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ERGONOMIC EVALUATION OF DATA ENTRY TASK PERFORMANCE UNDER THE INFLUENCE OF NOISE AND TASK STRUCTURE- THE EFFECT OF GENDER

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ABSTRACT

As computing has become an increasingly gender independent activity, efficiency of end users should be evaluated based on experimental investigation undertaken for both men and women. With this view an experimental study was conducted to explore the effect of gender on data entry task performance under the influence of noise and task-structure in a Human Computer Interaction environment. The performance measure was character entered per unit time (CEPUT). The result indicated that noise and task structure were statically significant and had a bearing on the operator's data entry task performance. On the other hand variable gender was found to be statically non-significant. The finding suggested that human computer interaction environment should be designed keeping the environmental as well as operational parameter at appropriate level.

Key-words: Human Computer Interaction, Noise pollution, Data entry
Task, Gender

1. INTRODUCTION

The use of visual display unit with the rapidly increasing pace of computerization in almost every walk of life has been continuously on increase**.** Numerous reports have observed that the computer usage causes occupational problems. The development in information system design suggests that VDU's will continue to be used as a medium for presentation of large amount of connected texts as in videotext, electronic journals, dynamic books or similar application. With the passage of time the user's interaction with their machines is increasing day by day. Throughout the 1980s the discipline of computer science become increasingly male dominated a trend which has continued into the 1990s. There can be little doubt that throughout this period computing has developed a masculine's image such as physics or engineering traditionally have (Chivers, 1987; Hawkins, 1985). As a result males perceive themselves to be more competent than females (Collis, 1985; Wilder, 1985). Unsurprisingly, then, there is a large body of research highlighting that females report more computer anxiety and negative attitude towards computers than males do (Brosnan and Davidson, 1994; Maurer, 1994;Whitely, 1997). Recent researches has identified and highlighted psychological gender as the salient factor determining computer anxiety and attitude, irrespective of biological sex (Brosnan, 1996; Colley, et.al., 1994; Rosen, et.al., 1987). Another study by Yelland & Lloyd (2001) found gender difference in the sense that boys obtain greater experience with computers by playing computer games than girls. Singh (2001) interviewed women who use the internet and found that they regarded it as a tool rather than as a technology for play or mastery. Various parameters may apparently influence the HCI like environment, working postures, distance from the VDU, level of illumination in the workplace, color contrast of the background and the projected matter, environmental variables like noise pollution, temperature, humidity etc. Data entry task is one of the computer related task extensively done by the operators. This task requires reading from source document and typing on the computer screen. Function of visual ergonomics is to optimize the perception of visual information used during the course of work, to maintain an appropriate level of performance, to guarantee maximum safety, and to provide acceptable visual comfort.

