

PSYCHOLOGICAL COPING WITH ELEVATION :
PRELIMINARY APPROACHES TO THE EFFECT
OF RESIDENCE IN MULTISTORIED HOUSING*1)

KEIICHIRO TSUJI

I. MULTISTORIED HOUSING VIEWED AS PSYCHOLOGICAL
ENVIRONMENT

1. The first generation of residents in multistoried housing called *Danchi-zoku* (1955-1975)

In Japan, multistoried housing areas *danchi* first appeared in the latter half of the 1950s when her economic self-reliance had started on the basis of domestic technology and industry. Since then it has been prevailing all over the country (Yoshida, 1980).

However, it must be ecologically unnatural and biologically risky that human lives at an elevated place. Staying there gives an idiosyncratic experience of perceptual space dissociated from behavioural one, and it induces a fear innately. Multistoried housing sets the residents a task for adjustment.

In fact, at an early period of the housing project, not a few cases were reported of psychological disturbances mainly among housewives and young children who spent most of their time at home. The symptoms reported were neurotic reactions and psychosomatic diseases in adults as well as retardation in social and verbal developments in young children (Kato et al., 1977; Kobayashi et al., 1977; Yamamoto, 1973). These difficulties can be regarded as summatory effect of environmental variables to be mentioned below.

In those days, *danchi* attracted the Japanese in their 20s and 30s who had a preference for western life-style introduced after World War II. Residents of multistoried housing *danchizoku* were viewed as white-collar workers with academic career. Since most of them had moved from rural towns, their new living conditions were quite different from the conditions in which they had been born and raised. They were therefore

faced with dual psychological shocks. Novel environment would suppress exploration and hinder habituation. Socially introversive persons were apt to feel difficulty in adjustment. Being strangers to each other, they had to establish interpersonal relations which would ease the difficulties. The symptoms mentioned above could be attributed to 'novelty' and 'collectivity' of the housing environment. 'Elevation' (height) of housing would cause a sort of emotional reaction, but it was not so influential on those symptoms as the remaining two variables.

2. The second generation of *danchi* residents (1975-present)

The signs of maladjustment have become less marked, in spite of the fact that housing project increases acceleratedly. Seemingly, residents have fitted to their environment and become free from serious problems. Those negative symptoms which were reported in '50s and '60s have been disappearing for the last two decades. Two reasons could be mentioned to explain the trend.

Firstly, communication network has been established among residents. Community activities promoted by them led to deepening interpersonal relations. Secondly, since there were an increasing number of residents born and raised there, they have been well adapted to the environment. These changes have made the multistoried housing easier to cope with and contributed to reducing negative effects caused by novelty and collectivity.

However, it seems that effects of elevation have replaced those of novelty and collectivity and become overt as an another problem. As described earlier, living at an elevated spot imposes on residents a task of adjustment since it is behavior-ecologically unnatural for men who "slipped down from the tree". Unsuccessful coping with it possibly leads to maladjustment. By a series of animal experiments, the present author has demonstrated that fear of elevation (acrophobia) is far more persistent than fear of novelty (neophobia) (Tsuji, 1978).

3. Aim of this study

Figure 1 is a hypothesis which summarizes psychological processes of resident's adjustment in relation to environmental variables of multistoried housing.

It gives us a framework to discuss psychological and behavioural effects of each of the three variables; novelty, collectivity, and elevation. Novelty induces the fear of unfamiliar environment and motivates residents toward social contact. Collectivity

