

**Psychological Studies**  
**on**  
**Zen Meditation and Time-Experience (III)**

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## I. Effects of Auditory Stimulation upon Time Estimation during Zazen

### I. 1. Pitch of Sound

In the preceding experiment, we investigated the experience of time during Zazen, using the production method of filled time with the sounds of various intensities. As a result, it was recognized that there is no definite relation between sound-intensities and time estimation. However, in the condition of Zazen, time tends to be underestimated compared with the group of control in the same as the results of our former experiments. The experiment reported herein investigates the effects of subjective side of Zazen namely *chojin* (mind-regulation), on the experience of time accompanied with noises, using the production method of filled time with the sounds of various pitches.

#### *Method:*

*Subjects;* Five male graduate students with 3 to 4 years of Zazen practice.

*Apparatus and records;* The respiration curve, heart rate, and time estimation were recorded by SANEI MODEL EG-130 electro-encephalograph. As sound stimuli for the filled time, four kinds sound pitches [200c/s (81 phon), 500c/s (82 phon), 1,000c/s (83 phon), 4,000c/s (89 phon) 82 dB, respectively] and white noise were setted through SANEI Stimulator Ps-202. Time estimation was recorded automatically on the EEG recording sheet by each subject's pushing a button.

*Procedure;* For the experiment, subjects were taken the measurements of Zazen (experimental group) for 25 min and Non-Zazen of quiet sitting (control group) for 25 min with 10 min rest in between, after the measurements of the first rest (3 min) on heart rate and respiration rate. The orders of both conditions were changed. The measurements of time estimation were conducted six to seven times respectively, the first at the 6th min since the experiment was begun, and after that at every

3 min intervals in both conditions of Zazen and Non-Zazen. For the estimation of 20 sec objective time, production methods of filled time with four kinds sound pitches and of unfilled time of soundless without counting were used, the experiment was performed in random order with the auditory signal (500 c/s, 75 dB, 0.5 sec) by the experimenter.

In the case of production method of filled time with auditory stimuli, the subjects were required to push a reaction button in hand when they sensed the auditory signal given by the experimenter. And then, for the while, the auditory stimuli are given continuously until the subjects push the reaction button again when they sensed the lapse of 20 sec. Further, since the basis is based on subject's estimation in production method, overestimation is shorter and underestimation is longer than the objective time. Before the testing of time estimation, subjects were allowed to practice several times and to watch the movement of the second hand of a watch for one minute. The experiment was conducted in an electrically shielded, semi sound proofed room with regulated temperature, ventilation and lighting.

*Results :*

Table I shows mean values of produced time for 20 sec objective time at various pitches of sounds, heart beats before and during (may or may not be included after) time-estimation, and respiration rate in both groups of Zazen and Non-Zazen.

*Time estimation* (Fig. I) ; Control group without Zazen tends to be overestimated in the filled time with sound stimuli except for the case of unfilled time without sounds, while Zazen group tends to be overestimated the objective time for 20 seconds at the sound intensity of 4,000 c/s. Individual differences for the grasp of the objective time are markedly in both groups. Produced time in the group of Zazen tends to be shorter (overestimation) compared with that of Non-Zazen group at any intensity of sounds. Then, observing the changes of produced time which are corresponded to various sound pitches, it is recognized that filled time with sound stimuli tends to be overestimated generally compared with unfilled

**Table I** Mean measured values of Produced time, Heart rate, and Respiration rate at each frequency, under the conditions of Zazen and Non-Zazen

	Rest	Soundless		200c/s		500c/s		1,000 c/s		4,000 c/s		White-Noise	
		Non Zazen	Zazen	Non Zazen	Zazen	Non Zazen	Zazen	Non Zazen	Zazen	Non Zazen	Zazen	Non Zazen	Zazen
Time estimation (sec)		16.6	19.1	13.5	18.7	14.1	18.4	15.9	16.7	13.5	15.1	15.8	18.8
Heart rate (beats/min)	69.2												
before estimation		69.2	70.8	69.8	69.6	67.3	70.0	69.4	71.8	69.0	69.7	70.2	69.8
during estimation		69.2	70.2	69.2	69.8	68.3	69.3	69.2	70.2	69.3	70.0	70.0	68.4
Respiration time (sec/cycle)	3.39												
before estimation		3.51	8.57	3.30	8.33	3.19	6.67	3.33	8.57	3.51	10.5	3.53	9.52
during estimation		3.37	8.57	3.33	7.50	3.37	5.88	3.24	8.45	3.51	10.0	3.45	8.22

time without sounds, in the group of control. However, there is no definite tendency between the intensity of sound and time estimation intra- filled time. In the group of Zazen, as the basis of the produced time in soundless unfilled time, time tends to be overestimated at relatively high intensities of sounds (1,000c/s, 4,000c/s) except for white noise. And, time is overestimated significantly ( $p < .05$ ) intra- filled time in the group of Zazen at the sound of 1,000 c/s which is relatively higher than that of 200 c/s. Noise is generally considered to bring about discomfort and thus causes overestimation of time, however, the white noise in actual is said to cor-

