Experimental Research on the Difference in "Feeling of Coziness" Depending on the Location in a Room-Space

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Abstract

The "feeling of coziness" refers to the feeling of comfort that people intuitively feel when they stay in a room-space for a while, and it depends on the location in the room-space. In this study, an experiment was conducted to understand and quantify this "feeling of coziness" in order to propose a prediction method. As a result of the experiment, a floor layout plan showing the "feeling of coziness" using contour lines was obtained, and a method for predicting this "feeling of coziness" was proposed.

Keywords: feeling of coziness, quantification theory type I, room-space, location (in a room-space)

1. OBJECTIVES OF THE RESEARCH

When selecting an area in a room-space where someone would stay for a while, most people do so by intuitively sensing the difference in comfort levels depending on the location in the room-space. In this report, the feeling of comfort that people sense in such situations will hereafter be referred to as the "feeling of coziness." One objective of this research was to grasp quantitatively through actual experiments the "feeling of coziness" in several basic cases of shape and area of room-space that people feel. Based on the data accumulated, another objective of this research was to propose a method for predicting the level of the "feeling of coziness" in order to provide basic reference material for planning interior spaces.

2. Experiment to Grasp the "Feeling of Coziness" Quantitatively

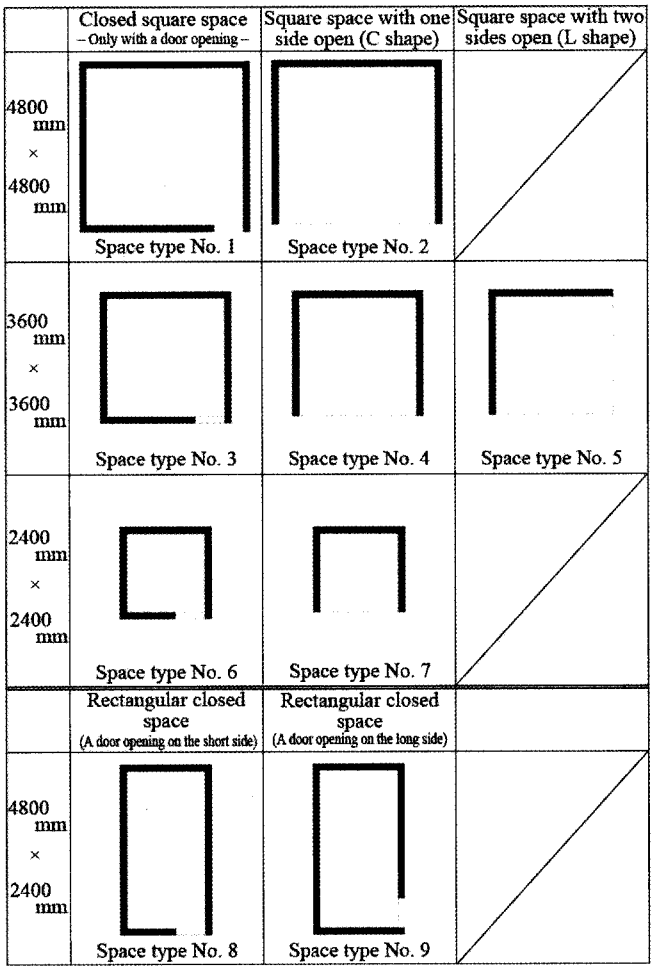
2.1. Experiment method

(1) Experimental apparatus

As shown in Figs. 1 and 2, a total of nine types of room-spaces were prepared for the experiments; two types of square spaces measuring 4800 mm ¥ 4800 mm (one closed square with a door opening and one C-shaped square with one side open); three types of square spaces measuring 3600 mm ¥ 3600 mm (one closed square, one C-shaped square, and one L-shaped square); two types of square spaces measuring 2400 mm ¥ 2400 mm (one closed square, one C-shaped square); and two types of rectangular closed spaces measuring 4800 mm ¥ 2400 mm. The door openings for space type nos. 1, 3, 6, 8 and 9 were 900 mm in width ¥ 1800 mm in height, and the ceiling heights were 2400 mm for all.

(2) Experimental subjects

Eleven students were chosen as the subjects.