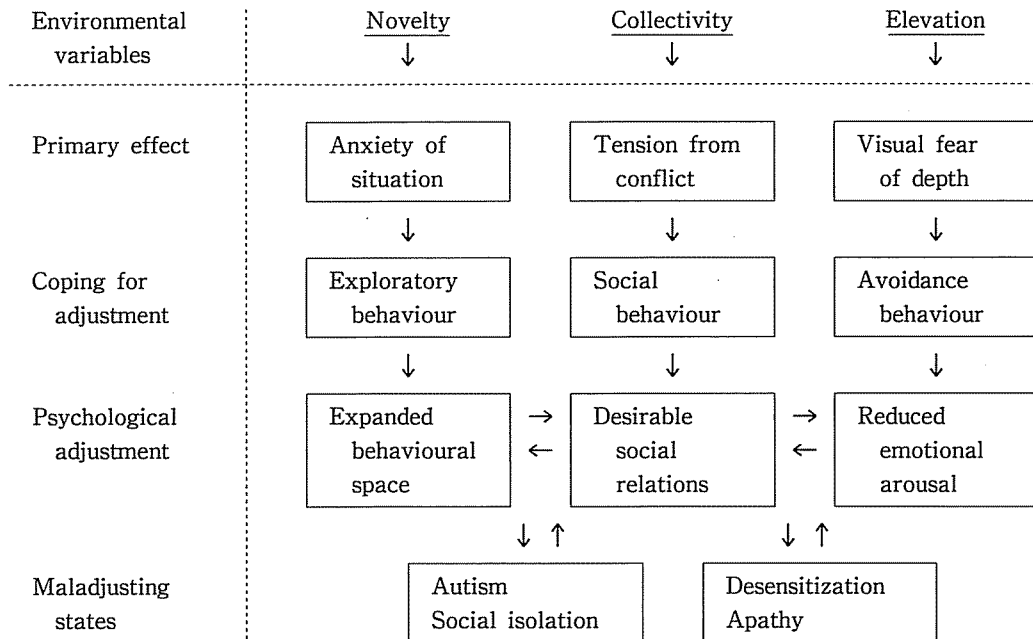


Figure 1 Schematic representation of the psychological and behavioural processes in the residents of multistoried housing.

initially might intensify tension among residents, which activates interpersonal behaviours. Failure in forming satisfactory relations would make residents unsociable and isolated. Elevation innately arouses fear. To overcome the fear, residents have to habituate themselves to it. However, this type of coping might cause a risk with which the present study is concerned.

As described above, it is assumed that, at early stage of multistoried housing, elevation caused a relatively small effect, when compared with novelty and collectivity. However, being separated from the latter, the former comes to be effective as the multistoried housing prevails. Interestingly, the effect is expected to appear in the opposite direction as it did at an early stage.

The present study is concerned with elevation as one of environmental variables of multistoried housing, examining its psychological and behavioural effects. Its first part reports the findings of a survey on the psychology and behaviour of residents, the second part analyzes cases of falling accidents at an elevated place, and the third part compares the responses to different types of visual environments between children and adults.

II. PSYCHOLOGY AND BEHAVIOUR OF THE RESIDENTS OF MULTI-STORIED HOUSING : A SURVEY REPORT

1. Purpose of this survey

This is a concise edition of the previously conducted survey (Tsuji et al., 1983) and focuses on psychological adjustment to elevation of multistoried housing.

2. Method

(1) *Subjects* Housewives (N=750) were sampled from the residents of four multistoried blocks of apartments with fifteen floors which were situated in Nagoya City. They had lived in the same houses for more than five years (mean: 10.8 years). Nearly equal number of samples were collected for each floor of the housing.

(2) *Questionnaire* The questionnaire consisted of 32 items including different aspects; cognition and evaluation of environment, positive and negative emotions aroused, interpersonal relations, daily behaviours. Data was analyzed mainly with the variable of elevation.

(3) *Execution of survey* The survey was conducted in November of 1988. Questionnaire was directly delivered and was collected one week later. Total number of the samples obtained was 576 (76.8%).

(4) *Analysis of data* To examine the effect of elevation subjects were classified into four groups depending on living floors; low (Floors 1-4; L); middle (Floors 5-8; M), high (Floors 9-11; H), superhigh (Floors 12-15; S). Comparisons were made among these groups.

3. Results

(1) *Judged elevation* Figure 2 shows the judged elevation as a function of physical elevation (living floor). As is clearly seen, judged value was not completely linear with physical one. Gradient of the curve was not constant but decreased roughly with living floors, whilst it was constant within the range of Floors 1-4, 5-8, 9-11, 12-15, respectively. The result coincided with grouping mentioned above and there were significant differences among these four ($p < .01$ - $p < .05$ by t value of Ryan's method).

