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An E-commerce site to propose gift flower arrangements that fit *kansei* and social manners

Keiko Ishihara, Ph.D.

School of Psychological Science, Hiroshima International University

k-ishiha@he.hirokoku-u.ac.jp

555-36, Kurose-Gakuendai, Higashi-Hiroshima, 739-2695 Japan

Ryo Nakagawa, Master course student

School of Psychological Science, Hiroshima International University

Shigekazu Ishihara, Ph.D.

School of Psychological Science, Hiroshima International University

Mitsuo Nagamachi, Ph.D.

Institute of user science, Kyushu University

Keywords: *gift, social manner, kansei, flower arrangement, constraint, expert system*

Category: *Research paper*

1. INTRODUCTION

We give people flowers on special occasions. For example, we give vases of field flowers to family members on their birthdays or passionate flowers to our lovers. Flowers are chosen to depict a message with the sender's *kansei* (Japanese word that means sense, feeling, or emotion) and are bound by social manners. Few buyers but most florists have expert knowledge of the flowering time, scent, price, and nature of each flower, and are experts in arranging flowers that meet a given purpose. Typically, a florist infers an acceptable solution after obtaining information from the customer.

This study sought to incorporate handling constraints into the inference process of a *kansei* engineering system. The proposed system deals with flower arrangements using foams in containers. A purchaser inputs data such as the purpose of the present, relationship with the recipient, and budget. The system receives the data and then retrieves suitable flowers from the database according to the results of a *kansei* evaluation and social constraints. Then the system displays a list of possible flowers and types of arrangements.

2. FLOWERS, COLORS, AND *KANSEI*

2.1 Types of flowers

In a flower arrangement, flowers are classified as form, line, mass, or filler according to their shape and size, and the flower to be attached (see Figure 1). A different arrangement composition role is given to flowers in each classification [1]. A form flower is comparatively large with a clear shape and has a strong individuality. It becomes the center-piece of the arrangement. A line flower has flowers attached along the stem and is used to establish the framework of the straight lines and curves in the arrangement. A mass flower is a gathering of many petals or small flowers that form a round shape. They are often used as the main flowers to produce familiarity. A filler flower has many small flowers and leaves attached to the branches. It is used to bury the space and give an appearance of solidity and unity.

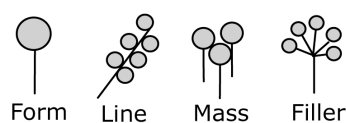


Figure 1. Types of flowers.

2.2 Relationship between flowers and *kansei*

We conducted a flower evaluation test using photographs of 25 types of flowers in which only a single flower was shown against a white background. We used mostly red flowers; if the particular type of flower was not red, then we used white or yellow flowers. One photograph was displayed on the monitor of a personal computer. The subjects evaluated each flower by answering the degree of *kansei* evoked on 5-point SD scale for 57 *kansei* word pairs, such as “light – not light” and “casual – not casual.” The subjects consisted of ten men and women between 21 and 50 years of age who were familiar with flowers.

A principal component analysis was performed using the mean value obtained from the evaluation results of each sample flower. The first and the second principal components (PCs) with large eigenvalues were used in our interpretation of the results. The *kansei* words that produced large positive first PC loadings were “thick,” “spicy,” “showy,” “tropical,” and “vivid.” The *kansei* words that produced large negative first PC loadings were “cool,” “neat,” “fresh,” “light,” and “soft.” Therefore, this PC showed the relative “lightness/heaviness” of a given flower. The *kansei* words with large positive second PC loadings were “childish,” “casual,” “pop,” “happy,” and “natural.” The *kansei* words with large negative second PC loadings were “luxury,” “adult,” “graceful,” “mysterious,” and “chic.” Thus, this PC showed the relative refinement of a given flower.