(3) Evaluation method

Space type No. 3 in Fig. 2, a closed square of 3600 mm ¥ 3600 mm, was determined to be the standard, and monitoring points for evaluating the "feeling of coziness" were established in the spaces, as shown in Fig. 3. The monitoring point in front of the door opening was set to be -2 points, and the monitoring point that was diagonally farthest from the door opening was set to be 2 points. Using the set points as the standard, other monitoring points were evaluated by extending on the arithmetic scale. Then, based on the feelings experienced in the standard space, the "feeling" at monitoring points in all the other spaces were evaluated. Throughout the experiments the standard space was always provided in the adjacent space to make it possible to return always to the standard space to decrease discrepancies in feelings. And the subjects were instructed in advance that conditions without the shape of room-space mentioned above, such as colors of the wall and floor, as well as the lighting and the surrounding view seen from the opening, should not be taken into evaluation. Figure 4 shows the experiment in progress.

2.2. Experimental results and consideration

(1) Variations in evaluation depending on subjects

Figure 5 shows the average evaluations and standard deviations by subject. According to this figure, deviations in the average values by subject were approximately 1.5 at the maximum level. Standard deviations for above and below the average values were also between 2 and 2.5. Although there were individual differences in the absolute value of the evaluation, relative evaluations were similar.

(2) Comparison and consideration of the evaluation results

Figure 6 shows a contour drawing of the average values of all subjects of each space evaluated. Based on this figure, the evaluation tendency was researched from several viewpoints, and the influence of each element was considered.

a. Evaluation tendency based on differences in openings

In every type of space, evaluation points increased in the form of an arc from the area surrounding the opening to a position in the farthest corner of the space. In the spaces that included a door opening, the area around the corner that was not visible from the opening was evaluated as the most comfortable. Moreover, spaces with one and two sides open were evaluated as having a lower degree of coziness than spaces with only a door opening. It is assumed that the reason for this is the effect of the wide opening, and greater visibility from the opening.

b. Evaluation tendency based on space area

i) In the case of the square-shaped spaces with a door opening:

In the square-shaped space with a door opening, the maximum values of the evaluation points became larger as the space became larger. The increase in the evaluation points was gradual as the

space became larger in the direction perpendicular to the door opening part, while the size of the space had little influence in the horizontal direction. Based on the fact that there was almost no influence caused by the size of the space in the direction horizontal to the door opening part, it is assumed that the increase caused by the size of the space in the perpendicular direction was strongly influenced by the fear to another participant's eyes.

ii) In the case of the C-shaped space:

In the C-shaped spaces, the maximum values of the evaluation points similarly became larger as the size of the space became larger. Furthermore, the curve of the arc in the direction perpendicular to the opening part also showed an increase.

c. Evaluation tendency based on the shape of the space

i) A comparison of the square-shaped space, the inverted C-shaped space and the L-shaped space:

When the spaces No. 3, 4 and 5 were compared, these spaces were evaluated as cozy in the order of No. 3, No. 4 and No. 5. With spaces No. 4 and 5, the evaluation points towards the wall were larger than those at the center of the opening area. This is attributed to a feeling of protection created by the walls.

ii) A comparison of the square-shaped spaces and rectangular-shaped spaces:

When the spaces No. 1 were compared with No 8 and No. 9, there was almost no difference. This is again attributed to a feeling of protection created by the walls.

iii) A comparison of openings in the rectangular-shaped spaces:

When the spaces No. 8 and No. 9 were compared, No. 9 was evaluated cozier. Based on this fact, it was assumed that a direction perpendicular to the door opening influenced the decrease of coziness more strongly than a horizontal direction.

2.3. Conclusion of experiment

Using contour lines, we showed the difference in the "feeling of coziness" depending on the location in several types of room-space. Since these spaces are the basic elements of space in various complex and actual spaces, it may become possible to predict the "feeling of coziness" that people will feel by applying the results of this experiment.

