

PROCEEDINGS OF THE 30TH ANNUAL CONFERENCE OF THE HUMAN ERGOLOGY SOCIETY

Tokyo, June 29 - 30, 1995

Secretary: Mamoru Umemura
Department of Management Science, Faculty of Engineering
Tokyo University of Science
Tokyo, Japan

Time-budget of shift workers in a glass factory in Thailand

Tsuyoshi Kawakami, Akiyoshi Ito, Kazuhiro Sakai, and Kazutaka Kogi
The Institute for Science of Labour

Previous researches concerning shift workers in Thailand revealed inconvenience in their life such as irregular meals and sleep hours. The present study thus intended to clarify the time-budget of shift workers in Thailand and to discuss their improvements. A time-budget questionnaire was applied to 30 workers (15 males and 15 females) in a glass factory employing 700 workers. The factory adopted a three-shift continuous shift system by 4 teams. The workers were asked to fill up questionnaires about their time-budget such as work hours, mealtime and sleep time for 10 days continuously. Response rate to the time-budget questionnaire was 100%. The time-budget results revealed workers' frequent changes of their shifts. Also frequently observed was continuous double shift work. For example, a male worker worked 14 shifts in the studied 10 days by being engaged in 5 double shifts and a triple shift. Comparing the relationship between work hours and other time components, both housekeeping time and sleep time became shorter when work hours became longer. The present study indicated that shift work in the studied factory was rather freely managed by the workers at work site, resulting in flexible shift changes or double shift work. Long and continuous work hours caused by double and triple shifts were considered to pose health and safety risks to the shift workers. In conclusion, practical advisory approaches to improving their shift systems for their healthier working life are recommended.

On the relationship of sound preference to work performance

Ichiro Hashiba ¹, Shinichi Nomura ², and Murako Saito ¹

¹ *Waseda University*, ² *Daiwa House Industry Co., Ltd.*

The recent life style has changed in a great extent which is caused by the wide variety of daily habits and performances in response to the external stimuli in the perceptual level. This experimental study aims at assessing the effect of sound preference on work performance and also at clarifying the relationship between psychological response to daily environmental sounds and work performance.

Test subjects were 13 male and 3 female students who were asked to perform a continuous calculation task of adding and subtracting figures under exposure to the test sounds provided for this experiment. These test sounds were extracted by a factor analysis in the preliminary experiment. They were 6 kinds of sounds with 3 sound pressure levels (40, 55, 70 dB) for each sound extracted.

Questionnaires on daily life and semantic differential method composed of 7 items of adjectives were applied for assessing preference and psychological response to daily environmental sounds.

The experiment revealed that as sound pressure increased, discomfort increased, while work performance decreased. A quantification theory I, applied to the standard deviations of work performance as criterion variables and of sound preference as predictor variables ($r=0.93$), verified that the difference in sound preference affect work performance. More precise measurements of the sound frequency and time sequential characteristics are needed to verify the effect of individual environmental sounds on work performance.

Changes in HIV/AIDS-related information sources, knowledge and prejudice among high school students in Tokyo in 1989 and 1992

Fumika Okajima, Shunichi Araki, and Katsuyuki Murata
University of Tokyo

Two independent study populations of senior high school students were examined using the same self-reported questionnaire in 1989 and 1992, to clarify which factors were associated with the prejudice against persons with human immunodeficiency virus (HIV) or acquired immunodeficiency syndrome (AIDS), together with the changes in information sources, knowledge and beliefs of HIV/AIDS from 1989 to 1992. A complete set of responses were obtained from 541 students (98.9%) in 1989 and from 517 (99.4%) in 1992. The results were as follows:

1) More than 90% of the students received information on HIV/AIDS from television in the two years data. The students of both sexes having received the information from school teachers and female students having received it from magazines increased significantly in proportion over three years. Knowledge about the modes of HIV infection was higher in 1992 than in 1989. The percentage of students who intended to continue to be friends with a classmate with AIDS increased significantly from 42% to 77%.

2) The result of multiple logistic regression analysis indicated that the absence of the consideration for the confidentiality of persons with AIDS and the low level of knowledge on HIV/AIDS were significantly related to the prejudice against a classmate with AIDS in 1989 and 1992; and, the sex and the perception about the chance of HIV infection were also significantly related in 1992.

These findings suggest that information from school teachers and/or mass media may promote correct understanding of HIV/AIDS, and correct knowledge and consideration for the confidentiality of persons with AIDS seem to reduce the prejudice against such persons.