Figure 1 shows the PC score of each flower. Since form flowers have strong meanings, those with unique meanings are located at the edge of the corresponding *kansei* space. For example, the anthurium on the right edge is “heavy”; at the upper right, the sunflower is “heavy” and “not refined.” The lily and narcissus at the left edge are “light”; the calla at the bottom left is “light” and “refined.” Mass flowers were distributed at various positions of the meaning space. In particular, the rose and gerbera daisy were located at a refined pole. A good correspondence was obtained between the classification according to the flower *kansei* evaluation and that found in flower arrangements.

The flowers and *kansei* were associated by classifying the PC scores in a hierarchical cluster analysis. We used the reliability presumption method with a multi-scale and bootstrap [2, 3] to determine the cluster. We used the correlation

coefficient as the similarity and the group average method (unweighted pair group method with arithmetic mean) to make the clusters. Eight clusters were adopted that had high values of appearance probability. In each cluster, the *kansei* word with the high evaluation value that corresponded well to the plot of the PC loads and was often used in actual arrangements was selected as a representative of the cluster.

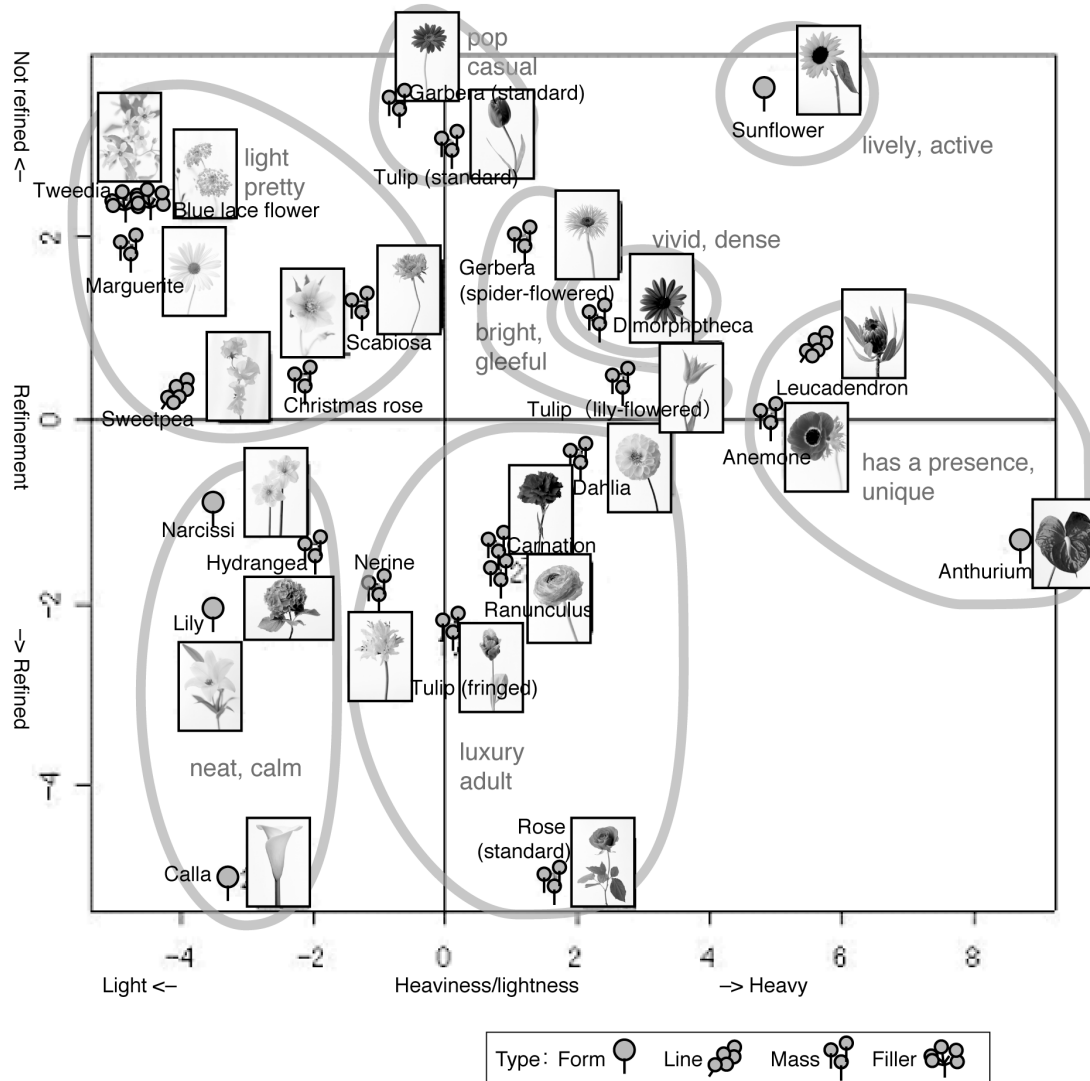


Figure 2. Principal component score of each flowers.

2.3 Relationship between colors and *kansei*

Round samples, 5 cm in diameter, were created using colored paper corresponding to 50 colors described in the flower database of our system. Each color sample was placed on gray background paper and evaluated. The same set of 57 *kansei* word pairs that was used to evaluate the flowers was also used to evaluate the colors.

The color PCs that showed a relative lightness/heaviness and refinement were included with the flower results. The PC score of each color and the corresponding *kansei* word were also classified into eight clusters.

3. FLOWER ARRANGEMENT EXPERTISE

A general procedure was used to select the main flower, determine the final shape of the arrangement, and then to choose other flowers with suitable colors and shapes.

3.1 Development of the flower database

The name, type, color, unit price, ease of scattering, and flowering time of each flower are included in the database.

3.2 Shape of the arrangement

The system considers five American-style shapes: round, triangular, diamond, fan, and spray. Each type has three sizes: large, medium, and small.

