

ANALYSIS OF FACTORS INFLUENCING CONSCIOUSNESS DISTANCE IN UNDERGROUND PASSAGE ENVIRONMENT

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Summary: *The effect of underground passage environment on consciousness distance was quantified by AHP, revealing four highly influential factors: diversity of visual environment, brightness, richness of visual environment, and busyness. Subjective sensation of distance shortened with increase in the total weight of AHP evaluation of the underground passage.*

1. INTRODUCTION

Toward realizing passageways that afford excellent pedestrian amenity, construction is planned on about 500 m of underground passages in downtown Sapporo, Hokkaido Prefecture. This study aims to show that the amenity of such passages can be enhanced by shortening the sensation of distance (consciousness distance). Analysis of the relation between underground passage environment and consciousness distance for transfer between subway lines revealed five factors that influence consciousness distance from previous research: busyness, richness of visual environment, brightness, diversity of visual environment and warmth. To clarify the relationship between underground passage environment and consciousness distance as indicated by time awareness, this study quantified the influence of each factor on time awareness by Analytic Hierarchy Process (AHP).

2. OUTLINE OF THE RESEARCH

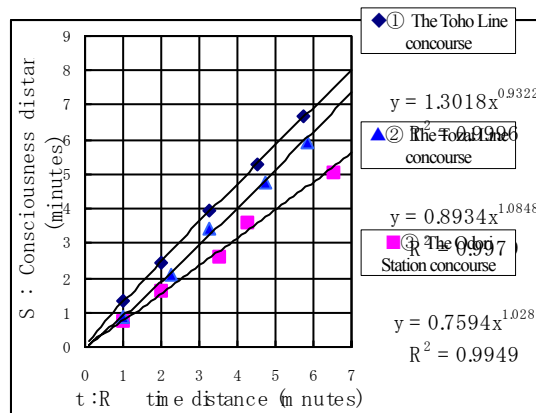
We established routes through underground passages between three subway concourses in downtown Sapporo: ① the oho Line concourse, ② the Tozai Line concourse, and ③ the Odori Station concourse. We led the subject through the routes and measured the consciousness distance in terms of time awareness. Using the consciousness distance for each underground passage environment, we developed an AHP questionnaire.

3. MEASUREMENT OF CONSCIOUSNESS DISTANCE

In the three underground passages, the subject was led for about 7 minutes and then was asked to estimate the consciousness distance in terms of time awareness. We applied the Law of Consciousness Distance ($S = \alpha t^\beta$), which we developed in previous research (Fig. 1), to the survey.

The resulting figure reveals the following.

- i. Time awareness calculated according to the Law of Consciousness Distance closely reproduced the measured values, according to goodness of fit.
- ii. The consciousness distance was less than the real-time distance in the Odori Station concourse and more than the real-time distance in the other concourses.



4. EVALUATION OF ENVIRONMENT BY AHP

Five factors (①busyness, ②richness of visual environment, ③brightness, ④diversity of visual environment, ⑤ warmth) that previous research showed to affect consciousness distance in the underground passage environment were set as criteria for evaluation of that environment. The alternative setting is the same as the underground passage that was the subject of the measurement of consciousness distance. This study used an absolute evaluation method, with valid response set at C.I. <0.15. The resulting hierarchy is diagrammed in Figure 2, and the AHP questionnaire was given on the basis of this. Criteria weight for evaluation of the passage environment are shown in Figure 3, and totals of weight are shown in Figure 4.

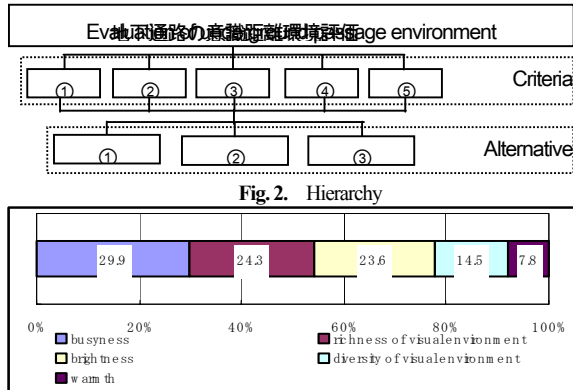


Fig. 2. Hierarchy

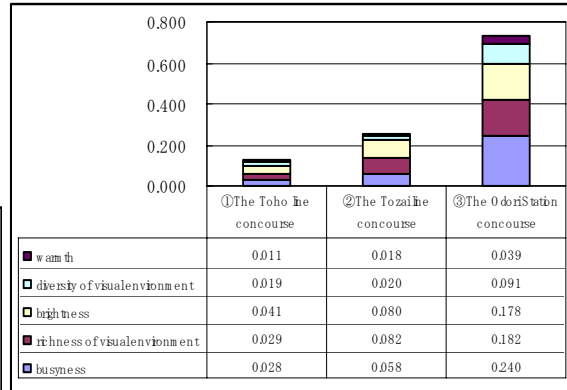


Fig. 3. Criteria weight

Fig. 4. Total weight

These figures reveal the following.

- i. Comparison of criteria proves that busyness, richness of visual environment, brightness, and account for a large proportion of the effect on consciousness distance.
- ii. Comparison of total weight showed that the concourses have a high weight that ranked from the highest in order of Odori Station concourse, Tozai Line concourse and Toho Line concourse.
- iii. A breakdown of total weight into the component weights of busyness, richness of visual environment, brightness, and diversity of visual environment showed great difference between passages.

5. RELATIONSHIP BETWEEN CONSCIOUSNESS DISTANCE AND AHP EVALUATION

Measurement of the consciousness distance and AHP evaluation revealed that high total weight agreed with short consciousness distance. This suggests that it is important to emphasize diversity of visual environment, brightness, richness of visual environment and busyness, all of which greatly affect consciousness distance, when constructing underground passages that are to realize shortened consciousness distance. In practice, it may be difficult for construction to emphasize busyness, the factor that affords the greatest influence, because of the great degree of fluctuation in crowds. Hence, the remaining factors should be emphasized. However, it is considered that improvements based on the other three factors will greatly shorten the consciousness distance, because these factors account for 63% of the weight of evaluation criteria.

6. CONCLUSION

The study showed the following.

- i. Four factors (diversity of visual environment, brightness, richness of visual environment, busyness) are important in achieving reduction in consciousness distance.
- ii. Consciousness distance shortened as total weight of AHP increased.