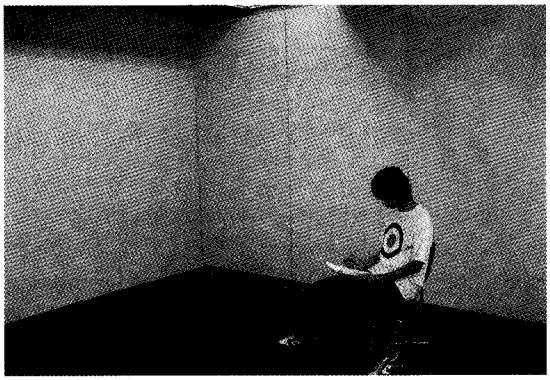
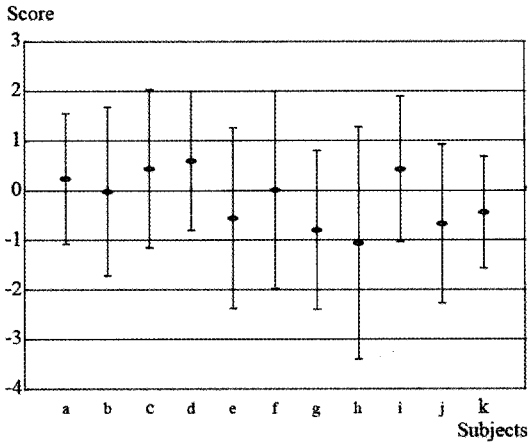
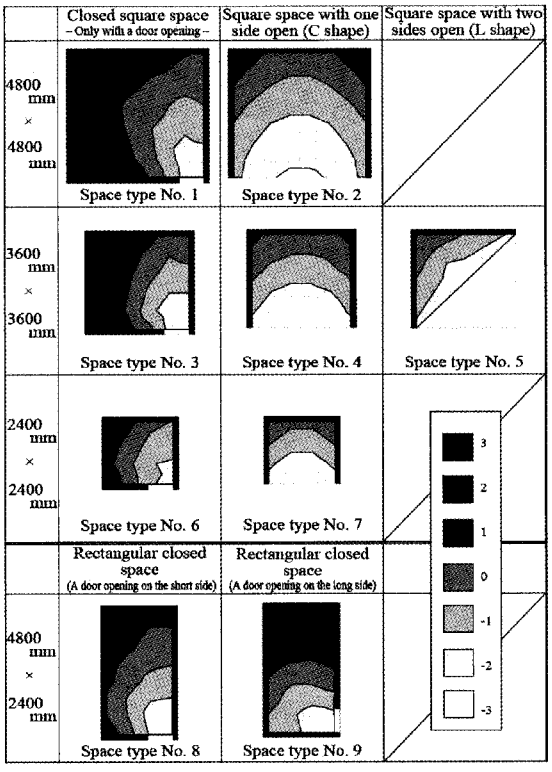


Fig. 4 The experiment in progress



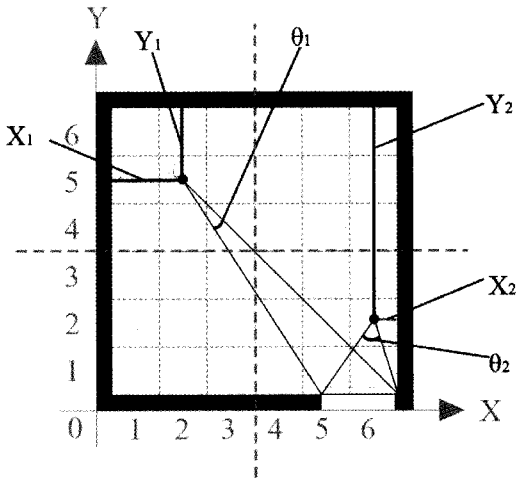


3. CONSIDERATION OF A METHOD FOR PREDICTING THE LEVEL OF THE "FEELING OF COZINESS" FOR VARIOUS ROOM-SPACES

3.1. Consideration of a prediction method using the analysis of the quantity theory type I

(1) Setting of the explanatory variables

As the explanatory variables, "distance from the wall," "angle of visibility of the door opening" and "distance from the door opening" were chosen as candidates. However, based on the results of the preliminary analysis of quantity theory type I analysis, the two elements adopted as the explanatory variables were "distance from the wall" and "angle of visibility of the door opening" because they had a strong influence on the objective variable, "feeling of coziness." For the "distance from the wall," as shown in Fig. 7, the sum of the nearest distances of the X axis and the Y axis from the location point (X1 + Y1) was used in all the spaces. In addition, the openings were not regarded as walls, and the "distance from the wall" in front of the opening was X2 + Y2, as shown in the figure. The "angle of visibility of the door opening" was established, as shown in Fig. 7.