An appropriateness degree is assigned to each shape using an integer value of [-10, 10] according to the purpose of the arrangements. The type of flower included in is also restricted by the shape of the arrangement. A round arrangement is made by putting flowers together to form a ball. It consists mostly of mass flowers, with few line flowers. A triangle shape is made from the straight forms of line flowers while filler flowers are used to make little triangles inside the arrangement to give a solid appearance. The height of a diamond arrangement is suppressed and the flowers extend sideways. Mass, filler, and form flowers are mainly used, with few line flowers. A fan arrangement is a large design that projects the stalks radially from the center of a round arrangement. Line flowers are necessary to make this shape. It is usually a very large arrangement that cannot be carried by hand. A spray-shaped arrangement looks as if a bouquet is being laid down on the container. Mass and form flowers are mainly used for this type of arrangement.

4. INFERENCE RULES

4.1 Selection of the main flower

The rules used to select the main flower are given priority in the following order and applied according to the buyer's specifications. 1. If a flower illustrated on the input screen is particularly desired, it is assumed to be the main flower. 2. If a special occasion is selected for the arrangement, such as "hospital visit" or "Buddhist memorial service," a specific atmosphere (*kansei*) is set. Here, "lively" and "neat" would be chosen, respectively. 3. A flower with a flowering time corresponding to the delivery date is chosen among the flowers that have the desired atmosphere for the recipient. 4. A flower with a flowering time corresponding to the delivery date is chosen using the correspondence rule between the interpersonal relationship and the *kansei*. For example, if the recipient is a superior, a "neat" flower is chosen. 5. A flower with a flowering time corresponding to the delivery date is chosen using the correspondence rule between the recipient's age and gender and the *kansei*. For example, a "pop" flower is chosen for girls aged 0-20 years.

4.2 Selection of arrangement shape

The shape and size of the arrangement are determined based on the purpose, main flower type, buyer's requests, and amount of money to be spent. The degree of appropriateness of each arrangement type is determined using the following constraint rules.

1. Usage constraint. A degree of appropriateness [-10, 10] is assigned to each arrangement type by considering the location, height, attractiveness, and ease of carrying. For example, for a party center piece, a diamond arrangement was set to 10 degrees of appropriateness because it is not very tall and looks attractive. A large arrangement that stands out was set to a high degree of appropriateness for a concert.

