第 8 章　Effects of personal responsibility and latitude for Type A and B individuals on psychological and physiological stress responses

INTRODUCTION

Occupation is an important activity to secure one's living and to realize one's goal in life. Occupation, however, could also act as a stressor on mental and physical health. Concerning stress in occupational situations, Karasek (1979) proposed the Job Strain Model. The Job Strain Model consists of two factors eliciting work stress, the job demand and the decision latitude. The job demand contains claims by others, difficulties of job contents, amounts of job, time pressure, role stress, and other job circumstances. The decision latitude is the ability or chance to control one's job by oneself. It involves choices of job contents, applications of technical skills, authorities to make decision, and chances of job training (see, Steptoe & Appels, 1989). Work stress is determined by the interaction of demand and latitude. Karasek (1979) noted that work under high demand and low latitude induced psychological and physiological strains. However, even if high demand is required, stress reactivity remains still low under controllable work; called an active job (Karasek, 1979). Therefore, latitude might be connected with stress reduction.

Latitude, which other researchers called personal control (see, Steptoe & Appels, 1989), is experimentally operated by a management of work-pace (Bohlin, Eliasson, Hjemdahl, Klein, & Frankenhaeuser, 1986; Steptoe, Fieldman, & Evans, 1993) and an availability of task selection (Burns, Hutt, & Weidner, 1993; Hutt & Weidner, 1993). Bohlin et al. (1986) compared psychological and physiological responses to self-paced (controllable) tasks with those to externally paced (uncontrollable) tasks. They showed that task performance was higher in the self-paced than externally paced conditions and that there were also larger increases of psychological and physiological indices in the externally paced condition. Steptoe et al. (1993) compared cardiovascular responses in the self-paced with those in the externally paced conditions. They showed that perceived control of work-pace was an important factor to elicit psychophysiological responses. Increments of blood pressures during a mirror tracing task were greater in the externally paced than in the self-paced conditions. Steptoe, Evans, and Fieldman (1997) also found that systolic blood pressure to a mirror drawing task were greater in the external than self-paced conditions using adult subjects. Iwanaga (1996) examined controllability of paces to start a task. Though there was little difference of task performance between the self-paced and the externally paced conditions, the externally paced condition induced increments of respiration and blood pressure. On the other hand, Burns et al. (1993), who operated latitude by a task selection, indicated that the latitude was related to the decrement of diastolic blood pressure in the low demand situation. Hutt and Weidner (1993) also showed perceived control reduced negative affects, by using the task selection procedure. High latitude (controllable) might have relation to high performance and to low psychological and physiological strains.

Martin and Wall (1989a) assumed that task demand and responsibility were closely related to each other in all kinds of work. They found that the high task demand under a high cost responsibility situation elicited high strains. Martin and Wall (1989b) examined the effect of responsibility under the double machine operation situation. They found that high responsibility rather than job demands caused the increments of stress responses. As mentioned in the above findings, high responsibility might be an important factor to elicit strains.

Bhalla, Jones, and Flynn (1991) surveyed the role stress of workers in the Federal Government of Canada. They found that clerical workers were distinguished for high level of insufficiency, officers for high level of conflict and the lowest level of job satisfaction and organizational commitment, and managers for higher level of perceived responsibility to others. Although managers have the decision latitude (Kawakami, Kobayashi, Araki, & Furui, 1995), they might perceive high role responsibility and therefore be in the state of high stress. These findings show that individuals with controllability like managers also perceive high role responsibility. According to the Job Strain Model (Karasek, 1979), high latitude reduces strains even under high task demand. Therefore, the notion from this model is inconsistent with the findings from research done on responsibility.

Price (1982) proposed the accountability hypothesis that type A individuals performed better than type Bs in the accountability situation. Accountability is a duty to disclose contents and results of work and performance. Therefore, disclosures of results are connected to reveal the locus of responsibility. Yarnold, Mueser, and Lyons (1988) examined the accountability hypothesis. They operated accountability by disclosures of individuals' performance of a simple task using type A and B individuals. They found that type A individuals showed higher performance than type Bs, which supports the Price's hypothesis. This high performance might be caused by competitiveness by type A individuals. Type A individuals during a game showed a greater desire to win the competition, and higher heart rate (Shahidi, Henley, Willows, & Furham, 1991). Svebak, Knardahl, Nordby, and Aakvaag (1992) reported that type A individuals showed increments of heart rate during a video game. Dembroski, MacDougall, Herd, and Shields (1979) reported that type A subjects responded with greater systolic blood pressure and heart rate elevation than type Bs during a cold pressure task and a choice reaction time task.