Xn+Yn : Distance from the wall
θ : Angle of visibility from the opening
In front of the opening part: The "distance from the wall" was X2 + Y2, as shown in the figure.

Fig. 7 Determining the explanatory variables

(2) Results of analysis

According to results of the analysis of the quantity theory type I, using "feeling of coziness" as the objective variable and "distance from the wall" and "angle of visibility of the door opening" as the explanatory variables, as shown in Fig. 8, it can be seen that "angle of visibility of the door opening" had a greater influence than did the "distance from the wall." As the values of "distance from the wall" became smaller, the evaluation score became larger. Similarly, as the values of "angle of visibility of the door opening" became smaller, the evaluation score became larger. Furthermore, the determination coefficient was 0.62, exhibiting a certain degree of reliability.

3.2. Verification experiment to confirm validity of the prediction method

(1) Purpose of the experiment

The purpose of this experiment was to confirm the validity of the prediction method through comparison of the evaluation value obtained from the prediction method and that obtained as a result of the verification experiment.

(2) Experimental apparatus and space conditions

Shown in Fig. 9, as for the square-shaped space, a closed square (3600 mm ¥ 3600 mm) space with a door opening of space type No. 3 was used as the standard space, and space No. 10, which differed only in terms of the position of the door opening, was prepared. As for the rectangular spaces, two kinds of spaces were prepared: No. 11 and No. 12, 2400 mm ¥ 4800 mm, which differed also only with regard to the position of the door openings.

(3) Experimental Subjects

Fifteen students were chosen as the subjects.

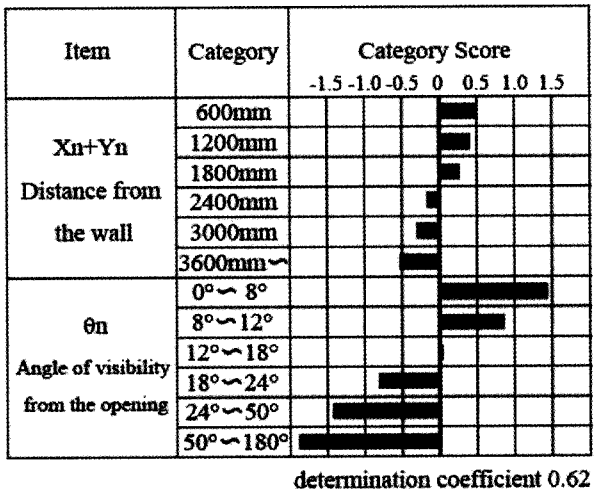
(4) Evaluation method

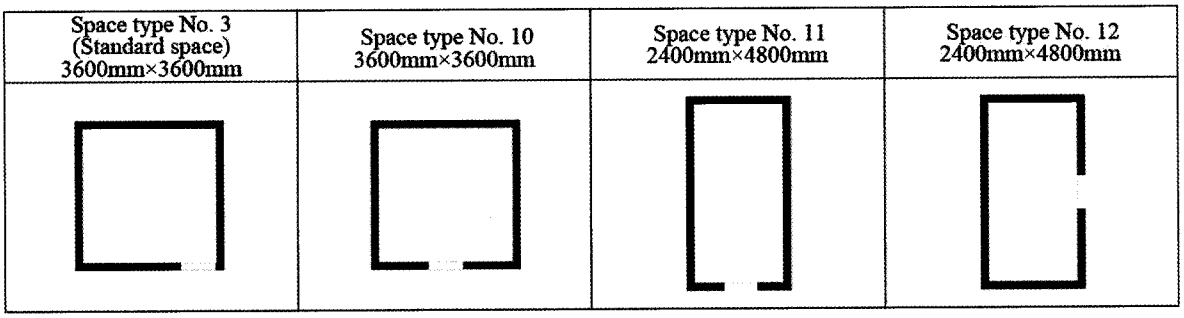
First, as standard evaluation points for the "feeling of coziness," the point in front of the door of the standard space shown in Fig. 3 was set to be -2 points, and a point that was farthest from it was set to be +2 points. Then, using the feelings in those two points as the standard, all the evaluation points in

