks about similarities and differences among elements. Because of such characteristics, the EGM is much more practical, i.e. more efficient and able to avoid redundancy of the output without losing the strength of an open-ended interview.

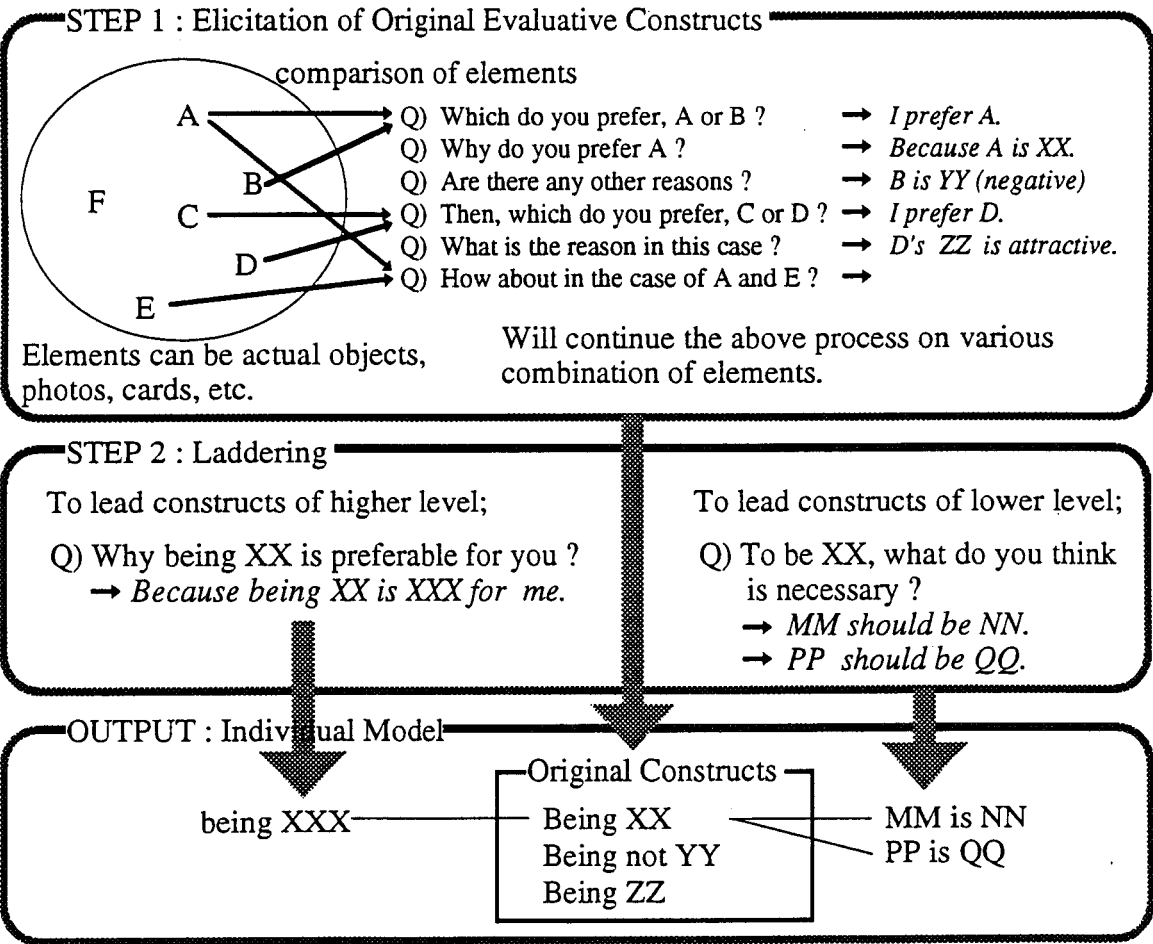


Figure 1: A General Outline of the Evaluation Grid Method.

Furthermore, the EGM maintaining the strength of the repertory grid method, has the following advantages.

1. Since the method is originally designed for clinical purpose, it is capable of eliciting participants' construct system with minimum use of hypothesis.
2. Though an interview itself is open-ended, the interview procedure is fixed as well as systematic. In an interview, an interviewer is allowed to speak only for instructing and encouraging, while inducing or referring to the contents such as asking an opinion according the interviewer's hypothesis is strictly prohibited. As a consequence, the outcome of an interview has minimum distortions which may be caused by the interviewer's ability or subjective hypothesis.
3. Since the EGM is based on a cognitive theory, together with a laddering procedure, the outcome of an interview can be presented as a hierarchical network diagram which is comprehensible for designers.