Blumenthal, Lane, Williams Jr, McKee, Haney, and White (1983) reported that type A individuals showed increased systolic blood pressure, heart rate, and skeletal muscle vasodilatation in incentive and non-incentive conditions, while type Bs showed increased heart rate and systolic blood pressure only when incentives were offered. Type A individuals show hyperactivity of cardiovascular system during performance (see, Houston, 1983).

As mentioned above, latitude and personal control, which has been considered as a stress reduction factor (Karasek, 1979; Steptoe & Appels, 1989), might elicit stress responses because of responsibility induced by personal control over work. Therefore, personal responsibility must be compared with latitude in the stress situation. According to the accountability hypothesis, especially, type A individuals might show greater stress responses under high responsibility situations. Type A behavior pattern is a valuable mediating factor of stress elicitation. The present study aimed to examine the effect of personal responsibility and latitude for type A and B subjects on psychological and physiological strains.

METHOD

Subjects

Subjects were selected from 524 undergraduates (male 239, female 285, mean age 19.1 yrs ranging from 18 to 21yrs) using a self-check list of type A behavior pattern (TABP), the Coronary-prone Type A Scale for Japanese students (CTS; Seto, Hasegawa, Sakano, & Agari, 1997). CTS consists of three factors; hostility, Japanese workaholic, and perfectionism. Each factor contained 10 items. The principle component factor analysis with varimax rotation was carried out to select valid items, and then four items in a Japanese workaholic factor were omitted from TABP assessment because of their low factor loadings. Scores of TABP were the total of 26 items of CTS. Finally, 62 undergraduates were used as subjects, who were assigned into four experimental groups, that is, 16 type A subjects for low responsibility (male 8, female 8, mean age 19.0yrs), 15 type As for high responsibility (male 8, female 7, 19.0yrs), 15 type Bs for low responsibility (male 7, female 8, 18.9yrs), and 16 type Bs for high responsibility (male 6, female 10, 18.9yrs). As distributions of male and female and mean ages were almost equal for each group, there were no gender and age differences. CTS scores for each experimental group are shown in Table 8-1. The result of analysis of variance (ANOVA) yielded that only TABP showed statistically significant difference ($F(1,58)=258.72$, $p<.001$). Scores of TABP for responsibility condition were controlled. No subjects were taking any medication at the point of the experiment.

Table 8-1. Mean scores of the Coronary-prone Type A Scale for Japanese (CTS)

Responsibility	Type A	Type B
Low	97.6 (5.8)	73.2 (7.7)
High	99.1 (5.3)	77.3 (3.6)

Note: Standard deviations in parentheses

Experimental design

The present study used three independent variables; that is, type A behavior pattern, personal responsibility, and latitude. As mentioned above, subjects were assigned into type A and B groups by CTS scores. Personal responsibility was operated by whether individual result of performance was disclosed or not. Subjects in the low responsibility condition were instructed that only the team performance would be announced to team partners, while subjects in the high responsibility condition were instructed that results of individual performance besides the team one would be announced to team partners.

Latitude was operated by an availability of management of task paces. For the low latitude conditions, tasks were started at random intervals ranging from 0.2 to 2.2 second (mean=1.2) according to the procedure of Iwanaga (1996). For the high latitude conditions, subjects could start tasks at their own paces. Tasks were not presented until subjects pushed the start button after the presentation of the message "Push start button." When the button was pressed, tasks started 0.3 second later.

Task

The task in the present study is a modified version of the mental arithmetic task by Bohlin et al. (1986). Two equations of addition and subtraction composed of single digit numbers were vertically presented at the center of the display. Subjects were instructed to answer an absolute value of difference between the two equations through a computer keyboard. Each absolute value as an answer was set up to be a single digit number. For example, when equations of "4+9" and "6-2" were presented, subjects would press the "9" key.

Presentation period of questions in the trial session was the mean response time in a practice session plus 1 second. When subjects could not answer within the presentation period, the task presentation was terminated and this trial was categorized as an error. Subjects were told that the presentation time of the task was a mean response time for normal undergraduates.