(2) *Fear aroused by elevation* Fear aroused by looking downward from balcony was rated on a five-point scale. Figure 3 gives intensity of the fear subjects used to

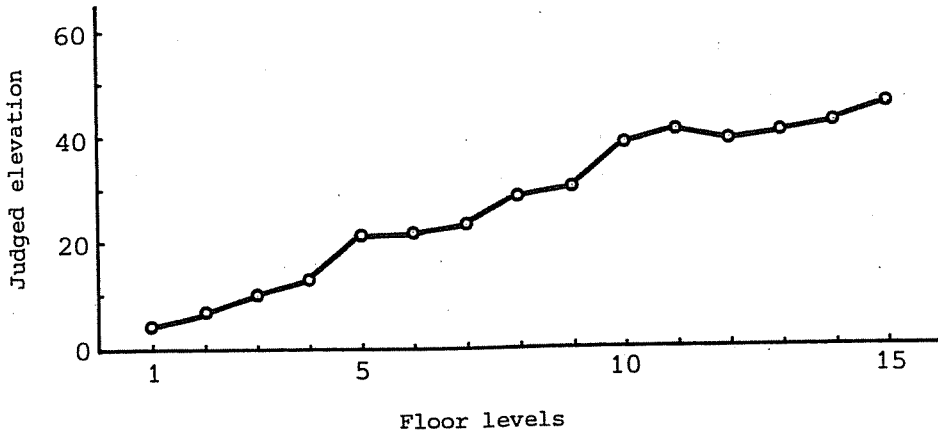


Figure 2 Judged elevation in meters as a function of floor levels.

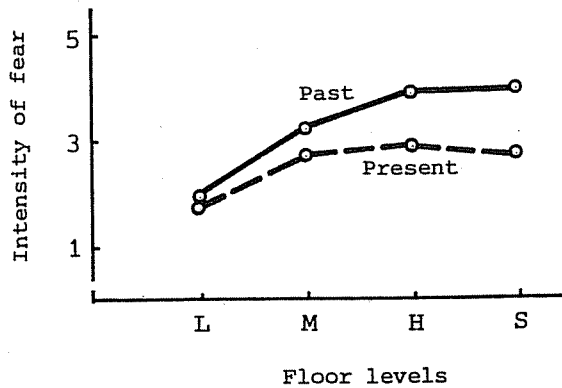


Figure 3 Rated intensity of the fear of elevation. Solid line shows the fear subjects felt in the past, and broken line indicates the fear they have at present.

have in the past (when they started living there) and the fear they feel at present. Intensity of the fear in the past increased from L to H and remained at the same level thereafter ($L < M < H = S$, $p < .001$). The fear at present showed no significant differences among groups, with an exception of the difference between L and M ($L < M = H = S$, $p < .005$). These findings suggest that residents have been desensitized to elevation through living experience and habituation is striking for the residents of higher floors.

(3) *Use of balcony* Frequency of using balcony was assumed to be an index of behavioural adaptation to elevation. The result confirmed that it was fairly high and did not differ among groups.

(4) *Interpersonal relations* The mean rating score for the number of friends was

2.98 (neutral) and did not differ among the groups. The mean score for feelings of satisfaction with real interpersonal relations was 3.42, 3.87, 3.55, 3.56, for Groups L, M, H, S respectively, which showed no consistency with elevation.

(5) *Need for moving*. Subjects were required to rate their needs for moving by reason of the height of living floor. The need showed a slight increase with elevation ($L=M<H=S$, $p<.010$), although the rating scores were small.

(6) *Attitude for development of multistoried housing*. The total mean score of rating was 3.03, which showed that the attitude was almost neutral. However, a weak tendency was found toward positive attitude to elevation ($L=M<H=S$, $p<.01$).

4. Discussion

Psychology of residents differed with their living floors. Height in their cognitive world was not exactly linear with physical elevation and was articulated in a different way from distance of horizontal direction of visual space (Hall, 1963; Gibson, 1979). Interestingly, fear of elevation depended on the floor at which residency commenced, but the trend was reduced while continuing to live there. Psychological adaptation to elevation thus occurred. Of course, it should be noted that the data was obtained by subject's judgment on memorized experience.