### 3 AN EXAMPLE OF THE EVALUATION GRID METHOD

An example of the EGM research presented here was carried out when the author was working at the Institute for the Science of Labor. The research was conducted for a manufacturer of the drafting instruments, with the aim for clarifying engineers' needs concerning a drafting room and instruments to get ideas for the future product planning.

#### 3.1 Research Outline

Twenty-five engineers/designers of nine firms (three architectural design, one civil engineering, five machinery design) working in the drafting division participated to the face-to-face interview. The procedure of each interview was as follows;

1. A participant was asked to recall the drafting rooms which he/she has experienced or has seen in magazines, TV, etc. Each recalled drafting room was nicknamed and written down on a card respectively such as "the drafting room of the former division", "Mr. X's office", "a room like an hospital I saw in the Architectural Magazine" and so on.
2. Adding the cards of "the room now I am working" and "my ideal drafting room", a participant was asked to rank the whole cards, i.e. drafting rooms, according to their overall preferences.
3. The reasons of why a drafting room is more preferable to others ranked lower than that room were asked respectively from the one ranked at the second bottom to the ideal one. The expressed reasons were recorded as the original evaluative

constructs (STEP 1).

4. After finishing the elicitation of original constructs, the leading questions (laddering questions) were asked on each construct to elicit the higher/lower level of constructs (STEP 2).

### 3.2 Individual Model of Evaluation

In the EGM, the results of each interview is presented as a model of evaluation of each participant, as shown in Figure 2. The model was produced only by adjusting the position of constructs in the manner that higher level constructs locate to the left, and connecting original constructs and those elicited by laddering questions by lines. At the same time, to make the model more comprehensive, the constructs expressed in negative mode were altered into positive mode.