2. Main flower type constraint. If the main is a line flower, a linear arrangement was set to a high degree of appropriateness while a small round arrangement was set to a low degree of appropriateness.
3. Buyer's constraints. If the buyer is concerned about the ease of carrying, small round, small triangle, and spray arrangements were assigned a degree of appropriateness of 10, while larger arrangements were set to a lower degree.
4. Budget constraints. If the budget is less than a certain amount, a low degree of appropriateness was set to large arrangements.

The type of arrangement with the highest degree of appropriateness is adopted by the system.

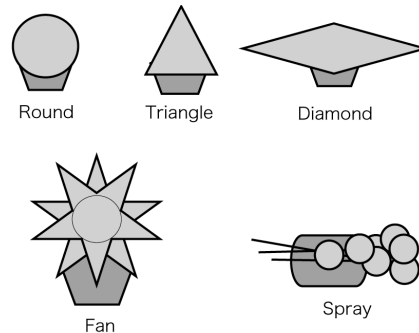


Figure 3. Shapes of arrangements.

4.3 Selection of flower combinations

Selection rules that reflect human relationships and the desired usage are applied to all the flowers in the database.

1. Price. If the recipient is a superior, relative, senior associate, junior fellow, or someone of whom the buyer is a fan, flowers that cost more than 250 yen are used to make an attractive arrangement.
2. Nature. If the buyer designates the "ease of carrying" as important, flowers that are not easily scattered are used.
3. Flowering time. Flowers whose flowering time includes the delivery date are used.

The flowers to be combined are determined among the remaining flowers by applying one of the color rules below.

1. Flowers with the same hue as the main flower and neighboring tones are combined.
2. Flowers with the same tone as the main flower and neighboring hues are chosen.
3. Flowers with the same tone as the main flower and opposite hues are used.
4. If the usage is "Buddhist memorial service," flowers with pale or light tones are combined.

4.4 Selection of the greens

Commonly used types of greens are added to the shape of the arrangement.

5. IMPLEMENTATION OF THE SYSTEM

The purchaser inputs data through a Web browser. The system receives the input data from scripts running on a server, and then displays the results of the inference on the user's browser window. The system components are shown in Figure 4.

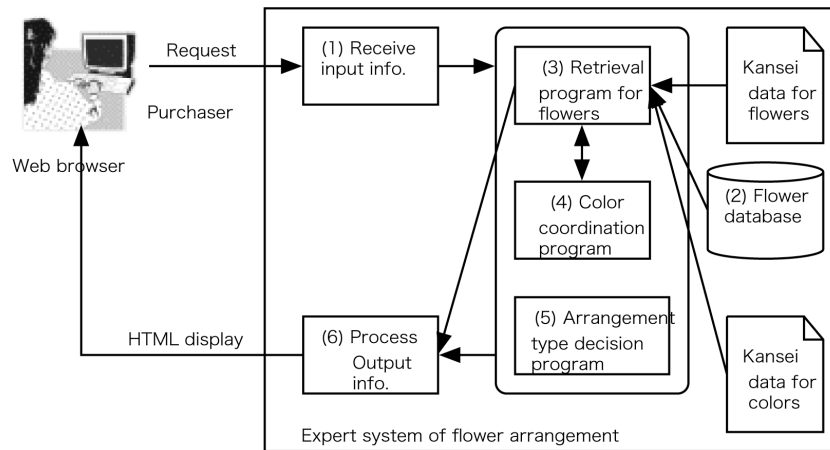


Figure 4. Components of our system.

5.1 Input and output items

Items in three groups are required to be input.

1. Information about the recipient (age category, gender, relationship, atmosphere, particular flower) is used to determine the flowers in the arrangement.
2. The purpose of the arrangement and shape specification are used to choose the type and size of the arrangement.
3. The budget, delivery date, contact address, and destination if different from the contact address are incorporated into the constraints for the arrangement size and types of flowers.

Output items consist of a list of flowers in the resulting arrangement, including greens and the shape and size of the arrangement. The flowers are described by their name, flowering time, color name, tone, and hue in P.C.C.S., as well as their type and unit price.