However, the main effect of elevation reported here can be of significance, considering a well-known fact that uncomfortable episodes tend to be suppressed with lapse of time. In the further study we have to make a systematic analysis of the process of emotional adaptation. Frequency of going out to balcony was high irrespective of elevation. Spatial size of this type of residence is so limited that the balcony portion is indispensable. Possibly, this housing condition has made the effect of elevation ambiguous, and has facilitated desensitization of acrophobic tendency as well. Feelings of satisfaction with interpersonal relations showed a slight effect of elevation, whilst number of friends did not. Frustration may be intense for the residents at higher floors who experience the discrepancy between perceptual space and behavioural space.

Whilst elevation affected selectively in the cognitive and emotional aspects as mentioned above, it had no effect on behaviour as exemplified by interpersonal relations and participation in community activities.

The survey has demonstrated that resident's emotion aroused by elevation was reduced with lapse of time. This finding has so far been overlooked in spite of the fact that elevation acts as a crucial factor in the process of psychological adjustment

(Baum & Valins, 1977; Heilweil, 1973). Also, such psychological coping with environment is assumed to take a more distinct form in younger residents. The following survey is concerned with it.

III. OVERADAPTATION TO ELEVATION IN CHILDREN AND YOUNGSTERS AS INFERRED FROM CASES OF ACCIDENTAL FALLS : ANALYSIS OF CASES *2)

1. Purpose of this analysis

Since behaviour at an elevated place is assumed to reflect a motivational aspect of depth avoidance, accidents of falling down from multistoried housing are worth analyzing in relation to the process of coping with elevation. Here the cases of this sort are examined.

2. Method

(1) *Cases* The cases (N=137) of falling accidents which had occurred in Aichi Prefecture and Tokyo Metropolis for five years from 1982 through 1986 were analyzed. Collected cases were not exhaustive and there was a lack of uniformity among individual records. However, analysis of the available records seems to be helpful enough, since statistics of this sort of accidents have not so far been reported.

(2) *Analysis* Eight items were checked from individual records to make analysis; gender, age, date and time of occurrence, elevation, situation, and outcome of accident.

3. Results

(1) *Annual change of the number of accidents* Accidents increased for these five years in both districts, as Figure 4 shows. In Aichi, there occurred just 15 cases in total for the five years from 1977 through 1981, which indicated that this sort of accidents increased by 3.3 times for the next five years.

(2) *Gender and age* Male to female ratio of the victims was 103 : 34. Occurrence of accidents by males was nearly 3 times as high as accidents by females. Figure 5 gives the age distribution. Age ranged from 1 to 19 years, peaking at 3 to 5 years (occupying one third of the total), and accidents markedly reduced for the ages over 15 years. Also, distribution for Aichi was skewed to younger ages as compared to that of Tokyo, although no plausible interpretation for the difference was given.

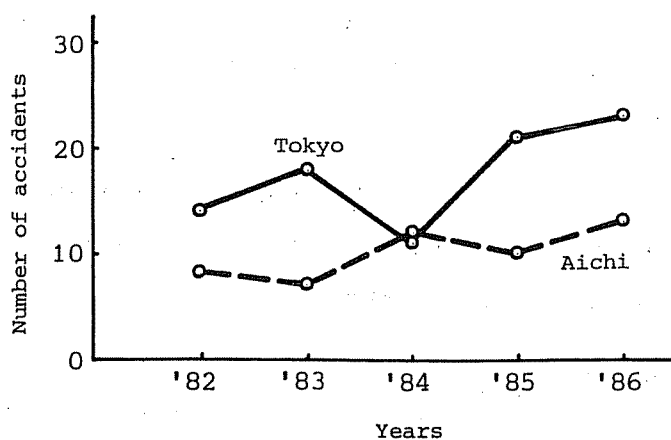


Figure 4 Number of accidental falls occurred in Tokyo (solid line) and in Aichi Prefecture (broken line) for 1982-1986.