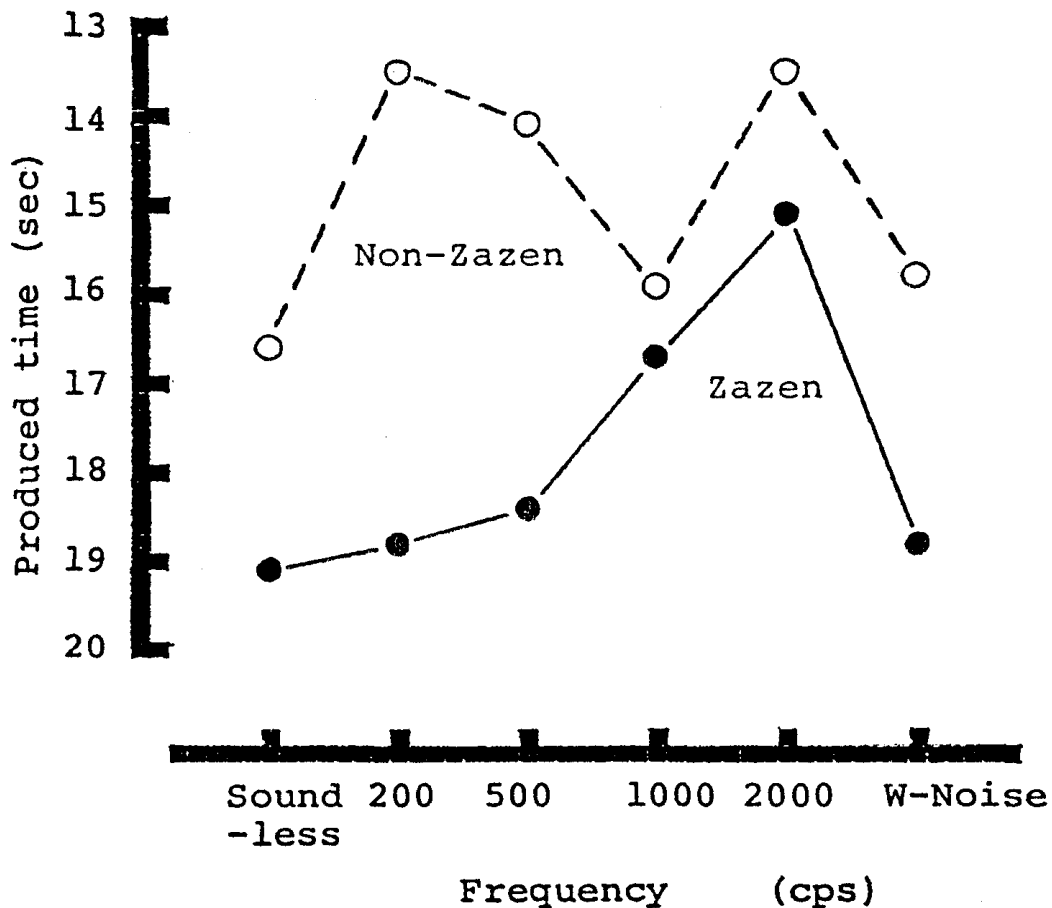


Figure I. Changes of mean values of produced time accompanied with various pitches of sound under the conditions of Zazen and Non-Zazen.

respond approximately with the sound of 1,000c/s, and there are individual differences in time estimation and subjects's how to grasp the noise.

*Heart rate*; Heart beats for periods of 30 seconds both before and after sound signals for each estimation of time were measured in both groups of Zazen and Non-Zazen. Thus, the heart rate for 30 seconds following the sound signal may be included the heart beats subsequent to completion of the estimation for 20 sec objective time. Heart rate in the group of Zazen tends to show some increases both during and after time estimation at any pitch of sounds except for noise, as compared with the heart rates under the conditions of rest and control group. However, the differences of the heart rates between before and during time estimation are not observed at all levels of sound pitches in both Zazen and Non-Zazen groups. There is no definite tendency on heart rates during and after the estimation of time compared with that of rest, heart rate between with and without stimuli, and between changes of heart rate and various levels of sound pitches. Accordingly, from the present results, it is hard to say that there is a relation between the changes of heart rate that corresponding to the sound pitches and time estimation.

*Respiration time*; The same as heart rate, mean values of required time for a cycle of each respiration for 30 sec periods both before and during (including after) time estimation were taken. In the group of Zazen, respiration rates both before and during estimation are decreased generally, thus respiration time for a cycle is longer ( $p < .05$ ) compared with those of the rest and the group of control. In the group of control, there is no significant difference of respiration time between before and during estimation of time. Although, respiration time during estimation of time tends to be longer than that of before time estimation in the group of Zazen. It is able to say that there are scarcely relations between the estimation of time and respiration rate corresponded to the various pitches of sounds, with and without sound stimuli, in both groups of Zazen and Non-Zazen.

*Discussion ;*

The effects of noises on time estimation have been investigated by Jerison (1955), Hirsh et al. (1956), Ludwig (1975) and others, who have been reported that noises generally cause overestimation of time. Further, in the studies on time perception, it has been shown that the strong sound induces overestimation of time than the weak sound (Oléron, 1952) and the sound of higher pitch causes overestimation than the sound of lower pitch (Goldstone et al. 1954).

In the present experiment, it was recognized that the sound of relatively higher pitch tends to cause overestimation of objective time in the method of production of filled time with sound stimuli under the condition of Zazen. Such tendency for overestimation of objective time during Zazen does not necessarily disagree with the results which are indicated that time is generally underestimated during Zazen, in a series of experiments using the method of production of unfilled time. The tendency in Zazen group to overestimate objective time is relatively less as compared with that in Non-Zazen group in the present experiment. Furthermore, when considering individual differences in the estimation of objective time, it will be ought to judge that the tendency in Zazen group to overestimate time is due considerably to the influence of filled time accompanied with the variations in the pitch and loudness of sound. Observing the results on the basis of the produced time in control group, it is recognized that subjective time becomes longer, in the group of Zazen, and objective time tends to be underestimated as compared with that of Non-Zazen group, which are in agreement with the results of a series of our previous experiments.