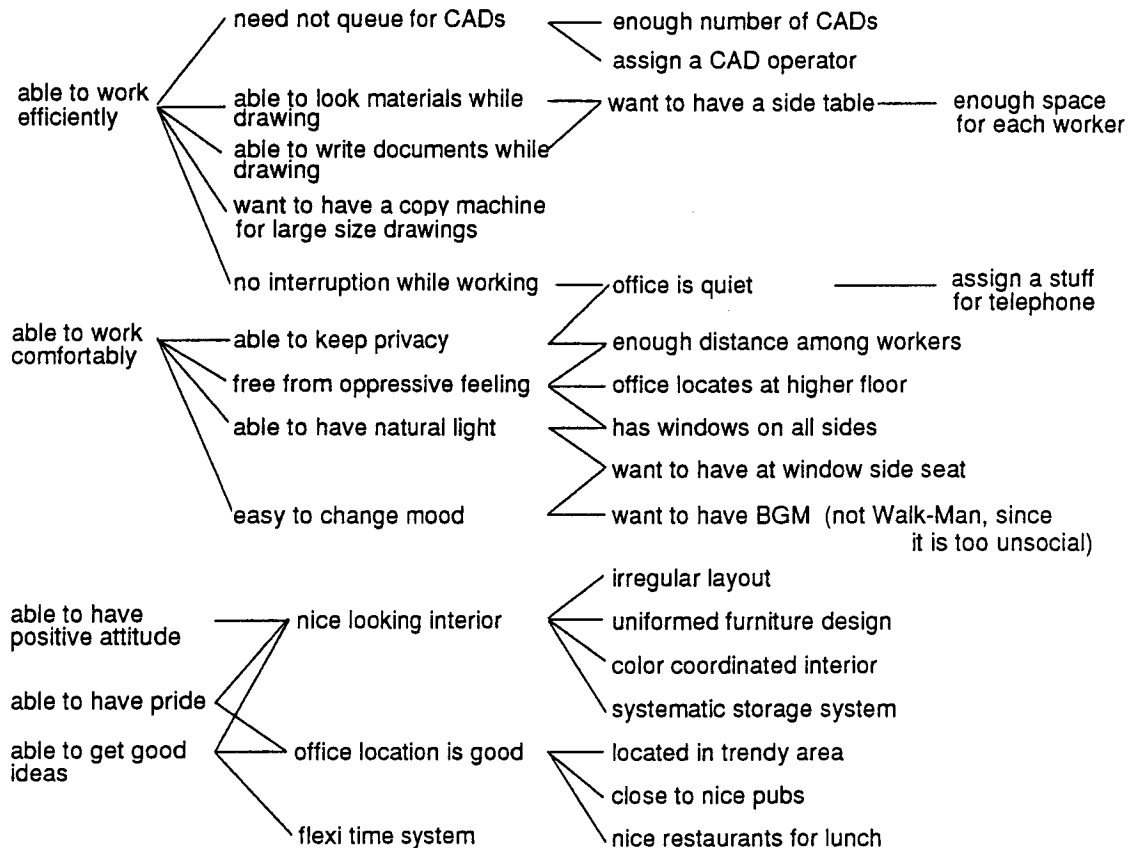


Figure 2: An Example of the Individual Model of Evaluation

Since the model of evaluation obtainable from each participant consists of his/her own viewpoints associated with the evaluation of the environment, it is not rare to find unique criteria. In the case of the participant shown in Figure 2, the series of criteria that "the more trendy area the office locating", then "the more he can have a pride in working in that office" and "the more he can be creative" may be a good example, which has never been reported in other relevant research studies.

These models of evaluation obtained for each participant are quite helpful for designers to get an inspiration for a new product. However, to make most of the information for the strategic decision making, particularly in the business situations, there should be some condensed information which enables to have an overview of user requirements.

### 3.3 Integrated Model of Evaluation

To meet this requirement, an integrated model of evaluation shown in Figure 3 (see next page) was produced by cumulating individual models. This cumulation was done by putting all constructs and the relationships among them on a sheet of large size paper in the manner that similar constructs locate near. Once all individual models have been transplanted, the constructs judged to have the same meaning were unified into the most representative construct together with their relationships with other constructs. Finally, the constructs shared by at least two participants were selected and the positions of those constructs were adjusted to minimize the crossing of lines showing the relations. This integrated model of evaluation presents the extent and the structure of users' viewpoints in evaluating drafting rooms and instruments. In other words, this model of evaluation can be used as a bird-view map on which one can check the strong/short points of the existing design solutions so as to find the needs which are still unsatisfied. In the case of this example, the constructs commonly used among participants which are indicated by thick border in the figure are almost identical to the hypothetical list of constructs. However, the important flow of constructs referred by the majority of participants that "if there is a side table", he/she is "able to look materials while drawing", and then "able to work efficiently" had been looked over in the hypothesis. Although the drawing task has been regarded as creating something from nothing, in fact, the substance of the drawing task is collection and processing of information. Such misunderstanding existed behind the complaints of engineers on the lack of facilities for referring materials such as side tables.

The hierarchical structure of the model of evaluation also clarifies the problems of existing design solution. A typical example found in this model was the contradictory requirements for partitions (boards between desks). In the model, there is a flow of constructs requesting partitions to get concentration on the one hand, and those of removing or lowering the height of partitions to keep good communication and also to lessen the sense of oppressiveness on the other. Partitions have become very popular in Japanese office environment, there are still some rooms for improvement and the direction of this improvement is to find the better solution to achieve these contradictory goals of design.