Procedure

The experiment was carried out by a group of three subjects. The three subjects entered a soundproofed experimental room together and sat side by side. Ag/AgCl electrodes were attached to their chests and measured their heart rate during a 5 min pre-base period. Subjects were told how to perform the task and that the result of the team performance would be compared with those of others. Subjects were told that they would receive rewards if the team performance was superior to the standard, but they did not receive any reward actually. Subjects received both low and high latitude conditions, which consisted of a 1 min practice session and a 5 min trial session, and the order of the latitude condition was counterbalanced among the groups. During the trial sessions, the heart rate was continuously measured. After the trial sessions, subjects completed questionnaires and then the heart rate was measured during a 2 min post-baseline.

Apparatus

An electrocardiogram was recorded by a polygraph 360 system (NEC medical systems) and translated into beats per minute (bpm) data by tachometer 1312 (NEC medical systems). BPM data were digitized per 1 second and recorded by a personal computer (EPSON 386GE) through an A/D converter. Tasks were independently presented by three personal computers (NEC PC-9801FA and PC-9821Xe10 and EPSON 386GE) for each subject.

Measures and analysis

Measures used in the present study were subjective, physiological, and behavioral indices.

Subjects rated questionnaires relating to apprehensions about appraisal, perceived control, perceived competition, boredom, and tension. Numbers of the items were 4 for apprehensions about appraisal (e.g., "I worried to be appraised by others."), 3 for perceived control (e.g., "I felt control over tasks."), 2 for perceived competition (e.g., "I thought I would lose the game."), 3 for boredom (e.g., "I felt sleepy."), and 2 for tension (e.g., "I felt tension."). Subjects answered the above questionnaires after each trial session. The scales were 7-points Lickert type, ranging form (1) "very little" to (7) "very much", and averaged scores for each sub-scale were used.

As physiological index, heart rate was measured during a pre-baseline period, trial sessions, and a post-baseline period. Heart rate was averaged for each period and session. Measures of heart rate were changes of beat per minute during trial sessions from pre-baseline period.

Mean reaction time and correct rate were used as behavioral indices. Medians of reaction time of correct responses for each subject were used for statistical procedures. Task start timing, which was intervals between the presentation of a message about the task start and a button push to start a task, were also measured. Reaction time and task start timing were measured in millisecond order.

All responses were analyzed by three-factor analysis of variances (ANOVA), TABP (2) × responsibility (2) × latitude (2).

RESULTS

Behavioral responses

Mean inter-trial interval in the high latitude condition was 1.23 second (SD=0.21), which is almost the same as that in the low latitude (mean=1.2 second). Mean numbers of responses during the trial session were 90.5 in the high latitude and 90.1 in the low latitude conditions, and there was no significant difference between the two conditions ($t_{(61)}=0.67$, n.s.).

Table 8-2 shows mean reaction time and correct response rate for each condition. Mean reaction was significantly shorter in the high latitude condition ($F(1,58)=6.25$, $p<.05$). Second interaction of TABP X responsibility X latitude approached significance ($F(1,58)=3.57$, $p=.06$). Although type A subjects showed shorter reaction time in the high responsibility condition, type Bs showed shorter in the low responsibility condition. Correct response rate in the high responsibility condition was better than that in the low responsibility condition ($F(1,58)=5.63$, $p<.05$) and type B subjects performed better than type As ($F(1,58)=4.07$, $p<.05$). Since the effect of latitude was significant, correct response rate in the high latitude was better than that in the low latitude condition ($F(1,58)=16.40$, $p<.001$).

According to results of behavioral responses, correct response rate for ttype B subjects in the high latitude condition was higher than the other conditions, while reaction time was shorter in the low latitude than in the high latitude conditions.