The first important point for the beginning of Zazen is to “abandon all personal and material bonds and engagement in activity”. Like this, to disconnect oneself from one’s external environment, and to realize the attitude of *muki* (neutral) which one transcends *gashu* (self-centered standpoint) through detachment from all external sensory stimuli is the state of *shai* (relinquishment of all intentional contrivances), that is *chojin* (mind-regulation). Considering the fact that sound stimuli used

in the present experiment are rather intensive, and further from the results of preceding experiments (1976, 1977) which show that underestimation of time is recognized even among the subjects who show practically no physiological changes peculiar to those in Zazen such as lowered metabolism and decrease in respiration rate, it is undeniable that the subjective aspect of Zazen has considerable effects on the underestimation of time during Zen meditation. Although, *chojin* is realized through equilibrium between *shui* (retention of intentional contrivances) and *shai*. Therefore, it is not able to realize that through *shai* only. This fact is greatly susceptible to variations of intensity and pitch of sound stimuli. Accordingly, *chojin* (mind-regulation) plays an important role in time experience during Zazen, though, that is not able to realize alone but becomes effective in cooperation with *choshin-chosoku* (regulations of posture and respiration).

From the results of the present experiment, it is hard to say that the higher the pitch of sound, the greater the effects on heart rate and respiration rate, and thus causing over estimation of time.

## I. 2. Loudness of Sound

In the present experiment, the experience of time during Zazen is investigated using the production method of filled time with the sounds of various loudness.

### *Method:*

*Subjects;* Five male graduate students with 3 to 4 years of Zazen practice.

*Apparatus and records;* As sound stimuli for the filled time, four kinds loudness by pure tone [low-weak (200 c/s, 41 dB, 36 phon), low-strong (200 c/s, 82 dB, 84 phon), high-weak (2,000 c/s, 76 dB, 80 phon), high-strong (2,000 c/s, 90 dB, 93 phon)] were setted through SANEI Stimulator Ps-202.

The others were the same as Experiment I. 2.

*Procedure;* The measurements of time estimation were conducted five times respectively, the first at the 6th min since the experiment was



begun, and after that at every 3 min intervals in both conditions of Zazen and Non-Zazen.

The others were the same as Experiment I. 2.

*Results and Discussion :*

Individual differences in the grasp of the objective time for 20 seconds are observed markedly, there is no significant change except that produced time tends to be longer (underestimation) under the conditions of low-weak sound (36 phon) and soundless, in the group of Zazen. Observing the results in time estimation on the basis of the produced time in Non-Zazen,

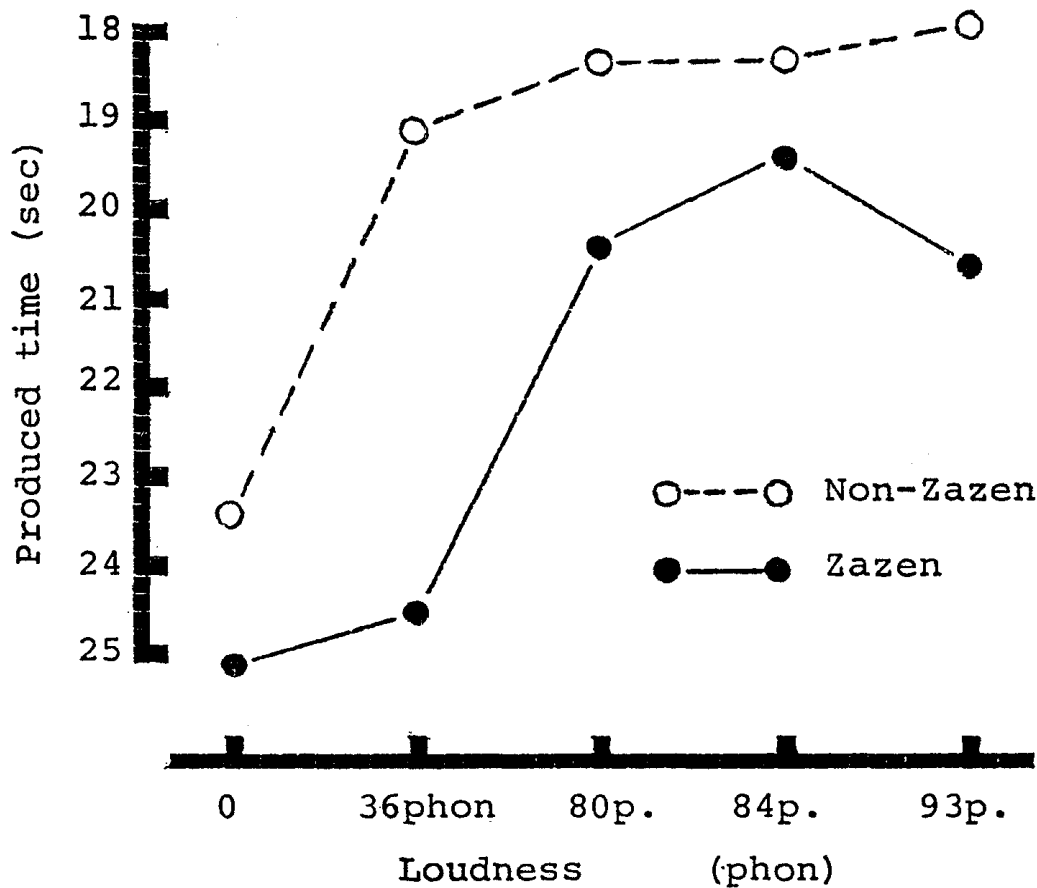


Figure II. Changes of mean values of produced time accompanied with various loudness under the conditions of Zazen and Non-Zazen.