5.2 Algorithm

When the buyer inputs data through the Web browser and sends them to the server, the system determines the main flower, type of arrangement, combined flowers, and greens added, in this order, according to the expertise and inference rules described above. After that, the system processes the output data for display on the Web browser. We do not consider the wrapping process, which is performed by an actual florist.

5.3 Application examples

Example 1: A pop arrangement for a birthday present

Input. The buyer wanted a “pop” arrangement for a female friend on her 23rd birthday, September 15, delivered directly to her house. The type of arrangement was requested to have a general spreading shape, and there was no special height requirement. The budget was 2000 yen.

Output. A spray-shaped arrangement composed of an orange garbera daisy as a main flower with brown-orange-yellow combination flowers was chosen (Figure 5). Garbera is a “pop” autumn flower, and the orange color is also considered “pop.”

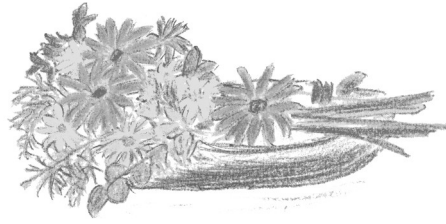


Figure 5. Image of the output arrangement (Example 1).

Table I. Contents of the output arrangement (Example 1).

| Role | Flower | Color | P.C.C.S. code |
|-------------|-----------------------|--------|---------------|
| Main | Garbera | Orange | v5 |
| Combination | Garbera | Orange | v7 |
| | | Yellow | v8, lt8 |
| | Chrysanthemum (small) | Orange | v5, b6, v7 |
| | Chrysanthemum (spray) | Yellow | b8 |
| | Cosmea | Brown | dk4 |
| | | Orange | v7 |
| | | Yellow | v8 |
| | Aster | Yellow | v8 |
| Scabiosa | Yellow | lt8 | |
| Leaves | Eucalyptus | Green | v12 |
| | <i>Doudan</i> -azalea | Green | v10 |
| | Asparagus-pera | Green | v10 |

Example 2: An adult arrangement for a farewell party

Input. The buyer wanted to carry an adult arrangement to a farewell party on March 10 for a superior who was a 51-year-old man. The budget was 3000 yen.

Output. A medium-sized round arrangement was chosen, with a fringed purple tulip as a main flower. All the flowers had a purple tone gradation. Both the fringed tulip and the purple color correspond to “adult.” Expensive flowers were used by the selection rule to make an attractive arrangement. Easy-to-scatter flowers were excluded. A rough image of the arrangement is shown in Figure 6.



Figure 6. Image of the output arrangement (Example 2).

Table II. Contents of the output arrangement (Example 2).

| Role | Flower | Color | P.C.C.S. code |
|-------------|---------------------|--------|---------------|
| Main | Tulip (fringe) | Purple | 1t20 |
| Combination | Tulip (lily) | Purple | 1t20 |
| | Tulip (double) | Purple | 1t20 |
| | Anemone | Purple | 1t22, v22 |
| | Rose (standard) | Purple | 1t20, 1t22 |
| | Rose (spray) | Purple | 1t20, 1t22 |
| | Gentian | Purple | v20 |
| Leaves | Galax | Green | v11 |
| | Asparagus (million) | Green | v10 |
| | Ivy | Green | v14 |

6. CONCLUSIONS

We proposed an inference system to integrate *kansei* engineering based on flower evaluation tests and constraints of gift flower arrangements. The output arrangements were approved by the assessment participants, who had experience presenting flowers. This study provides a means to develop an e-commerce site that will propose products to satisfy the buyers' needs, while most current online shops merely allow buyers choose ready-made goods.

ACKNOWLEDGMENTS

The authors wish to thank Ms. Satoe Yamaoka who graduated from Hiroshima International University in March 2005, for participating in the development of our system. This work was supported by the Japan Society for the Promotion of Science (JSPS) Grant-in-Aid for Scientific Research (A) No. 15200016.

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