Table 8-2. Mean reaction time and correct response rate

	Low responsibility		High responsibility	
Latitude	Low	High	Low	High
Reaction time (sec)				
Type A	2.03(0.31)	2.15(0.36)	1.99(0.33)	2.01(0.35)
Type B	2.21(0.42)	2.14(0.40)	2.20(0.38)	2.32(0.34)
Correct response rate (%)				
Type A	53.1(12.7)	64.9(10.9)	62.0 (9.1)	69.2(10.8)
Type B	63.4 (9.6)	66.4(12.0)	64.0(13.1)	73.0(12.0)

Note: Standard deviations in parentheses

Subjective responses

Table 8-3 shows mean scores of sub-scales of subjective questionnaires for each condition. As for apprehensions about appraisal, no main effects or interactions were significant ($Fs(1,58)=0.10$ - 1.79, n.s.). There was no difference in apprehensions about appraisal for any experimental conditions. Perceived control showed a main effect of latitude which was significant. Subjects perceived more control to execute the task by their own paces in the high latitude condition ($F(1,58)=14.00$, $p<.001$) and perceived more competitiveness in the high responsibility condition ($F(1,58)=4.83$, $p<.05$). A main effect of latitude showed that subjects felt more boredom in the low latitude condition ($F(1,58)=4.83$, $p<.05$). As for tension, there were no main effects of experimental conditions ($Fs(1,58)=0.75$ - 2.20, n.s.), while an interaction of responsibility and latitude was significant ($F(1,58)=6.11$, $p<.05$). Subjects felt more tension in the high responsibility and low latitude condition.

According to subjective responses, responsibility heightened competitive and tense feelings. Although subjects felt at ease in the high latitude condition, they were felt more boredom in the low latitude condition.

Table 8-3. Mean scores of sub-scales of subjective responses

		Low responsibility		High responsibility	
	Latitude	Low	High	Low	High
Apprehension for appraisal					
	Type A	3.8 (1.3)	3.8 (1.4)	4.3 (1.0)	3.9 (1.1)
	Type B	3.4 (1.7)	3.4 (1.4)	4.0 (1.4)	3.8 (1.4)
Perceived control					
	Type A	2.9 (0.8)	3.3 (1.1)	2.9 (0.8)	3.5 (1.0)
	Type B	3.1 (0.9)	3.5 (1.0)	2.9 (0.9)	3.5 (1.0)
Perceived competition					
	Type A	2.9 (1.2)	3.0 (1.4)	3.9 (1.7)	3.9 (1.5)
	Type B	2.6 (1.6)	3.0 (1.4)	3.4 (1.5)	3.3 (1.5)
Boredom					
	Type A	2.7 (1.0)	2.7 (1.1)	3.3 (1.1)	2.7 (1.1)
	Type B	3.3 (1.1)	3.0 (1.0)	2.6 (1.3)	2.4 (1.1)
Tension					
	Type A	4.2 (1.0)	4.5 (1.3)	5.2 (1.1)	4.4 (1.2)
	Type B	4.0 (1.4)	4.3 (1.5)	4.4 (1.6)	3.8 (1.4)

Note: Standard deviations in parentheses

Table 8-4. Increments of heart rate from base-line (bpm)

	Low responsibility		High responsibility	
Latitude	Low	High	low	High
Type A	6.4 (4.6)	8.1 (7.2)	13.6 (6.3)	17.5 (8.9)
Type B	8.5 (7.7)	8.7 (6.8)	8.7 (6.8)	8.8 (9.5)

Note: Standard deviations in parentheses

Physiological response

Heart rate as a physiological index is shown in Table 8-4. ANOVA showed a main effect of responsibility which was significant ($F(1,58)=6.87$, $p<.05$). Increments of heart rate were greater in the high responsibility than in the low responsibility conditions. A significant interaction between responsibility and TABP ($F(1,58)=6.58$, $p<.05$) shows that type A subjects in the high responsibility condition had the greatest increment of heart rate in all conditions. Personal responsibility elevated heart rate.

Particularly, type A behavior facilitated heart rate increment.

DISCUSSION

The present study examined the effect of personal responsibility and latitude for type A and B individuals on stress responses under the task performance. Personal responsibility elevated psychological and physiological stress responses. Especially, type A subjects were affected by responsibility. Since type A subjects responded faster than type Bs, TABP affected the task performance.