Relationships between sleep patterns of mothers and movements of their infants during nights of the postpartum period

Kyoko Nishihara¹ and Shigeko Horiuchi²

¹ Tokyo Institute of Psychiatry, ² St. Luke's College of Nursing

The relationships between sleep patterns of mothers and movements of their infants during nights in postpartum period were studied under conditions in daily life. Subjects were ten primiparae, aged 23-31 (mean age of 26.8) and their infants. Mothers' polysomnograms and actigrams of infants' legs were simultaneously recorded using Medilog 9000 at home in the 1st, 3rd and 6th postpartum weeks. Polysomnographic recordings of mothers were also made during late pregnancy (36 weeks). Mothers' sleep stages and their infants' movements were visually scored by an epoch of one minute.

The infants' movements were classified into four states (i.e., MOV0, MOV1, MOV2 and MOV3) which were defined as epochs with 0, <20, 20-40, 40-60 sec activity, respectively.

Sleep parameters of mothers were compared among the four periods (i.e., late pregnancy, the 1st, 3rd and 6th weeks of postpartum) using a two-way ANOVA (period x subject). Total sleep time was not significantly different among the four periods (pregnancy: 361.9min, postpartum 1st: 313.8min, 3rd: 312.9min, 6th: 312.6min). Percent of waking time in the postpartum period (1st: 25.1%, 3rd: 21.3%, 6th: 20.8%) significantly increased as compared with the late pregnancy period (6.3%). Percent of stage 3+4 and stage REM did not change across the four periods, but percent of stage 2 in the postpartum period (1st week: 36.2%, 3rd: 38.4% 6th: 37.1%) significantly decreased as compared with the late pregnancy (56.1%). Mean percent of each state of the infants' movements for time in bed were 52.9% for MOV0, 31.4% for MOV1, 8.1% for MOV2, and 7.7% for MOV3. Percent of mothers' waking epochs synchronized with each state of the infants' movements was calculated for total epochs of each state. In 13.0% of MOV0, 26.8% of MOV1, 55.3% of MOV2, 86.9% of MOV3, wakefulness was observed in mothers. This result was consistent across the 1st, 3rd and 6th weeks.

In conclusion, the mothers seemed to sleep effectively during the postpartum period, though their wakefulness at night increased. The mothers' wakefulness during night in the postpartum period was related to their babies' movements, and its relationship was consistent through the 1st, 3rd, and 6th weeks. The mothers' wakefulness in the postpartum period may decrease when their infants acquire circadian rhythms.

Change of leg length in Japanese during the last 50 years, since the end of World War II

Kumi Ashizawa and Chiyoko Kumakura

Otsuma Women's University

This discussion was based upon the data from the Ministry of International Trade and Industry (MITI), and the Ministry of Education, Science, and Culture (MESC).

1) In the MITI series, a comparison between 1978-81 and 1992-94 data sets was made for stature, body weight, crotch height, upper chest circumference for males, and waist circumference for females in 10-year-old, 20-24, and 45-49 age groups. It became clear that stature, body weight and circumferences from the 1992-94 group were significantly larger than those from the 1978-81 group. For crotch height, however, no significant increase was detected in all male groups and the age 10 female group, in which the adults' crotch height was rather diminished by 4 or 5 mm. In contrast, the female's crotch height increased by 7-13 mm. That is to say, the Japanese became bigger in general, but the Japanese male's leg length relative to stature became smaller during these 14 years, whereas the Japanese female's legs continued to elongate.

2) In the MESC series, the stature and leg length (stature minus sitting height) of school children aged 7-17 were analyzed cross-sectionally and semi-longitudinally from 1900 to 1994. As a cross-sectional observation, stature in both sexes increased from 1900 to 1939, but it decreased during the World War II; the 1948 stature was smaller than that of 1939. This diminution was less marked in girls than in boys, and greater in adolescent children than in pre-and post-adolescent children. As a semi-longitudinal observation, an increase in the leg length/stature ratio seems to have stopped during the past 10 years or more. Between boys and girls, there was a different trend; boys born in 1977 have smaller leg/stature ratio than boys born in 1967 at ages 15-17, while girls born in 1977 have a little greater leg/stature ratio than girls born in 1967 at age 17.

In conclusion, elongation in the absolute and relative leg length has stopped in Japanese males since the 1980s, whereas they are still continuing to elongate in Japanese females, especially in the younger.