it is recognized that the produced time in the group of Zazen tends to be longer generally than that in Non-Zazen group. In the group of Zazen, considering the changes of produced time which are corresponded to various loudness, it is recognized that produced time in filled time with sound stimuli tends to be shorter (overestimation). There is no definite tendency between the changes of loudness and time-estimation intra- filled time. In the group of Zazen, the produced time in the condition of the more loud sound relatively (over 80 phon, low-strong 84 phon, high-weak 80 phon, high-strong 93 phon) tends to be shorter compared with the both conditions of unfilled time without sound and filled time with low-weak sound (36 phon). However, it is not to say necessarily that the more loud sound the more shorter subjective time.

Heart rate and respiration time per cycle in both groups of Zazen and Non-Zazen were measured for 30 sec before and after the auditory signals for each estimation of time. Heart rate in the group of Zazen tends to be decreased generally in both before and during (including after) estimation of time compared with those of rest and Non-Zazen group, fluctuation curves of heart beats in Zazen, which are corresponded to the respective sounds show a symmetrical pattern compared with that of Non-Zazen. There are no significant differences of heart rates between before and during time estimation in both groups of Zazen and Non-Zazen, respective heart rates in both groups show much the same patterns of fluctuations between before and during estimation of time. Therefore, we are not able to recognize the significant relations among the changes of sounds, produced time, and heart rate.

In the group of Zazen, respiration rate is decreased generally, respiration time for a cycle becomes longer, and respiration time during estimation of time tends to be shorter than that of before time estimation. There are scarcely relations between the produced time and respiration rate corresponded to whether with sounds or not, whether loud or not.

Generally, filled time of strong or high pitched sounds are tended to overestimate. According to the results of present experiment, produced

time becomes shorter relatively in the case of the loud noise condition (over 80 phon), However, especially, in the case of Zazen, it is hard to say simply that the duration of more loud sound, the greater the effects on heart rate and respiration rate, and thus causing overestimation of time. In spite of the condition of noise, the tendency that subjective time during Zazen becomes longer is the same as the results of our preceding experiments. For the reason, it is able to consider that *chojin* which abandons intentional contrivances, and brings to naught the self-centeredness has a great meaning on the underestimation of time during Zazen.

## **II. Effects of Intermittent Stimulation upon Time Estimation during Zazen**

### **II. 1. Click-sounds**

In the practice of Zazen which abandons all personal and material bonds and engagement in activity through mind-regulation, subjective time tends to be longer. The experiment reported herein investigates the experience of time during Zazen using the production method of filled time that is changed the frequency of intermittence in sound stimuli.

#### *Method:*

*Subjects;* Four male graduate students with 3 to 4 years of Zazen practice.

*Apparatus and Records;* Time estimation, respiration curve, and heart rate were recorded by SANEI MODEL EG-130 electroencepharograph. As intermittent sound stimuli for the filled time, five kinds frequencies of clicks (0.5/sec, 1/sec, 5/sec, 10/sec, 50/sec, by pure tone of 200c/s, 50dB respectively) were setted through SANEI Stimulator Ps-202.

*Procedure;* For the experiment, subjects were taken the measurements of Zazen (experimental group) for 25 min and Non-Zazen of normal quiet sitting (control group) for 25 min with 10 min rest in between, after the measurements of the first rest (3 min) on heart rate and respiration rate. The orders of both conditions were changed. The measurements of

time estimation were conducted six times respectively, the first at the 6th min since the experiment was begun, and after that at every 3 min intervals in both conditions of Zazen and Non-Zazen. For the estimation of 20 sec objective time, production methods of filled time with five kinds intermittent sounds and of unfilled time of soundless were used without counting, the experiment was performed in random order with the auditory signal (500 c/s, 75 dB, 0.5 sec) by the experimenter.

*Results and Discussion :*

For 20 sec objective time, the produced time tends to be longer (under estimation of objective time) during Zazen, however, definite tendency is not observed in the group of quiet sitting without Zazen. Produced time during Zazen is the longest in the case of without sound stimuli. Observing the results in time estimation on the basis of the produced time in Non-Zazen, it is recognized that except for the produced time at 5 clicks/sec and 50 clicks/sec, the produced time during Zazen is generally longer than that of Non-Zazen group, particularly in the case of soundless, 0.5 click and 1 click per second, the tendency is remarkable. As the changes in the produced time corresponded to the frequency of clicks, under the condition of Non-Zazen, produced time tends to be shorter in the case of filled time with clicks of 1/sec or more, particularly at the frequencies of 5 clicks/sec and 50 clicks/sec, compared with that in unfilled time without sound stimuli. However, there is no definite relation between the various frequencies of clicks and time estimation intra- filled time. Under the condition of Zazen, produced time in filled time with clicks is generally shorter than that in unfilled time without sound stimuli, and the tendency is particularly remarkable at the frequencies of 5 clicks/sec or more. Intra-filled time, however, no definite tendency in the fluctuation of produced time is observed.