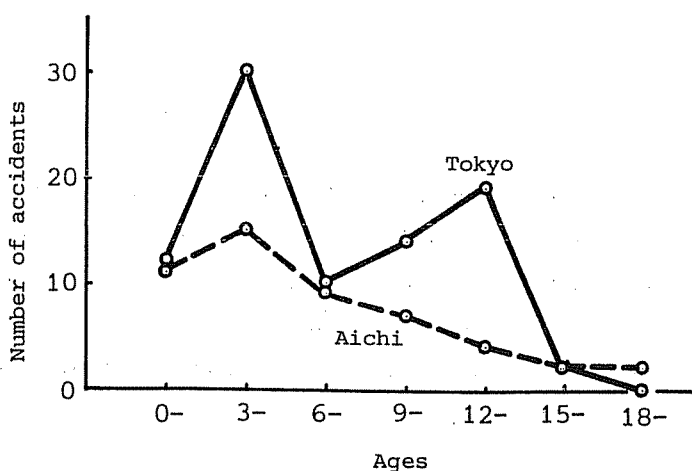


Figure 5 Age distribution of victims in Tokyo (solid line) and in Aichi (broken line).

(3) *Month and time of a day* Month of occurrence was classified into four categories. As the result, 35.0% of total cases occurred in August to October, 22.5% in May to July, 21.2% in February to April, and 11.0% in November to January. On the other hand, all the cases but one occurred in daytime, but no peaking time was found.

(4) *Place and elevation of accident* As was predicted, place of accident varied with ages. Preschool children mostly fell from balcony. Accidents by primary school children occurred mainly near their houses where they used to play with friends. Accidents by

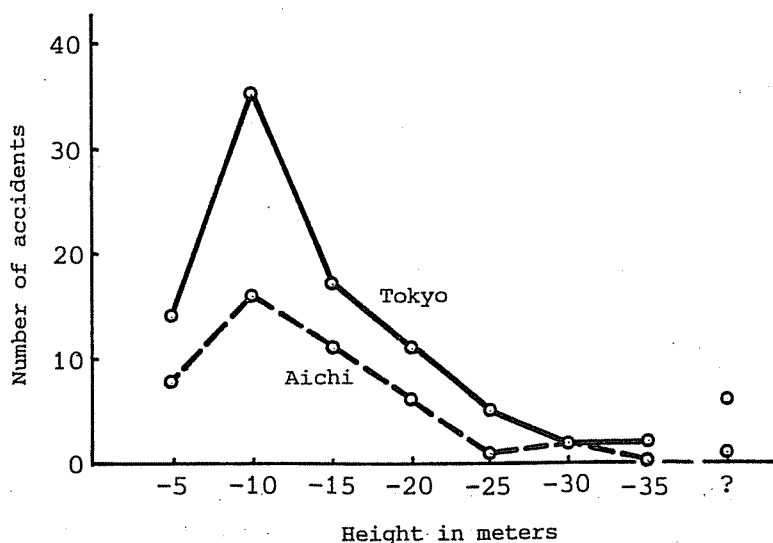


Figure 6 Elevation of falls in Tokyo (solid line) and in Aichi (broken line).

junior high students mostly occurred at school. Figure 6 gives the distribution of elevation. Its peak was at 5 to 10m with 37.2% of total cases, and 86% occurred at the elevation lower than 20m.

(5) *Situation* It must be very helpful in preventing similar accidents if the situation in which victims found themselves just before is specified. Since the necessary data was not detailed for most of the available case records, the author tried reproducing the behaviour which had led to the accident. Table 1 gives the result.

Most frequent was the case in which children had been too much accustomed to elevation, occupying two thirds of the total. Accidents which occurred in their own houses or at familiar places (like playing spots) were included in this category. Cases of this type were widely observed for the age groups ranging from young children to senior high students, peaking at the primary school stage. Accidents of a second type were the cases in which a strong valence existing downward competed with the fear of elevation. For instance, a young child attempted to follow his mother when he found her going out shopping and fell from balcony. Most accidents of this type occurred with young children. The third type were the cases classified as slipping behaviour. These occurred for junior and senior high students at schools.