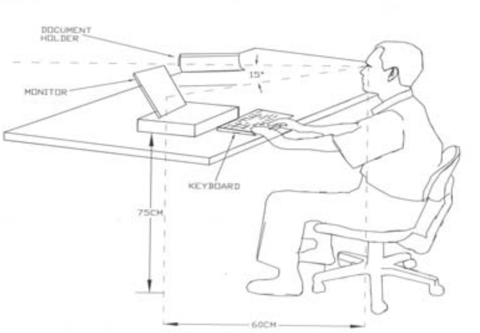
The readability of printed or typed text, and its comprehension is a function of a wide assortment of factors such as type style, type form (capital, lower case, boldface, italics, etc.), size, contrast, leading (spacing) between lines, length of lines, and margins. This presents obviously a very broad spectrum of variables. The color combination of the character/background of source document is an important factor in VDU text entry task. Text/background color of display constitute one of the variable that has been found to be having detrimental effect on performance of user population specially for desktop and lap-top type computing system. Ling and Schaik (2002) investigated the effect of color on the presentation of information in a navigation bar, and aims to contribute towards design guidelines for the use of color on the web. They studied the effect of combination of text and background color on visual search performance and subjective preference. From the analysis, the result showed that higher contrast between text and background color led to faster searching and were rated more favorably. Color can also be an effective way of communication if chosen properly. Recently researcher in color combination has exposed that the text/background color combination had a significant effect on reading performance (Wang and Chen, 2003). The author investigated the effect of text/background color combinations which were white on black, black on white, blue on white, red on white, blue on yellow and green on white. The result of the analysis of variances showed that different color combination settings of display had a significant effect on reading performance. This paper had suggested higher color difference of text/background color combinations to maintain good reading performance. The critical factor in text/background color combination is luminance contrast between the text and background colors. Shieh and Lin (2000) revealed that visual preference increased as the luminance contrast of text/background color combination become greater. Similarly, Wang, et al (2002) also reported that subjects' searching performance on leading display was improving when the color difference of text/background become larger. One of the important adopted parameter for assessing /evaluating the human performance is the noise level. The magnitude of decrement in task performance depends on nonauditory factors such as the difficulty of the task without noise and motivation of the person doing the task. The level of noise necessary to produce adverse effects is greatly dependent upon the type of task. Haslegrave (1990) concluded her review by stating that effects are difficult to determine and are task-specific. Simple routine tasks usually remain unaffected at noise levels as high as 115dB(A) or above while more complex tasks are disrupted at much lower levels (Suter, 1991). Workers are generally not motivated to do anything about noise at work because noise injury, poor efficiency and accompanying occupational hearing loss (OHL) occurs gradually, is not visible and has an uncertain time course in individuals (ISO, 1990, 1999). Multiplication and reading tasks performed by children with low intelligence were affected under the impact of continuous (51dB) and (55dB) intermittent noise (Johansson, 1983). Hartely et.al., (1986) showed that noise hindered the spatial strategy of the subjects in sentence verification task. Noise causes brief periods of inefficiency when sustained visual attention (e.g., visual target detection) is required without decrement in overall levels of performance (Berglund and Lindvall, 1995; Warner and Heimstra, 1972). Impulsive and continuous noise impairs the human performance in signal monitoring and tracing task (Loeb and Jones, 1978). The performance of the subject engaged in an audio-visual task under the impact of noise deteriorates (Arnoult and Voorhees, 1980). Noise hinders the performance of subjects in sentence verification and vowel and consonant recognition tasks (Hartley et.al., 1986; Fu et.al., 1998). Zaheeruddin and Garima (2006) developed a neuron-fuzzy model for predicting the effects of noise pollution on human work efficiency as a function of noise level, type of task, and exposure time. As far as this visually intensive task of data entry is concerned it was found from the literature reviewed that the topic under reference has not been studied in a major way under the influence of level of noise and task-structure from point of view of gender effect. This area becomes all the more important to investigate as more and more female workers are taking employment and human rights call to guarantee equal opportunity for employment irrespective of gender. Keeping this in view, the problem was formulated to study how the organismic variable gender affects human performance while carrying out the data entry task under the influence of task-structure and noise.

2 METHOD

2.1 Subjects:

42 Subjects (21 males and 21 females) were recruited from University Sains Malaysia who participated in this study. None of the subjects had any previous history of neuromuscular disorder. All the subjects were between 20 to 30 years of age (Mean = 24.6 years, SD = 2.5). All the experimental sessions were conducted between 0900 and 1300 hours.

2.2 Apparatus and VDT workplace condition



The experiment was conducted at an adjustable VDT workstation. Text was displayed on a A4 size paper. Three texts of required length (example shown in Appendix) were presented to the subjects. Source document from which subjects were doing data entry task was placed on a holder perpendicular to the line of sight. Text was entered on a Pentium ll computer, using a 60Hz, 96dpi 17-in high-resolution RGB monitor. The print was high contrast (Weber contrast 0.94). Luminance of letter was 0.146 candelas per square meter, and was kept constant. The light source was located overhead and to participant's side. Fluorescent tube light was used and no glare or reflection appeared on the VDT screen. The monitor as well as document holder were placed on a table 75cm in height. The front edge of table was 35cm from the screen center. The distance from the subject's eyes to the screen center was 60cm and measured by using auto-focusing video recorder. The inclination of monitor was 105^{0}. The angle of the screen was 15^{0} and recorded by using a goniometer below the horizontal line of sight. The same has been shown in Figure-1.