Heart rate and respiration time per cycle in both groups of Zazen and Non-Zazen were measured for 30 sec before and after sound signals for each time estimation. The heart beats in the group of Zazen tend to be increased generally compared with that in rest and that in the group of quiet

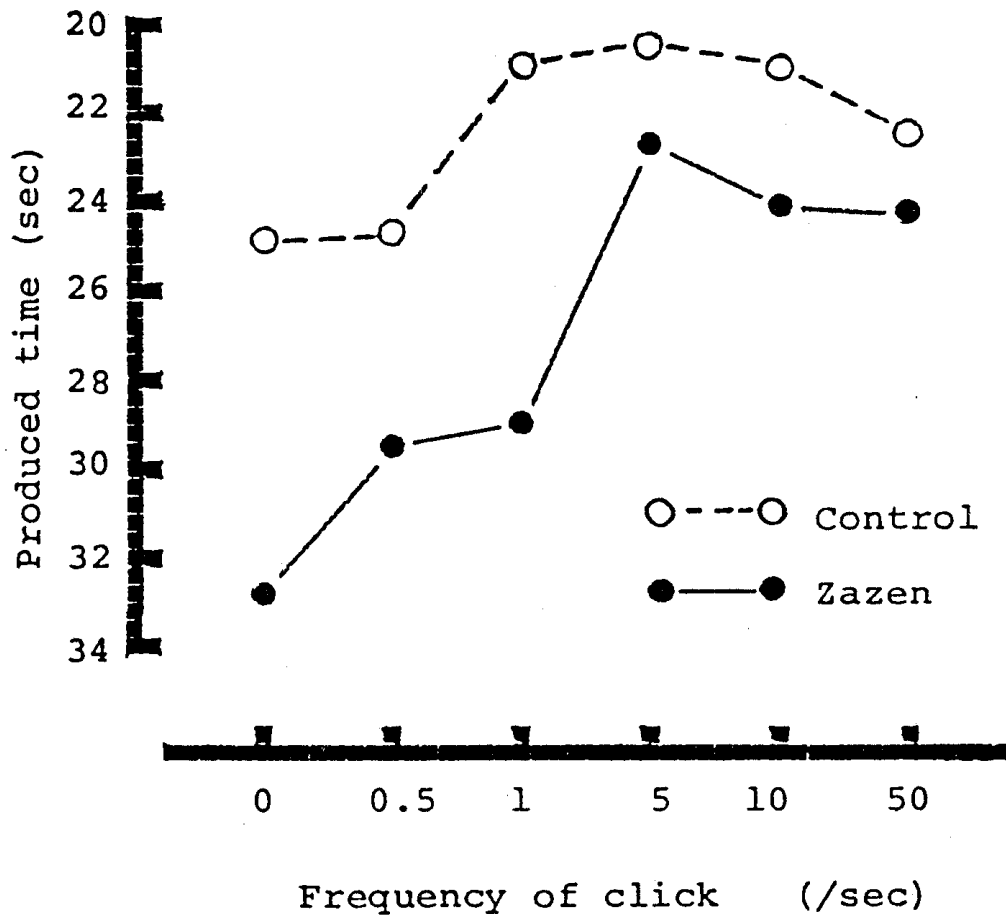


Figure III. Changes of mean values of produced time accompanied with various frequency of clicks under the conditions of Zazen and Control.

sitting without Zazen. The tendency to increase in heart rate is recognized also during (including after) time estimation in the group of Zazen, but, the tendency is less than that in Non-Zazen. Then, respiration rate during Zazen is decreased generally, respiration time per cycle becomes longer. However, there are no significant correlations between the more or less of clicks and heart rate, respiration rate, or produced time.

It is said that time experience depends on the input volume of external stimulation, and the greater the number and complexity of stimuli, the longer the experience of time (Frankenhaeuser, 1959; Fraise, 1963).

However, according to the results of present experiment, it is not able to say necessarily that the higher frequency of clicks influences simply heart rate and respiration rate of the subjects, brings about the overestimation of objective time. The tendency that subjective time becomes longer (underestimation of objective time) in the condition of Zazen, in spite of the condition of excess stimulation, is the same as the results of a series of our experiments. For the reason, it is able to consider that *chojin* which one abandons intentional contrivances and brings to naught one's ego-centeredness has a great meaning on the underestimation of time during Zazen. From the viewpoint, we are not able to deny unqualifiedly the hypothesis by Ornstein (1969) that the experience of time is decided by "storage".

## II. 2. Flash-lights

In the present study, the experience of time during Zazen is investigated using the production method of filled time that is changed the frequency of intermittence in light stimuli.

### *Method :*

*Subjects ;* Six male graduate students with 3 to 4 years of Zazen practice.

*Stimulation ;* Five kinds frequencies of flash (0.5/sec, 1/sec, 5/sec, 10/sec, 50/sec) were setted through SANEI Stimulator Ps-202.

*Procedure ;* For the estimation of 20 sec objective time, production methods of filled time with five kinds intermittent lights and of unfilled time of lightless were used without counting, the experiment was performed in random order with the auditory signal by the experimenter. The others were the same as Experiment II. 1.

### *Results and Discussion :*

In the same as the results of a series of our experiments, subjective time tends to be longer (underestimation of objective time) in spite of the condition of excessive stimulation during Zazen that one abandons all personal and material bonds and engagement in activity. Then, in the

group of Zazen, heart rate tends to be increased generally. As for the heart rate during Zazen, there are also many reports that heart rate tends to be decreased during Zazen, many results are inconsistent. Therefore, the cause to increase of heart rate in present study is not clear whether that is due to Zazen, time-experience, and stimulation itself or not. Further, respiration rate is decreased generally, respiration time per cycle becomes longer in the group of Zazen.