Relative foot size and shape to general body size in Javanese, Filipinas and Japanese with special reference to habitual foot gear types

Chiyoko Kumakura ¹, Ayano Kusumoto ¹, Kumi Ashizawa ¹, and Shuichiro Narasaki ²

¹ *Otsuma Women's University*, ² *Gunma Museum of Natural History*

Stature, body weight, left foot length and breadth were measured on East Javanese (103 females and 126 males, in 1991, children and adults, age unknown), Filipinas in Northern Luzon (34 women, in 1989), and Japanese in Tokyo (300 boys and 325 girls, aged 6-18, in 1985; 40 women in 1991 and 107 men in 1995). No footgear was used by the Javanese, rubber sandals were used by the Filipinas and sneakers or leather shoes were used by the Japanese group. Regression lines regardless of age were obtained among the above four measurements, body mass index (BMI), and relative foot breadth to foot length. The relationships between general body size and foot size/shape were examined in regard to the footgear used. The results can be summarized as follows:

- 1) In either sex, as compared with the Japanese, the East Javanese have a longer foot for the same stature and body weight, and a wider foot for the same BMI and foot length.
- 2) The relationship between BMI and foot shape (breadth/length) is nearly the same in the Filipinas and Japanese females.
- 3) Sexual dimorphism of the foot is greater among the East Javanese than among the Japanese.
- 4) As body size/weight increases, the sexual dimorphism diminishes among the East Javanese, whereas it is more emphasized among the Japanese.
- 5) The appropriateness is supported for estimating the stature of prehistoric humans using the regression equation between the stature and foot dimensions obtained from the present-day bare-footed people.

Walking of mentally retarded children from the viewpoint of force plate analysis

Tomoyasu Yasui ¹ and Kazuo Maie ²

¹ *Hokkaido University of Education*, ² *Otsuma Women's University*

In order to clarify the force characteristics during walking in the mentally retarded children, their walking gait was analyzed by using a force plate. The subjects were students of a special school for mentally retarded, whose ages were from 12 to 15. The time measures analyzed, were the time points at which the maximum braking force, the maximum acceleration force, the 1st and 2nd vertical peak forces, and the polar minimum vertical force occurred, respectively. These were normalized by the contact duration of the foot. The force measures were the maximum braking force, the maximum acceleration force, the 1st and 2nd vertical peak forces, and the polar minimum vertical force, each of which was normalized by the subject's body weight.

The values of the time measures in mentally retarded children were almost the same as those in healthy children, except for the time of the 2nd vertical peak force, which showed a greater variance. In the force measures, however, the maximum acceleration forces were smaller and the polar minimum forces were larger in the mentally retarded than in the healthy children. These results suggest that nervous systems controlling the timings of walking gait are not so different between the mentally retarded and the healthy children, while the muscle forces are weaker in the former.

The same analysis was performed after 3 years of muscle training to the same subjects. Almost all subjects didn't show a clear training effect, but a few subjects showed appreciable improvements. Based on the above results, we shall make a better plan to improve their walking gait.

Laterality and movement characteristics of picking up an infant

Hiroko Iwata

Nagoya Women's University

To clarify the relationship between the movement of a person in picking up an infant and laterality of the person, an experiment was conducted using two baby dummies of different sizes (66cm/7.5kg and 75cm/10.0kg). The subjects were 37 female students aged from 20 to 22, who had no prior experience in picking up an infant in the arms. Laterality of the subject was firstly examined. Then the subjects were instructed to approach the smaller dummy, which was lying on a low seat (37.4cm), and take it up in the arms by two ways; at first taking it up approaching from the dummy's right side, and then from the dummy's left side. The same instruction was given to the subjects using the larger dummy.

In the case of right-handed subjects (N=35, 94.6%), the following was observed.

1) In both of the approaching ways from the right and left side, more than half of the subjects (N=21, 60.0%) bent hips and kept the torso in a relatively horizontal position when picking up the dummy. Additionally, about half of the subjects (N=17, 48.6%) carefully picked up the dummy in both arms in a face-to-face position (slightly more subjects did so with the larger dummy).

2) For both of the smaller and larger dummies, the subjects used their arms similarly with respect to the side from which they approached the dummy. About half of them (N=16, 45.7%) carried the dummy in their arms in a face-to-face position with one arm under one of the dummy's armpits and the other arm around its hips. Some subjects (N=8, 22.9%) used both arms in a parallel position to scoop up the dummy. The other subjects (N=6, 17.1%) lifted the dummy with their hands under the dummy's left and right armpit.