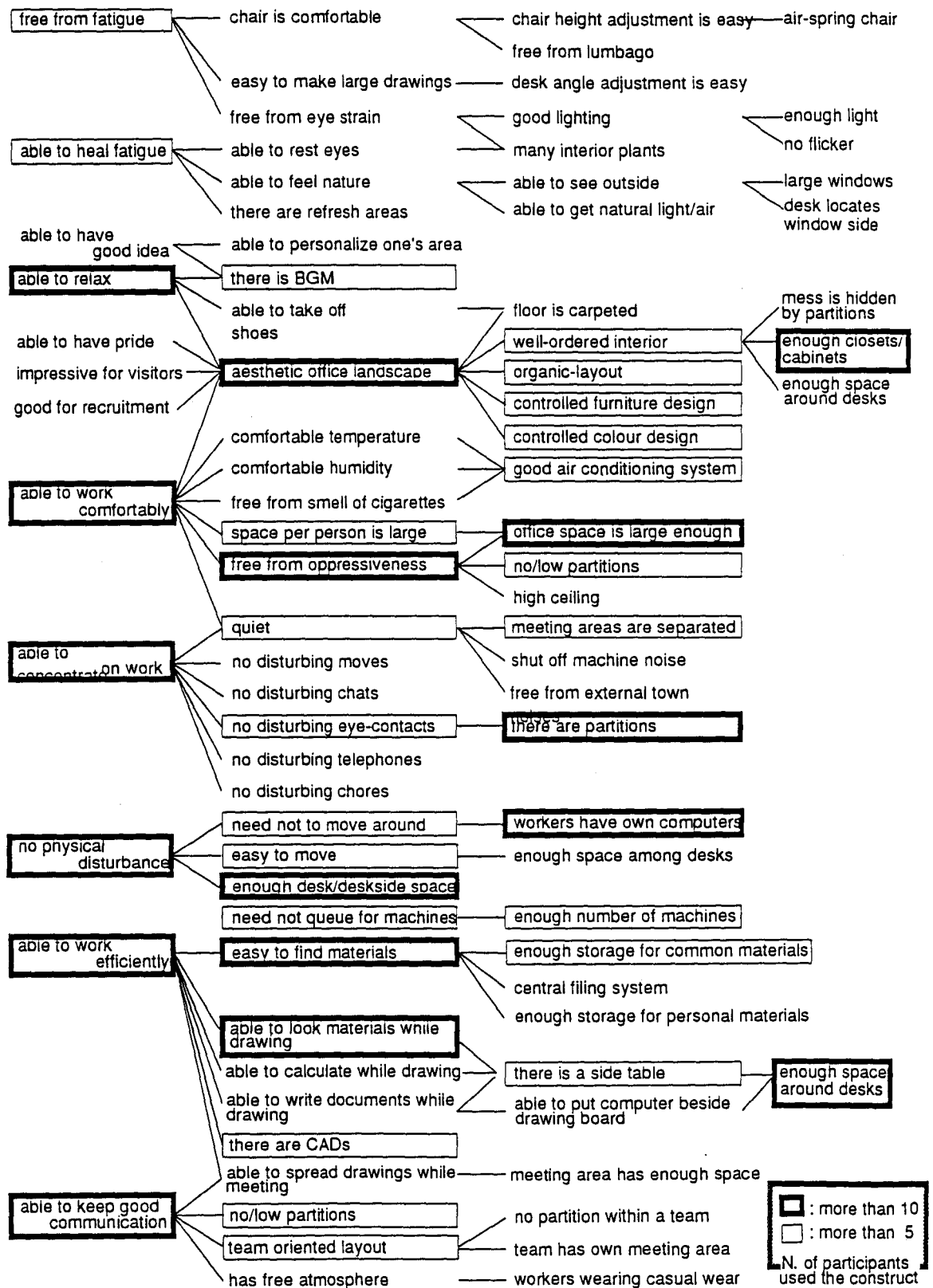


Figure 3: The Integrated Model of Evaluation on a drafting environment



#### 4. CONCLUSIONS

Nearly ten years have passed since the first proposal of this method by the author and the number of research applying the EGM is increasing not only in the academic field but also in the business world. In the case of the example introduced in the previous chapter, the company actually made a design prototype of drafting equipments for the 21st century, where the outcome of the research was reflected in the proposal of the desk-side digital filing and referring system.

Other applied examples reported are: one on the ski-resort development (Ujigawa and Sanui 1995a, 1995b) and one as a sales promotion tool (Maruyama et al. 1995). In the former case, a model of ski-resort evaluation was produced based on the EGM, followed by the conjoint analysis on the data obtained by the questionnaire. In the latter example, a construction firm has developed a sales promotion program in which carrying out the EGM research on the potential users is included as a part of contract. Thus, by showing its ability to grasp users' requirements, the firm intends to receive trust of their clients. Also by actually creating better buildings based on the research output, the company can expect to obtain future contracts from the same client. Besides these reported examples, a prefabricated housing maker has used the EGM in the creation of new products to grasp local requirements, such as those in high density area or those in very cold area.

Application of the EGM is not limited in the architectural field. In Nissan Motor Co., the EGM is used not only for developing a concept of new car, but also for grasping detailed requirements of users on particular performance or equipments. In the latter type of application, since the EGM does not require a special skill, engineers of relevant parts by themselves conduct interviews with users directly.

The EGM introduced in this paper still has problems to be solved. For example, the creation procedure of the integrated model from individual ones is still primitive as well as time consuming. However, as is shown in the example, even though the size of research is small, and even though there are no statistical confirmation, it can provide helpful information for designers. It would be grateful if you could find its potentiality as a research method for grasping users' requirements to create better design.

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