Table 1 Presumed causes of accidental falls.

Inferred causes	Districts		Total
	Aichi	Tokyo	
Habituated to height	31 (62.0)	60 (69.0)	91 (66.4)
Attracted downwards	5 (10.0)	12 (13.8)	17 (12.4)
Slipped in behaviour	3 (6.0)	9 (10.4)	12 (8.8)
Defect of environment	3 (6.0)	4 (4.6)	7 (5.1)
Blurred attention	1 (2.0)	1 (1.1)	2 (1.5)
Miscellaneous	1 (2.0)	0 (0.0)	1 (0.7)
Impossible to infer	6 (12.0)	1 (1.1)	7 (5.1)

4. Discussion

The present author has kept watching occurrences of falling accidents among youngsters. They have increased while symptoms like neurosis and developmental retardation have decreased in contrast. Particularly noteworthy were the following characteristics : 1) The accidents mostly occurred in familiar places. 2) They were attributable to insufficient attention to elevation and reduced fear of elevation. 3) Youngsters of widely ranged ages were the victims.

This finding, together with the result of Survey I, seems to suggest that desensitization to the fear of elevation has been facilitated as a consequence of psychological coping with living environment. However, it could be against adaptation, since it deteriorates a process of self-defense which is built-in through a long history of evolution. In that sense, it is 'overadaptation' to environment.

As pointed out earlier, multistoried housing is ecologically peculiar since perceptual space is dissociated from behavioural space. Residents therefore have to learn the connection of the two sorts of space, at an early stage of life. Young children who have lived there seem to have lost the opportunity of learning it and to have become less sensitive to the emotion aroused by elevation once having been habituated. For the prevention of these accidents, no attempt for technological improvement could be successful for the prevention of these accidents. Such tragedy would increase acceleratedly, unless any psychological actions are taken without delay.

IV. EFFECTS OF VISUAL ENVIRONMENT UPON AUDITORY REACTION TIME : EXPERIMENTAL STUDY

1. Purpose

Analysis of falling accidents reported above suggests that residents attain their psychological adaptation by reducing the fear of elevation. This experiment compares effects of emotion upon performance among different visual environments and explores the applicability of laboratory techniques in specifying the effect of the fear of elevation. Four conditions are set up, and effects on the selective judgment are examined.

2. Method

(1) *Subjects* Volunteered subjects were 20 pairs of mother and her child who had lived at Floors 5-8 of a multistoried housing in Nagoya. As for the variable of living experiences, half of them had lived there for shorter than 6 months (Group S), whilst the other half had lived for longer than 5 years (Group L). Children were all 5 year-old males.

(2) *Conditions* For each subject, the reaction time (RT) was measured in all of four conditions; elevated(E), open(O), dark(D) and control(C).

Condition E: Subjects were required to do the task while looking down to the ground from the roof of the fifteenth floor.

Condition O: Subjects were required to do the task while standing at the center of a big open gymnasium.

Condition D: Subjects were required to do the task while keeping their eyes open in a completely dark room.

Condition C: Subjects were required to do the task while closing their eyes in relaxed posture on a sofa.

(3) *Procedure* Subjects were given through headphones 20 presentations of either of two tones (1000Hz or 400Hz, both 40dB, 500ms) in random order. They had to respond selectively to the higher tone (1000 Hz) by key-pressing. RT was measured and data was analyzed for time, variation coefficient, and error rate, respectively. RT was obtained as the mean of 20 data and its relative value was calculated with RT in control condition (C) as its basal value.

3. Results

(1) *RTs for selected stimulus* Figure 7a shows the mean relative RTs. Analysis of variance produced no significant effects of main variables of condition, age, living experience. A weak tendency of interaction was obtained only between condition and living experience. However, RT of Condition E was significantly larger than RTs of Conditions O and D, in adults ($t=2.813$, $p<.05$, for E vs O; $t=3.516$, $p<.01$, for E vs D).

