

IMAGE TECHNOLOGY BASED ON KNOWLEDGE ENGINEERING AND
ITS APPLICATION TO DESIGN CONSULTATION

* Nagamachi, M., Ito, K., and Tsuji, T.
Hiroshima University, Higashi-Hiroshima, Japan

Keywords: Image Technology, Knowledge Engineering,

INTRODUCTION

When a client plans to have a new house built, he or she represents a variety of demands of house or room images, such as a room "should feel as if it is luxury". The completed house sometimes differs greatly from the images which the client has had until its completion, because the builder makes the house design based on his experience and design philosophy. To reduce this kind of mismatch between the client and the house designer, Image Technology (called Emotion Technology or Kansei Engineering in Japan) was developed by Nagamachi, which is defined as "a translation system of client's image or feeling into desired physical design elements".

So far Image Technology has been applied to interior design, sofa design, fashion design, lighting system and car design. It has a lot of possibility of application. In this paper, we present HULIS (Human Living System) and FAIMS (FASHion IMAGE System) which are based on Knowledge Engineering, a kind of Expert System (Nagamachi: 1987, Nagamachi et al: 1985, 1986).

SYSTEM STRUCTURE OF HULIS

System structure of HULIS is shown in Figure 1. This is the same as Expert System which consists of knowledge base, database, inference engine and so forth. System diagram of HULIS is drawn in Figure 2.

According to the procedure of this diagram, a client describes firstly to an architect some adjective words which represent how the house should look like from the outside. The client's requirements are checked with the adjective database and basic adjective words are selected. Finally the specific colored shape is decided by rule base and database, and displayed on CRT as shown in Figure 3.

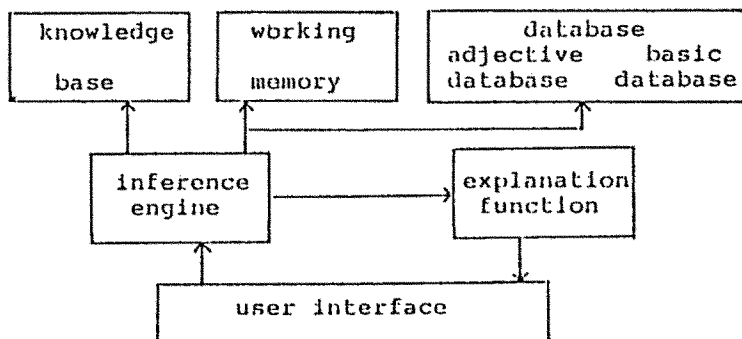


Figure 1. A diagram of Image Technology Expert System.

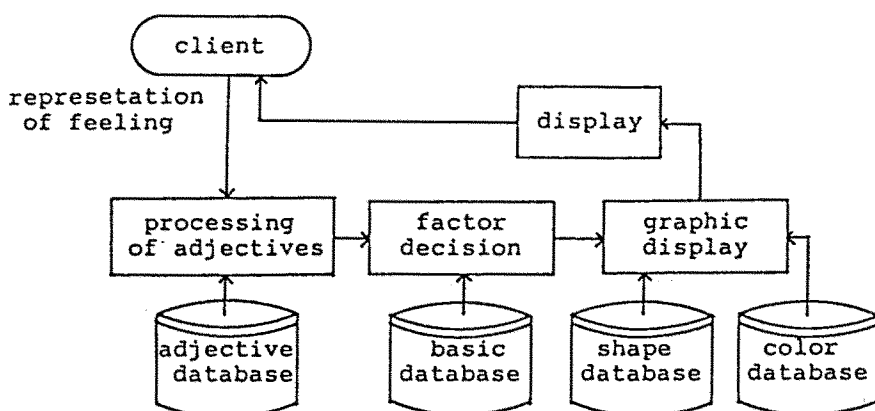


Figure 2. System diagram of HULIS.

PROCEDURE OF IMAGE TECHNOLOGY--HULIS

1. Adjective and basic databases

From architectural magazines 227 adjective words were selected. Forty house designers were displayed a variety of house slides and evaluated them for each of those adjectives on Osgood's SD scales. The estimates were analyzed by Principal Component Analysis and several words were selected from each factor and constituted basic database with 40 adjective words. The designers were again shown other 40 house slides which had a variety of design elements and estimated them with 40 words on SD scales, which were analyzed by Hayashi's Quantification Theory Class II. The results show us what kinds of design elements including colors contribute feeling of adjective words. The estimation was carried out for six components of outside view, entrance, western-style room, Japanese-style room, kitchen, and bathroom.

2. Knowledge base

Knowledge base consists of adjective rules, control rules of Quantification Theory Class II, and color rules. The client is able to express his or her feeling words until 10 words, and adjective rules are able to regularize the inconsistency among words. The control rules of Quantification Theory Class II extracts a list of candidate design elements with the highest contribution scores. The color rules have rules of color conditioning and color feeling.

3. Graphic database

Graphic database connects to shape database and color database. The shape database has a lot of parts of interior design and the appropriate parts are selected to constitute a display according to rules. A scene of display is colored by color database. A blackboard model decides final colors if inconsistency among colors emerges. Colors of scene are able to be changed with an aid of color system of color database if the client wishes to do so.

PROCEDURE OF FAIMS

FAIMS implies Image Technology system for fashion design and uses a shell of HULIS as the computer system. That is, it has

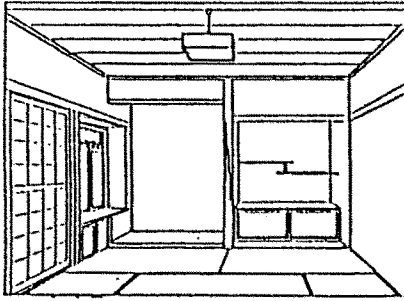


Fig. 3. A display of Japanese-style room.

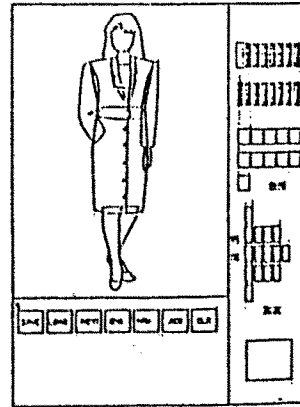


Fig. 4. A display of FAIMS.

In FAIMS, 240 adjectives for fashion were gathered through fashion magazines and analyzed by Principal Component Analysis to find out the factor structure. From these data, 71 basic adjectives were selected. In order to make a consultation system for young ladies, fashion slides were shown to 120 college female students and they estimated the feeling of each fashion of female suit on SD scales with 71 adjectives. The estimated scores were analyzed by Hayashi's Quantification Theory Class II to find out how much each of design elements of suit contributed to their feeling.

A female student desires to make a new suit with a feeling of "intellectual suit", she inputs the word "intellectual" into computer. The computer combines parts of elements of suit and colors appropriate to her image and display it on CRT. This system has 50 candidates fitting to her image decided by its inference and can show each of them if the client wishes to do so. And also it can change the parts of design and color if required.

An example of FAIMS is shown in Figure 4.

REFERENCES

- Nagamachi, M., 1987, Emotion technology and its applications. *Japanese Journal of Ergonomics*, 22 (6), 316-324.
- Nagamachi, M., Ito, K., Fukuba, Y., Tsuji, T., 1985, House interior color simulation system. Department of Construction 85 Project Development Report.
- Nagamachi, M., Ito, K., Fukuba, Y., Tsuji, T., and Kawamoto, H., 1986, A development of interior consultation system based on knowledge engineering. *Japanese Journal of Ergonomics*, 22 (1), 1-7.