2.3 Experimental procedure

Before the actual experimentation, a pilot study was undertaken. This helped in preplanning the details of experimental session and checking the suitability of the observation sheet designed for collecting the experimental data. Following preparatory steps were undertaken before actually conducting the experiments.

(a) Each subject selected for the experiment was briefed about the objective of the experiment whereas the instructions to be followed by them while performing the experimental task were imparted to the subjects in writing.
(b) The subject-related characteristics like age, height and weight were recorded.
(c) A training session was organized for each subject in order to familiarize him with the procedure of the experiment mentioned earlier. One complete run for the experiment was undertaken for this purpose. After the subject had taken his seat in the experimental chamber and all the instructions imparted, the following steps were taken to collect data, for both training as well as experimental sessions:

1 A printed sheet that contained the matter content pertaining to the task in the form of a document fixed on the document holder was presented.
2 The text/background color of source document was presented in a randomized manner during the experimental session.
3 The call bell was triggered to signal "START" of the experimental session.
4 The subject responded by starting the data entry task.
5 The call bell was again triggered after 20 minutes to signal "STOP" of the task performed by the subjects.
6 The inter-trial period was 5 minutes for each subject
7 Number of words entered was selected by select icon of computer and subsequently words entered were noted down.

2.4 Selection of parameters and their levels

The data entry task performance was carried out in the School of Mechanical Engineering in a computer room in the above stated condition. Selection of appropriate levels of parameter under reference was very important for this purpose a through survey was taken in 100 computer centers to find out the levels of noise. Noise surveys are a useful method of evaluating the distribution of noise in a working area and the exposure of workers/operators. In present case noise survey was done by the approach that is called personal sampling as well as area sampling. In the present study three different computing environments was chosen. First was office environment where most of the work is done using computer now a days. In this place the survey was done using the area sampling as people working have fixed position and the noise is fairly constant. It was found during survey that some value of noise level increased due to some telephonic call enquiry or similar nature of work. Second place chosen in present study was professional computer learning centers where novices learn how to operate computer and other related job. In this place novices often move from one place to another in order to take help from fellows and talk, also instructions imparted to the learners also become a source of noise. Where as the third working environment chosen was commercial places where large number of people visit for different kinds of work (mega malls, cafeterias, public dealing govt/private offices). In the latter two environments survey method adopted was personal sampling because noise source is not always fixed. Noise may be due to movement of the people visiting or due to certain announcement from public address system etc. The noise level was measured with the help of sound level meter which is also a data storage and display device (Bruel & Kjaer Observer Type 2260). The sound level meter was calibrated before the actual measurement. The noise was measured in accordance with the guidelines furnished in ISO-1999 standard. The equivalent SPL (L_{eq}), weighted "A", were recorded. Sample of the equivalent noise recorded is shown in Figure-2. Sound level varied from 70dB(A) to 115 dB(A). Average = 85.65dB (A), SD= 10.43 dB(A). The frequency analysis of SPL (L_{eq}) of 1/3 octave band observed at the grid point of highest noise for each computer work station. The main peaks of noise ranged from 25 Hz to 65 Hz. On the basis of survey result the noise levels were set at 75dB(A), 95dB(A) and 115dB(A). The color combination of character and background of source document typically adopted is black character on white background for data entry kind of VDU task. However, it was found through the literature reviewed that higher color difference does play significant role in computer related work. Therefore, in present research three higher color combinations (black-on-white, white-on-black, red-on-white) were selected for the source document character/background color combination.