Since subjective and physiological responses were higher in the high responsibility condition, responsibility might be related to the facilitation of stress responses. Because type A subjects showed greatest increment of heart rate in the high responsibility condition than any other conditions, type A individuals might be easily affected by responsibility. On the other hand, latitude (personal control) was not related to stress reduction except for subjective tension under the high responsibility condition. This result does not support the previous studies (Bohlin et al., 1986; Steptoe et al., 1993; Steptoe et al., 1997). Personal control under high responsibility facilitated the activity of the autonomic nervous system in the present study. On the other hand, previous studies noted that personal control over tasks lowered stress responses. This difference might be concerned with personal responsibility. As the previous studies did not examine the effect of responsibility, latitude or personal control might have been related to stress reduction. If, however, latitude was interacting with personal responsibility, the reduction effect of stress by latitude might be masked by personal responsibility. As Martin and Wall (1989a) noted, responsibility might be a dominant factor eliciting stress.

Increments of stress responses by personal responsibility in the high latitude condition might be related to the causal attributions of low performance. Since subjects in the high latitude condition could manage the task start by their own paces, low performance would be attributed to subjects' failures of self-management of the task performance. In the high responsibility condition, therefore, subjects would be apt to attribute their low performance to failures of their own management. On the other hand, since the task start depends on the management by experimenters in the low latitude condition, subjects could attribute their failures and low performance to unsuccessful management of task pace by the experimenter. That is, if control over situations is connected with responsibility, control itself may be related to stress elicitation.

The effect of personal responsibility was remarkably pronounced among type A persons. As characteristics of type A individuals are competition, hostility, perfectionism, and so on (Friedman & Rosenman, 1974), they were strongly motivated by controlling the situation and by competing to overcome others. Therefore, type A individuals might be easily affected by the effect of personal responsibility. As type A individuals showed high performance in high responsibility situations (Price, 1982), they were always in the condition to make over-effort. Since their efforts facilitated cardiovascular activities (Bongard & Hodapp, 1997), responsibility might be related to the coronary heart disease for type A individuals. Though type A subjects under high responsibility felt tension under low latitude more than high latitude condition, heart rate showed contrary results. There was dissonance in expressions between psychological and physiological indices for latitude and responsibility.

As for task performance in the high latitude condition, reaction time was longer, while correct response rate was higher. That is, reaction time and correct response rate were traded-off. Since subjects could manage the start of tasks, they might select the strategy that they spent enough time to solve tasks in order to perform better. Correct response rate in the high responsibility was higher than that in the low responsibility condition. This result showed that disclosures of the results of subjects' performance facilitated the motivation to perform better. There were no differences of correct response rate between type A and B subjects. As for reaction time, however, type A subjects had shorter reaction time, while type Bs had the contrary result. Therefore, type A subjects showed better performance than type Bs. This result supports the accountability hypothesis by Price (1982). Personal responsibility might be an overloaded factor for type A individuals in the work situation.

LIMITATION

As described below, there are three limitations in the present study.

The first limitation is the problem of subjects used in the present study. We used Japanese undergraduates, whose TABP scores are different from those for Western people. Japanese tended to show low hostility (Hayano, Takeuchi, Yoshida, Jozuka, Mishima, & Fujinami, 1989) but high time urgency and perfectionism. As Japanese people are also said to be shy, they tended to feel apprehensions for disclosures of personal performance. Therefore, they might be sensitive to personal responsibility for their performance. Characteristics of Japanese individuals might affect the results of the present study. Furthermore, job contents, degrees of control, and responsibility of jobs are different between employers and employees. As undergraduate students used in the present study have no job, they did not know enough about control and responsibility at work. Therefore, results from the present study should be interpreted carefully.

The second limitation is the problem of a physiological index; we used only heart rate. Since we adopted group experiment by a group of three subjects, we could not measure other physiological indices. As blood pressure is usually used as a physiological index of stress, many studies measured blood pressure to assess the cardiovascular activity system. Since heart rate was increased by the task effort (Bongard & Hodapp, 1997; Gerin, Litt, Deich & Pickering, 1995), increments of heart rate observed in type A subjects might be caused by over-effort to execute responsibility. To assess the cardiovascular activity accurately it is necessary to measure blood pressure and respiration, besides heart rate.

The third limitation is that the present study is a laboratory analogue study. Though stress loadings in the laboratory setting are acute, those in real work situations are tonic, which may differ from those in the present study. Increments of heart rate in the present study, which were over 13 bpm for type A subjects under high responsibility conditions, were greater than those in the previous studies (e.g., Burns et al., 1993; Steptoe et al., 1993). However, since these increments were observed in the short period because of the laboratory setting, one should be careful to interpret the present findings. Further research in the real work settings must be examined.

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