3) Whenever a subject approached the dummy's right side, she usually carried it on her left chest. Similarly, whenever she approached the dummies left side, she usually carried it on her right chest. These results seem to show that the side from which the subject approached the dummy tends to determine its initial carrying position on the chest of the subject. Therefore, the side of the chest where a dummy (or an infant) is initially carried seems to be independent of the laterality of the carrying person.

Differences in increase of force between thumb and index fingers in deployment of pinch force

Katsunori Tanii

National Institute of Bioscience and Human-Technology

This study was conducted to investigate functional roles of the right thumb and index finger in a ballistic deployment of a pinch force. Forces exerted by the two fingers were independently measured by strain gauge methods and summed up in a personal computer. Experiments were conducted under load intensity conditions of 20%, 50%, and 80% of the maximum pinch force (summation of the forces measured for the two fingers). In the experiment of each load intensity, the ballistic pinch force was exerted 15 times under two conditions, i.e., with and without display of the load intensity.

In the same load intensity, there were no differences in standard deviations of the summed pinch forces between the display conditions. This result shows that the summed pinch force produced without the display was more similar between the trials than was expected. The maximum rate of force increment was larger in the thumb than in the index finger. The force increased faster in thumb than in the index finger in the middle portion of the rising phase from the onset to the peak force. How-

ever, in the latter portion of the rising phase close to the peak force, the rate of force increment was smaller in the thumb than in the index finger.

These results suggest that, in the deployment of the pinch force, the thumb plays an effective role in an enhancement of the force exerted by the index finger, especially in a phase just before the peak force.

Occupational safety and health activities on greenhouses working in Kochi

Shigeki Koda and Hiroshi Ohara

Kochi Medical School

Greenhouses have been popular in Kochi because of the geographic characters. In the viewpoint of occupational safety and health, high incidence of injuries, aging in farmers, high incidence of work-related musculo-skeletal disorders (low back pain, neck and upper limb disorders etc.), hazardous chemical agents and so on, have been reported as serious occupational safety and health problems.

While these occupational safety and health issues have been discussed among farmers, agricultural extension service workers, and specialists, we have proposed many improvements. These improvements in greenhouses working are divided in five categories; avoiding dangerous agents, improvements as for working environments, helpful tools in handling heavy materials, ergonomic improvements in planting, selecting, pruning and harvesting, and providing adequate personal protective equipments. Providing and conducting occupational safety and health improvements not only in agriculture worksites but also in small-sized industrial enterprises, we have to recognize what workers need, and to communicate with them adequately. Their concern is often productivity, and we should offer improvements which could provide higher productivity and a better place for working. In fact, practical improvements providing higher productivity popularize widely. Second, we have to conduct improvements using adequate methodology (for example, industrial hygiene, toxicology, ergonomics, occupational medicine, occupational physiology, and so on). Last, we have to discuss with workers when improvements have been conducted, and to evaluate what the improvements have provided. It is very important to consider these processes in order to succeed in improvements at worksites.

Preferred bathroom chair height during body-washing

Satoshi Kose ¹, Yoshiaki Goto ², and Takayuki Nakamura ²

¹ *Building Research Institute*, ² *Sekisui House Co. Ltd.*

Bathroom chairs commonly sold in the Japanese market have a typical height of approximately 150 mm. It is much lower than normal chairs, and it surely imposes uncomfortable posture during body washing in the washing area. In order to determine the favorable chair height, relationships between bathroom chair height and subject's posture during simulated body washing were examined. Two typical activities were chosen as representative, i.e., washing the face with a wash basin and washing the feet. Nine elderly and 7 younger subjects participated in the face washing experiments, and 16 elderly and 5 younger subjects in the foot washing experiments. The subjects were asked about their preferences. Chairs with different heights, i.e., 150 mm, 250 mm and 350 mm were provided in the experiments. Subject's posture during the simulated activities was recorded on videotapes and later analyzed.

The height of the base of wash basin was evaluated the best if it was the same as the bathroom

chair height. Preferred height of the bathroom chair was 250 mm for elderly subjects, and 250 mm or 350 mm for younger subjects. One of the reasons for this difference was their stature.