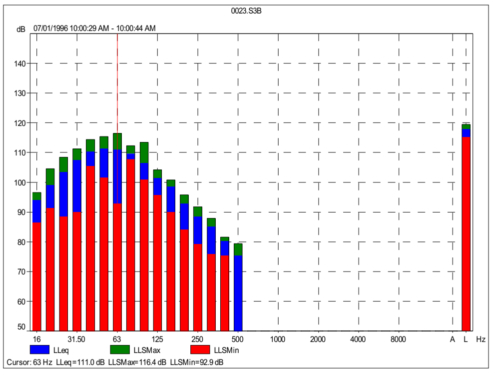


Figure 2: Observation sheet showing example of noise level during data entry task operation

2.5 Experimental Design

A three factor repeated measure type of experimental design was used to analyze the data. Human performance (measured in terms of number of characters entered per unit time) was treated as dependent variable while independent variables were noise level, text/background color of source document and gender.

2.6 Error handling

An error in this study is any difference between the given text and the text reproduced/entered by the subject. Subjects were required to perform the data entry task as detailed instruction given in experimental procedure section above. Typing speed as well as typing accuracy was recorded for each subject. The typing accuracy is defined as the percentage of characters correctly typed. An accuracy rate of 96% indicates an average of approximately three mistakes per line on an exercise. Although in literature the data entry speed is normally reported in word per minute but in this study the performance measure is taken in characters entered per minute because of the alphanumeric nature of the moderately and fairly difficult task. However it was found that error committed by the subjects were less than 3% while doing the data entry task.

3 RESULTS

Three experiments were conducted to study the effect of gender on data entry tasks (simple, moderately difficult and fairly difficult) performance of humans and they are described in more detail as under.

3.1 Experiment 1

In this experiment the gender effect on data entry task performance under varying levels of noise and task-structure (text/background color of source document) for simple task (example shown in Appendix, Task-A) was investigated. Result of the analysis of variance summarized in Table-1 implied that the effect of gender and task-structure were not statistically significant; however, the noise level was found to be statistically significant. It was found that the gender factor did not significantly interact with the noise and so was the case with noise and task-structure. Similarly the second order interaction of gender X noise X task-structure was found to statistically non-significant for the simple data entry kind of task considered in this study. The relationship between the human performances in terms of characters entered per unit time under varying levels of noise exposure was explored through regression analysis software and found to be linear in nature. The human Performance (HP) model obtained for varying levels of noise were as follows:

HP_{N1} = 125.27-5.0(T/B) ------------------------------ (3.1.1)

HP_{N2} = 110.86-3.9(T/B) ----------------------------- (3.1.2)

HP_{N3} = 107.27-7.0(T/B) ---------------------------- (3.1.3)

(T/B) = 1 (for black- on- white)

(T/B) = 2 (for white-on-black)

(T/B) = 3 (for red-on-white)

Where HP_{N1}, HP_{N2} and HP_{N3} represent dependent variable in terms of number of characters entered per unit time for respective levels of noise, i.e., 75 dB(A), 95 dB(A) and 115 dB(A). (T/B) represent the text/background color of source document considered in this study, i.e., black-on-white, white-on-black and red-on-white. For illustration it can be said that if performance measure of operators are required at noise level 1 (75dBA) for the simple data entry task for respective task-structure, i.e., for black- on-white, white-on-black and red-on-white then equation 3.1.1, will be able to provide the same.

Figure 3, shows the relation between the task-structure and human performance for the kind of simple task considered in the present study. For each level of noise the performance has been evaluated and same is also shown in the Figure3.

Table 1: Summary of the analysis of variance (ANOVA) pertaining to the studies on gender effects when operators performed the data entry task under varying levels of noise at different task-structure for simple task.