(2) *Variation in RTs* Figure 7b shows coefficients of variation in RTs for each of four groups. Analysis of variance produced a significant effect of condition ($F=2.24$, $df=3$, $p<.05$). Specifically, in Condition E, adults with long living experience showed larger variation than the remaining three groups ($t=2.481$, $p<.05$ as compared to adults with short experience; $t=6.024$, $p<.001$, $t=2.402$, $p<.05$, as compared to children with long and short experience, respectively).

(3) *Error in selective response* Figure 7c shows percentage errors in selective response for each of four groups. The errors included both missing of the correct tone and key-pressing to the wrong tone (400Hz). Percentage errors was calculated with the frequency of errors in Condition C. Slightly significant effect was found for interaction bet-

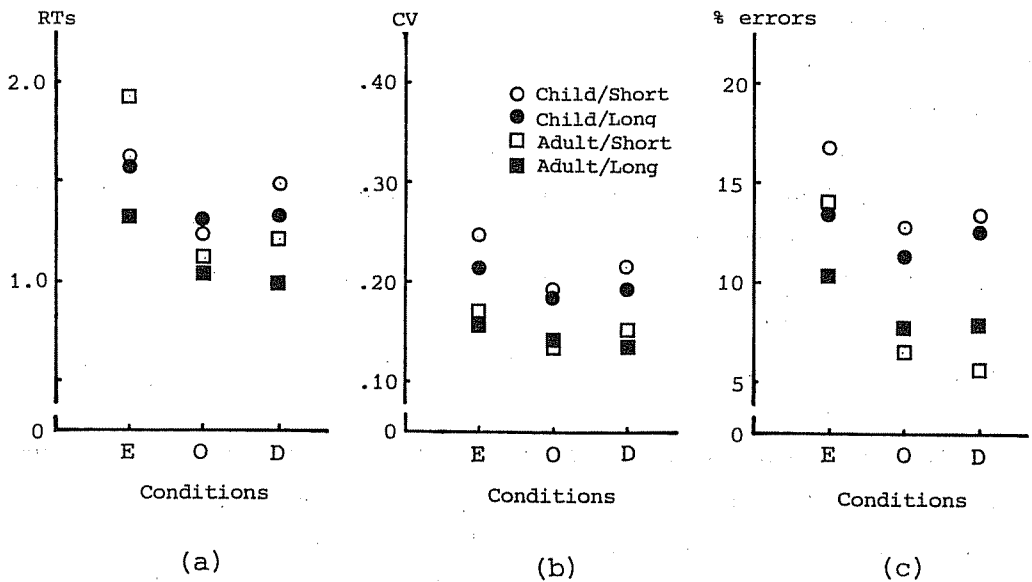


Figure 7 Selective responses of four groups in three visual conditions; mean relative reaction times (a), coefficients of variation in reaction times (b), and percentage of errors (c). Circle and square indicate young children and female adults. Open and solid ones indicate short and long living experience, respectively.

ween condition and living experience ($F=9.880$, $df=1/3$, $p<.05$). Group S of both ages showed significantly higher percentage errors in Condition E, as compared to Conditions O and D, whilst Group L did not show similar increases of error rate in Condition E.

4. Discussion

The results of this experiment confirmed that performance was more remarkably affected in Condition E in comparison with either Condition O or D. Elevation delayed and dispersed RTs, making the selective response erroneous. This suggests that elevation arouses psychological tension or fear more strongly, although the conclusion has to be reserved for further investigation.

It is interesting that in Condition E there were differences in task performance between Groups L and S. The former group was less severely disturbed. This indicates that living experience reduced the fear of elevation in the time course of adaptation. The rate of adaptation seems to be age-dependent, although it was not fully confirmed in this study.

In outdoor studies, some uncontrollable variables possibly affect the result. In this experiment, novelty of situation might have differently contributed to the performance. Also, the task of selective response could have reduced the difference among conditions and/or groups, since the task required our subjects to concentrate on a given tone.

In spite of the fact that the paradigm and procedure must be improved, this experiment has successfully demonstrated the applicability of laboratory techniques to psychological assessment of visual environments.