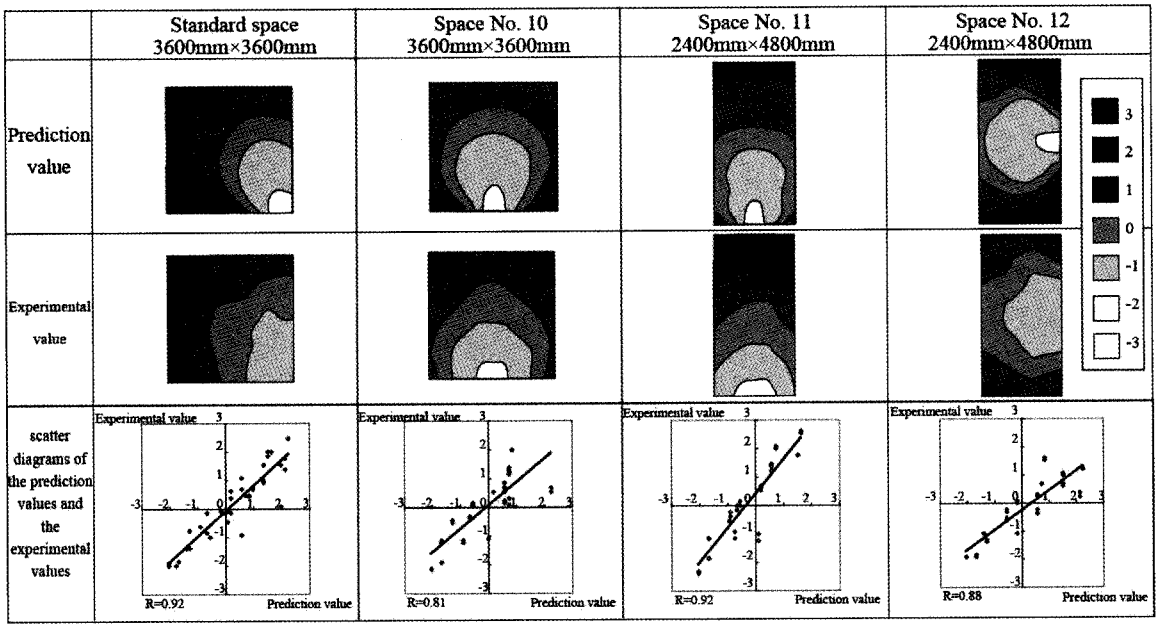
all the other space types were extended on the arithmetic scale to be compared and evaluated.

(5) Evaluation results and consideration

Figure 10 shows evaluation distributions by space types obtained from the prediction method and that obtained from the experiment, and a scatter diagrams to consider the correlation of the both. When the distribution of the experimental values and that of the prediction values in each space were compared, as can be seen here, distribution charts having almost similar forms were obtained in all the spaces, although there was a slight difference. As for the correlation coefficients, these values were 0.92, 0.81, 0.92 and 0.88, and it was confirmed that each of them had a strong positive correlation.







3.3. Conclusion of the verification experiment

Through this research, the prediction method proposed based on the quantity theory type I analysis almost matched the results of the verification experiment. Therefore, the validity of this prediction method was confirmed.

4. CONCLUSION

Conclusions that were obtained from this research are as follows.

1. Through the experiments, differences in the "feeling of coziness" depending on the location in room-spaces was quantitatively grasped, and the results were shown using contour lines in the room-space plans.

2. Based on the quantity theory type I analysis, using "feeling of coziness" as the objective variable and "distance from the wall" and "angle of visibility from the door" as the explanatory variables, a method for predicting the "feeling of coziness" was proposed.

3. An experiment to consider validity of the proposed prediction method was conducted, and through that, it was confirmed that this prediction method was generally valid.

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