Source of variation	**df**	**MS**	**F**	**P**
Between Subjects	13	-	-	
A (Gender)	1	8773.38	0.87	0.80
Subjects within groups (Error-I)	12	1008.34	-	
Within Subjects	154	-	-	
N (Noise level)	2	3005.68	61.05	.001
Gender x Noise	2	166.57	3.38	.0743
Noise x Subjects within groups (Error-II)	24	49.23	-	
C (Task-structure)	2	1557.61	7.18	0.09
Gender x Task-structure	2	86.86	0.4006	0.99
Task-structure x Subjects within groups (Error-III)	24	216.79	-	
Noise x Task- structure	4	9.51	1.12	.3447
Gender x Noise x Task-structure	4	14.72	1.73	.2071
Noise x task-structure x Subjects within groups (Error-IV)	48	8.52	-	
Total	292	-	-	

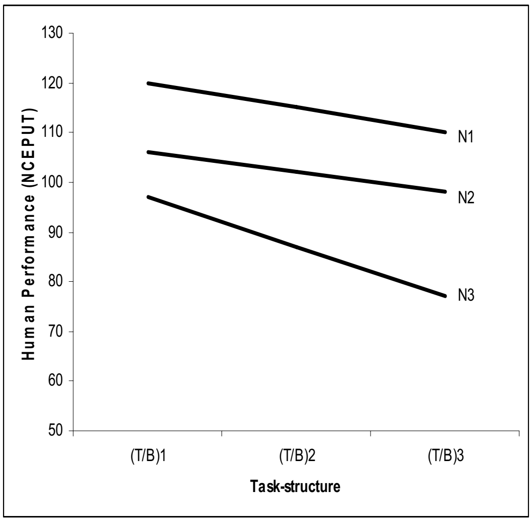


Figure 3: Relationship between data entry task performance and type of task-structure at different levels of noise (Simple task).

3.2 Experiment 2

In this experiment the gender effect on data entry task performance under varying levels of noise and task-structure for moderately difficult task (example shown in appendix, Task-B) was investigated. Result of the analysis of variance summarized in Table-2 implied that the effect of gender in the kind of task considered was statistically non-significant. Interaction between the task-structure and gender and between the noise and gender were found to be statistically non-significant. However interaction between noise and task-structure was found to be statistically significant. Besides this noise and task-structure separately found to have detrimental effect on the performance of the operator for moderately difficult data entry task considered in this study. Similarly the second order interaction of gender X noise X task-structure was found to statistically non-significant for the moderately difficult data entry task. The relationship between the human performances in terms of characters entered per unit time under varying levels of noise exposure was explored through regression analysis software and found to be linear in nature. The human Performance (HP) model obtained for varying levels of noise were as follows:

$HP_{N1} = 112.86\text{-}6.0(T/B)$ -- 3.2.1

$HP_{N2} = 92.22\text{-}3.2(T/B)$ -- 3.2.2

$HP_{N3} = 95.12\text{-}9.8(T/B)$ -- 3.2.3

Where symbols used in the above equations has same meaning as mentioned above.

Table 2: Summary of the analysis of variance (ANOVA) pertaining to the studies on gender effects when operators performed the data entry task under varying levels of noise at different task-structure for moderately difficult task.

Source of variation	**df**	**MS**	**F**	**p**
Between Subjects	13	-	-	
A (Gender)	1	8173.38	0.68	0.84
Subjects within groups (Error-I)	12	12005.41	-	
Within Subjects	154	-	-	
N (Noise level)	2	3985.68	94.15	.000
Gender x Noise	2	106.57	2.51	.0743
Noise x Subjects within groups (Error-II)	24	42.33	-	
C (Task-structure)	2	3457.61	10.91	0.01
Gender x Task-structure	2	86.86	0.274	0.99
Task-structure x Subjects within groups (Error-III)	24	316.69	-	
Noise x Task-structure	4	75.51	16.70	.001
Gender x Noise x Task-structure	4	8.72	1.92	.4071
Noise x Task-structure x Subjects within groups (Error-IV)	48	4.52	-	
Total	292	-	-	

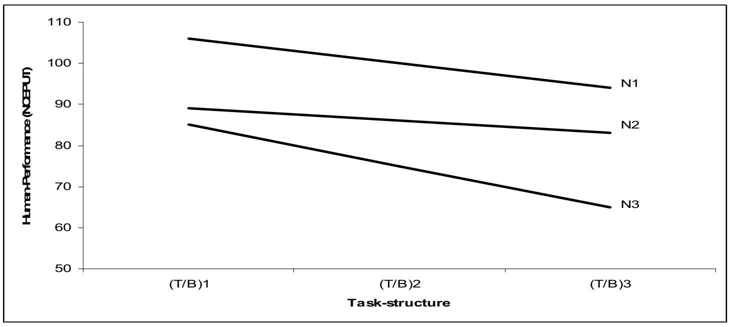


Figure 4: Relationship between data entry task performance and task-structure at different levels of noise (Moderately difficult task).