As for the produced time, it tends to be relatively closer to the objective time at the frequencies of flashes more than 1/sec during Non-Zazen and

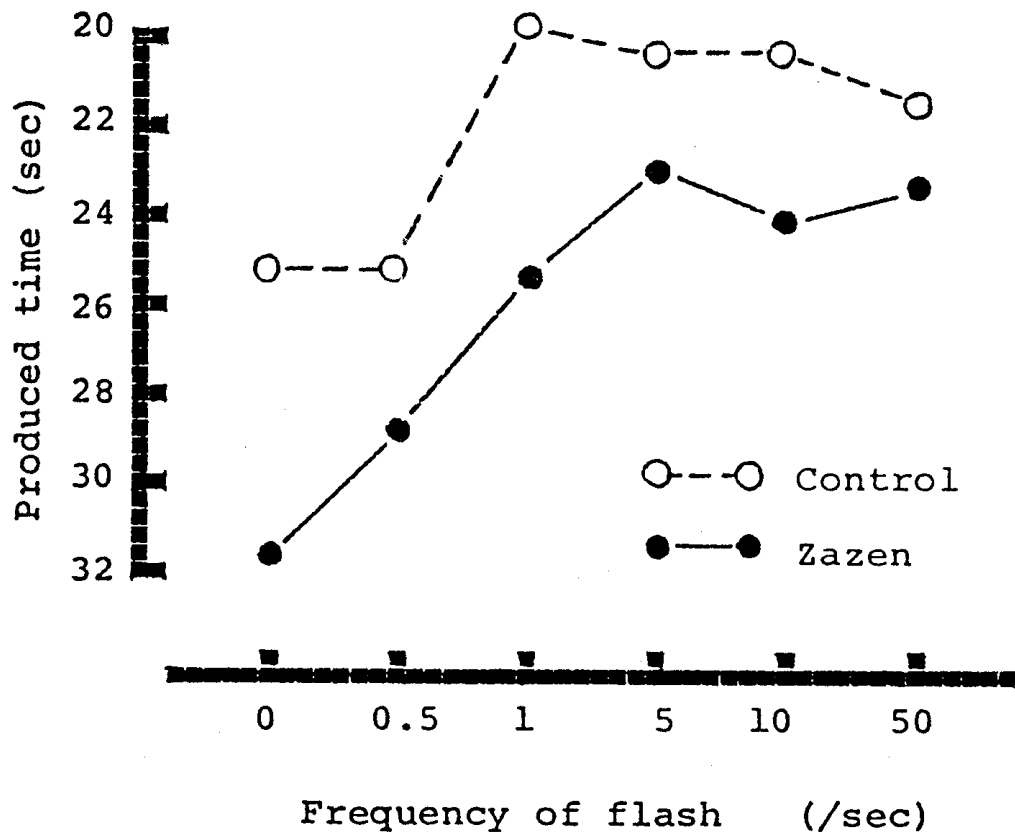


Figure IV. Changes of mean values of produced time accompanied with various frequency of flashes under the conditions of Zazen and Control.

more than 5/sec during Zazen. It is able to consider for the reason that subjects probably accepting the provided stimuli as a "unity" when the counting was prohibited. In this case, the rhythm of each respiration may be utilized as a yardstick, but according to the former studies, it is recognized that subjective time becomes longer even when the respiration rate is not decreased during Zazen. There is no significant difference between the produced time with sound and that with light, the patterns of the changes are mutually similar to the both cases of sound and light.