V. GENERAL DISCUSSION

Prevalence of multistoried housing in Japan has created a new problem to which residents must find a solution, since it was unnatural from a behavior-ecological point of view. Viewing residential environment as a psychological space, visual emotion (fear) has been mostly disregarded, notwithstanding that it is aroused in contingency with spatial perception and motivates behavioural coping.

The present author has therefore paid attention to the fear of elevation and resident's coping with multistoried housing in connection with it.

The three types of analysis reported here seem to have converged into a fact that

residents are coping with elevation by fear reduction. The facts suggest that in order to prevent accidental falls coming from such 'overadaptation', one must take psychological points of view.

Japanese culture was of 'naturalism' in its tradition. Space has been thought of a 'natural container' in which human lives are accepted. This idea contrasts with the western tradition which has developed the 'technology of space' by the introduction of linear perspectives into gardening and architectural designing. However, the recent Japanese situation promoted by economical and technological demands has been changing this traditional conception of space. In the near future, 'psychotechnology' will make an important contribution to planning multistoried housing in harmony with psychological and behavioural traits of the residents.

References

- Baum, A. and Valins, S. *Architecture and Social Behavior: Psychological Studies of Social Density*, New Jersey: Lawrence Erlbaum Associates, 1977.
- Gibson, J.J. *The Ecological Approach to Visual Perception*, Houghton & Mifflin, 1979.
- Hall, E.T. A system for the notation of proxemic behavior. *American Anthropologist*, 1963, 65, 1003-1027.
- Heilweil, M. The influence of dormitory architecture on resident behavior. *Environment and Behavior*, 1973, 5, 377-412.
- Kato, M., et al. *Comprehensive Study of Mental Healthiness in Urban Lives*, Project Research Report/The Science and Technology Agency of Japan, 1972-1974. [in Japanese]
- Kobayashi, S., et al. Resident Healthiness as related to changes in community environment I, *Mental Hygiene Studies/ Japanese Institute of Mental Hygiene*, 1977, 24-148. [in Japanese]
- Tsuji, K. *An Ontogenetic Approach to Visual Space Perception*, Research Report/ Scientific Research Granted by the Ministry of Education, Science and Culture, 1980. [in Japanese]
- Tsuji, K., et al. Psychology and behaviour of the residents in multistoried housing. In Ishimizu, T. (Ed.), *Cognition of Environment and Spatial Behaviour*, Research Report/ Nagoya University, 1983. [in Japanese]
- Yamamoto, K. Environment from the view point of community mental health. *Japanese Psychological Review*, 1973, 277-297. [in Japanese]
- Yoshida, M. (Ed.) *The Psychology of Urban Environment and Housing*, Tokyo: Shokokusha, 1980. [in Japanese]

Notes

- *1) This study was supported by a Grant-in-Aid given to the author from Japan Compre-

hensive Center for Housing in 1987.

*2) The author is grateful to Aichi Police Head Office and NHK for their cooperation in collecting original data of accidental falls.

ABSTRACT

The present study is concerned with elevation as a variable of residential environment of multistoried housing and examines its psychological and behavioural effects. In the first part, housewives who had lived in multistoried housings were asked to respond to a questionnaire consisted of 32 items including different aspects; cognition and evaluation of environment, positive and negative emotion aroused, interpersonal relations, and daily behaviours. The result showed that resident's emotional arousal was reduced with lapse of time. In the second part, accidents of falling down from elevation were analyzed, since the author paid much attention to a tendency that accidents of this type had increased. Accidents mostly occurred in familiar places. They were attributable to insufficient attention to environment and/or reduced fear of elevation. Youngsters tend to give rise to accidents. These findings suggest that the increasing tendency of this type of accidents reflects the desensitization facilitated by living at an elevated place. It is 'overadaptation' to the environment. In the third part, attempt was done to assess different visual environments by comparing their effects on the performance of a judgmental task (selective reaction time; RT). Elevation delayed and dispersed RTs, making the response erroneous. This suggests that elevation arouses psychological tension (fear) more strongly and that living experience reduces the fear of height.