The analysis of the subject's posture during face washing revealed that elderly subjects tended to adjust to the changes of the chair height with extensive movements of hands between the wash basin and face, while younger subjects changed the inclination of upper torso against the floor in order to adjust to the changes of the chair height. As to foot washing, the majority of elderly subjects preferred 150 mm, while younger subjects preferred 250 mm for the bathroom chair height. The reason for the preferences seems to have been influenced by the difficulty in reaching the floor where the feet were placed on. The subjects seemed to adhere to their own way of foot washing. It was, however, noted that an elderly subject, who already had knee problem, preferred a higher chair, because it enabled him to do the required activity more easily, once he changed his behavioral pattern from washing the feet placed on the floor to washing them while raising the foot higher up.

Japanese behavior in taking a bath

Hiroyuki Murata and Akihiro Hotta

Takarazuka University of Art and Design

At present, style of taking a bath in Japan is very diverse. We have various kinds of style for taking a bath such as in our own housing, the public bath, hotels in the city and hot spring resort, sport club, and health center. This diversity in the style of taking a bath applies not only to cleaning his/her own body, but also to soaking by putting the own body completely in hot water, and to taking a bath together with other persons in public bath. So in order to get the concept of bath design, we asked 68 young persons and 51 old persons for their opinions and behavior in taking a bath by a questionnaire. The results of this investigation were as follows:

- 1) The bath is equipped in most Japanese housing.
- 2) Japanese like taking a bath at least once a day.
- 3) The duration of taking a bath per day is 15-30 minutes and its purpose is to keep health and to clean the body.
- 4) Clean hot water is used to wash the body and face, and to shampoo hairs.
- 5) The aims to use public bath in hot spring resort are to take comfort and amusement.

From these results, two axes or factors were drawn representing the needs for Japanese to take a bath; one axis was characterized by health and amusement, and the other axis by privacy and publicity at the extremes. By a combination of these two axes, four concepts in the style of taking a bath can be proposed in near future.

How the aged perceive colors

Jiro Kajiwara and Haruhiko Sato

Kyushu Institute of Design

It is conceivable that the decline of visual functions with aging may affect perception of color. Although Yoshida and Hashimoto (1989) studied the color perception of the aged by photographing various colors with a color filter simulating cataract, it was no more than a simulation study. It is unclear how the aged actually perceives colors. As a fundamental step to clarify this problem, we carried out an experimental research on the color perception of the aged.

Thirty healthy elderly, 22 females and 8 males, from 60 to 90 years old, participated in the

present study. The subjects tried to discriminate 74 pairs of colors in three groups (A, B and C). Pairs of color in group A consisted of the colors which looked the same for the aged in the simulation study. The colors of group B were considered to be difficult to distinguish for the aged people. Group C was safety colors of Japanese Industrial Standard.

The results showed that some colors are easy to discriminate, some are not. There were no problems for discrimination of colors in group C. Thirty-one pairs of colors in A and B groups were difficult to be discriminated for 26 subjects. A certain trend was observed for the changes in color perception with aging. For group A, 18 subjects discriminated all colors, while 13 pairs of colors were distinguishable by all subjects. It has been found that the results of simulation study don't always apply to aged persons. Color perception of the aged appears to be different from that of the young.

Methodology of ergological studies

Haruhiko Sato

Kyushu Institute of Design

I dearly love the Human Ergology Society, because we talk frankly in the society. Attending an annual conference of the Society brings me energy with which I can spend next one year in the stressful world.

Essentially I grasp human ergology as biology of human living phenomena according to E. Haeckel's idea (*Die Lebenswunder*, 1904). He divided anthropology into morphology and physiology, and distinguished physiology into Ergologie (*Arbeitsphysiologie*) and Perilogie (*Beziehungsphysiologie*). The concept of work (*ergon*) was expanded to life. Ergology consisted of vegetative ergology and animal ergology.

Instinctive (genetic) element and learned (environmental) element constitute human behavior. It is conceivable that the adaptation by human learnability brings about nowadays 'high-tech' societies while genetic human attributes (human nature) are adaptive to living environments of hunters and gatherers which has lasted for long time in human history. Hunter-gatherers form a band consisting of about 25(30-100) persons and move in a more or less vaguely defined territory (1000-3000 km²). Unsuitableness of human nature for modern civilization has caused various problems. Keeping human nature in mind when considering human life is philosophical background of human ergology. This viewpoint is very important today when 'modernism' falls to ruin. Esteeming fieldwork among fieldwork, experimental study and study by literature is one of the methodological features of human ergology. Fieldwork necessitates observations, interviews and measurements.