According to the results of present experiment, it is not able to say

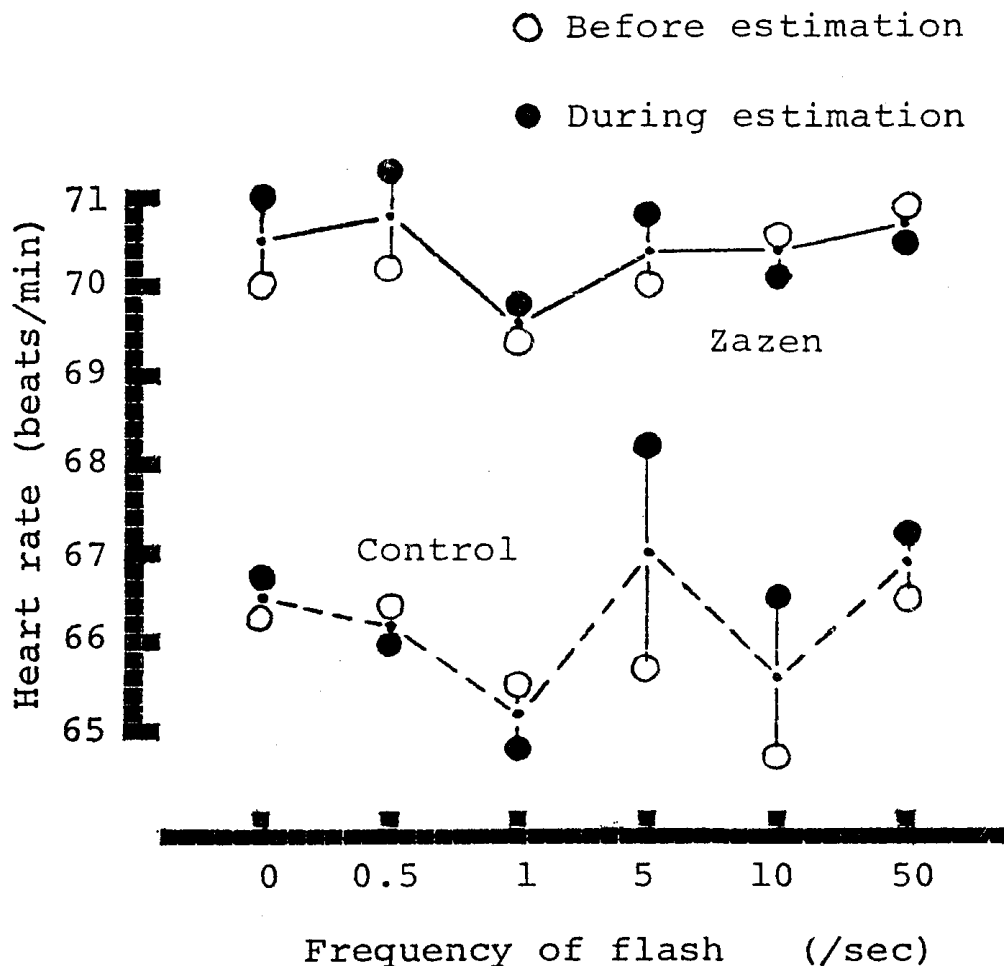


Figure V. Changes of mean values of Heart beats before and during estimations of time at each frequency of flash, under the condition of Zazen and Control.



necessarily that the higher frequency of flashes influences the heart rate and respiration rate of the subjects, and brings about the overestimation of objective time.

Unlike the unconsciousness or sensory deprivation, Zazen enables one to abandon all intentional contrivances and nullifies one's ego-centeredness through *Choshin-Chosoku-Chojin* (regulations of body, respiration, and mind). Therefore, it is able to consider that the experience of time during Zazen may depend greatly on "storage" rather than the input of stimuli.

As there are a number of experimental problems, we intend to carry

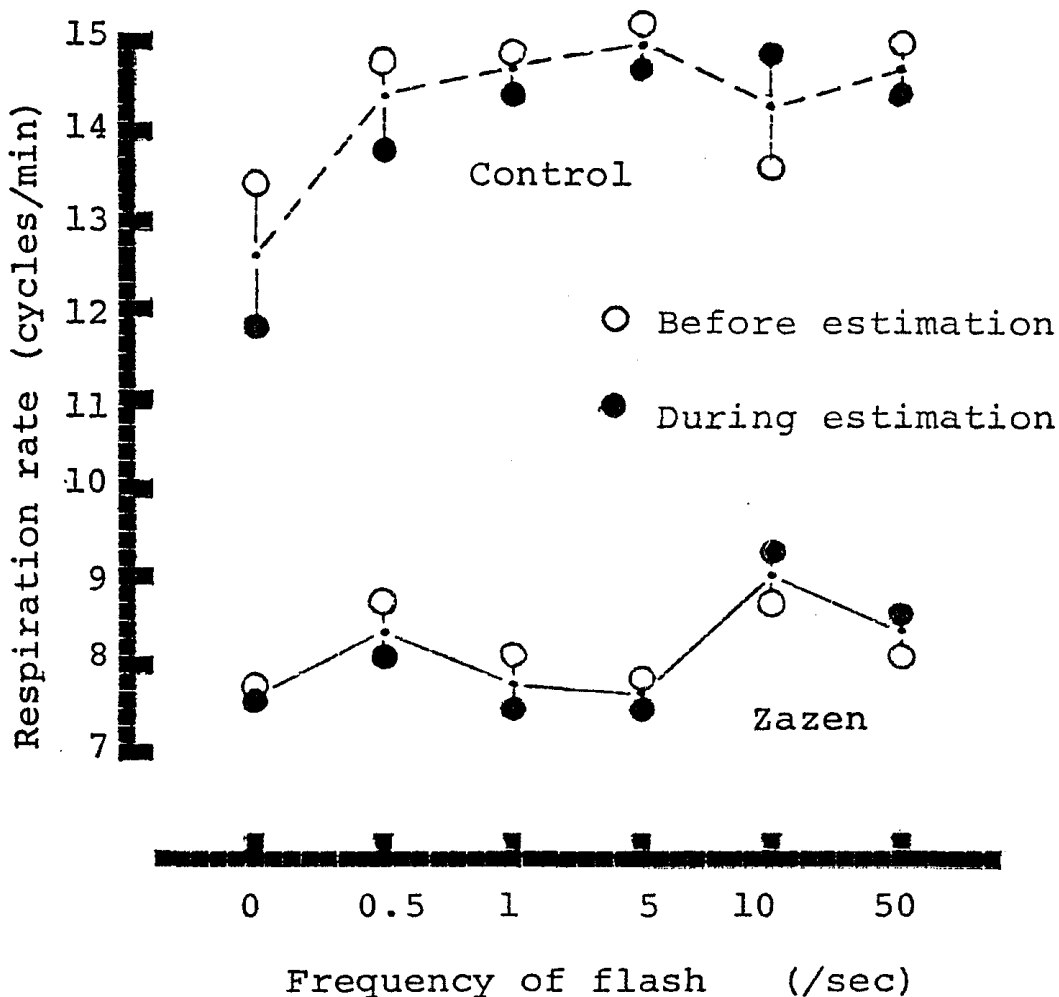


Figure VI. Changes of mean values of Respiration rates before and during estimations of time at each frequency of flash, under the conditions of Zazen and Control.

out more detailed studies in the future.

### Summary and Conclusion

The experience of time is influenced by both subjective and physiological factors, it is said that time is overestimated under the condition of excess of external stimuli such as noises. According to the experiments, it is recognized that the sounds of relative higher pitches (over 1,000 cps) tend to cause overestimation of objective time in the method of production of filled time with sound stimuli under the condition of Zazen. But the tendency is relatively less as compared with that in Non-Zazen. Then, subjective time becomes longer, in the group of Zazen, and objective time tends to be underestimated compared with that of Non-Zazen, which are in agreement with the results of a series of our former experiments. For the reason, it is undeniable that the subjective aspect of Zazen has considerable effects on the underestimation of time during Zen meditation. From the results of the experiment, it is hard to say that the higher the pitches of sounds, the greater the effects on heart rate and respiration rate, and thus causing overestimation of time (I. 1.).

Generally, filled time with strong sounds and higher pitch sounds are tended to overestimate. According to the results of experiments, produced time becomes shorter relatively in the case of the noise condition (over 80 phon). It is hard to say that the more loud sound, the greater the effects on heart rate and respiration rate, and thus causing overestimation of time. It is the same tendency as the results of our preceding experiments that subjective time during Zazen becomes longer in spite of the condition of noise (I. 2.).

It is said that time experience depends on the input volume of external stimulation, and the greater the number and complexity of stimuli, the longer the experience of time. However, according to the results of present experiment, it is not able to say necessarily that the higher frequency of clicks influences simply the heart rate and respiration rate of subjects, brings about the overestimation of objective time. The tendency that

subjective time becomes longer (underestimation of objective time) in the condition of Zazen, in spite of the condition of excess stimulation, is the same as the results of a series of experiments (II. 1.).

As for the produced time with flash light, it is able to consider for the reason that subjects probably accepting the provided stimuli as a "unity" when the counting was prohibited. Then, there is no significant difference between the produced time with sound and that with light, the patterns of the changes are mutually similar to the both cases of sound and light. Zazen enables one to abandon all intentional contrivances and nullifies one's ego-centeredness through *Choshin-Chosoku-Chojin* (regulations of body, respiration, and mind). Therefore, it is able to consider that the experience of time during Zazen may depend greatly on "storage" rather than the input of stimuli (II. 2.).

### References

- 1) Akishige, Y. (Ed.) Psychological Studies on Zen, I. *Bull. Fac. Lit. Kyushu Univ.*, 1968, **II**, 1-280.
- 2) Akishige, Y. On the laws of realization of Non-Ego. *J. Indian. Buddhist Studies.*, 1974, **23**, No. 1, 1-6.
- 3) Akishige, Y. (Ed.) Psychological Studies on Zen, II. *Bull. Zen Inst. Komazawa Univ.*, 1977, **I**, 1-479.
- 4) Banks, R. and Cappon, D. Effect of reduced sensory input on time perception. *Percept. Mot. Skills.*, 1962, **14**, 74.
- 5) Bonaparte, M. Time and the unconscious. *Int. J. Psycho-Anal.*, 1940, **21**, 427-468.
- 6) Burton, A. A further study of the relation of time estimation to monotony. *J. Appl. Psychol.*, 1943, **27**, 350-359.
- 7) Chihara, T. Psychological Studies on Zen Meditation and Time-Experience. In Y. Akishige. (Ed.) Psychological Studies on Zen II. *Bull. Zen Inst. Komazawa Univ.*, 1977, 361-398.
- 8) Cohen, J.J., Hansel, C.E.M. and Sylvester, J.D. Interdependence of temporal and auditory judgments. *Nature (Lond.)*, 1954, **174**, 642-646.
- 9) Fraisse, P. *The Psychology of Time*. New York: Harper & Row, 1963.
- 10) Frankenhaeuser, M. *Estimation of Time*. Stockholm: Almqvist and Wiksell, 1959.
- 11) Goldstone, S. and Lhamon, W.T. Studies of auditory-visual differences in human time judgment: I. Sounds are judged longer than lights. *Percept. Mot. Skills.*, 1974, **39**, 63-82.

- 12) Goyche, J.R.M., Chihara, T. and Shimizu, H. Two concentration methods: A preliminary comparison. *Psychologia*, 1972, **15**, 110-111.
- 13) Günter, G. Time, timeless logic and self-referential systems. In Interdisciplinary perspectives of time. R. Fischer (Ed). *Ann. N.Y. Acad. Sci.*, 1967, **138**, 396-406.
- 14) Hirsh, I.J., Bilger, R.C. and Deatherage, B.H. The effect of auditory and visual background on apparent duration. *Amer. J. Psychol.*, 1956, **69**, 561-574.
- 15) Jerison, H.E. Effect of acoustic noise on time judgment. *U. S. A. F., W.A.D.C. Tech. Rep.*, 1955, No. 55-358.
- 16) Lindsley, D.B. Common factors in sensory deprivation, sensory distortion, and sensory overlord. In P. Solomon. et al., (Eds) *Sensory deprivation* Cambridge: Harvard Univ. press. 1961, p. 174-194.
- 17) Ludwig, A.M. Sensory overlord and psychopathology. *Dis Nerv. System.*, 1975, **36**, 357-360.
- 18) Masler, E.G. The subjective perception of two aspects of time: Duration and timelessness. *Int. J. Psycho Anal.*, 1973, **54**, 425-429.
- 19) Oléron, G. Influence de l'intensité d'un son sur l'estimation de sa durée apparente. *Année. Psychol.*, 1952, **52**, 383-392.
- 20) Ornstein, R.E. *On the experience of time*. New York: Penguin Books, 1969.
- 21) Vernon, J.A. and McGill, T.E. Time estimations during sensory deprivation. *J. Gen. Psychol.*, 1963, **69**, 11-18.