Figure 4, shows the relation between the task-structure and human performance for the kind of moderately difficult task considered in the present study. For each level of noise the performance has been evaluated and same is also shown in the Figure4.

Table 3: Analysis of Simple Main Effect when different subjects performed data entry task at varying levels of noise under different task-structure for moderately difficult data entry task.

Source of variation	**df**	**MS**	**F**	**p**
B (Noise level) at				
(T/B)1 (Black-on-white)	2	151.04	2.54	0.079
(T/B)2 (White-on-black)	2	3368.89	68.43	0.001
(T/B)3 (Red-on-white)	2	5567.90	104.87	0.001
C (Task-structure) at				
Noise level$_1$ (75 dBA Leq)	2	231.78	2.51	0.98
Noise level$_2$ (95 dBA Leq)	2	4374.04	88.35	0.001
Noise level$_2$ (115 dBA Leq)	2	1045.11	21.23	0.001

Table 4: Summary of the analysis of variance (ANOVA) pertaining to the studies on gender effects when operators performed the data entry task under varying levels of noise at different task-structure for fairly difficult task.

Source of variation	**df**	**MS**	**F**	**p**
Between Subjects	13	-	-	
A (Gender)	1	9173.38	0.62	0.83
Subjects within groups (Error-I)	12	14565.41	-	
Within Subjects	154	-	-	
N (Noise level)	2	4685.68	145.92	0.000
Gender x Noise	2	96.57	3.00	.0703
Noise x Subjects within groups (Error-II)	24	32.11	-	
C (Task-structure)	2	5452.61	56.23	0.01
Gender x Task-structure	2	80.86	0.83	0.89
	24	96.69	-	
	4	175.51	38.82	0.001
	4	7.72	1.70	0.307 1
Noise x Task-structure x Subjects within groups (Error-IV)	48	4.52	-	
Total	292	-	-	

3.3 Experiment 3

In this experiment the gender effect on data entry task performance under varying levels of noise and task-structure for little fairly difficult task was investigated. Result of the analysis of variance summarized in Table-2 implied that the effect of gender in the kind of task considered was statistically non-significant. Interaction between the level of task-structure and gender and between the noise and gender were found to be statistically non-significant. However interaction between noise and task-structure was found to be statistically significant. Besides this noise and task-structure separately found to have detrimental effect on the performance of the operator for fairly difficult data entry task considered in this study. Similarly the second order interaction of gender X noise X task-structure was found to statistically non-significant for the fairly difficult data entry task. The relationship between the human performance in terms of characters entered per unit time under varying levels of noise exposure was explored through regression analysis software and found to be linear in nature. The human Performance (HP) model obtained for varying levels of noise were as follows:

$HP_{N1} = 90.77-7.0(T/B)$ -------------------------------- 3.3.1

$HP_{N2} = 75.81-8.3(T/B)$ -------------------------------- 3.3.2

$HP_{N3} = 60.11-8.5(T/B)$ -------------------------------- 3.3.3

Where symbols used in the above equations has same meaning as mentioned above.

Figure 5, shows the relation between the task-structure levels and human performance for the kind of fairly difficult task considered in the present study. For each level of noise the performance has been evaluated and same is also shown in the Figure5.

Table 5: Analysis of Simple Main Effect when different subjects performed data entry task at varying levels of noise under different task-structure for fairly difficult data entry task.

Task-structure x Subjects within groups (Error-III)

Noise x Task-structure

Gender x Noise x Task-structure

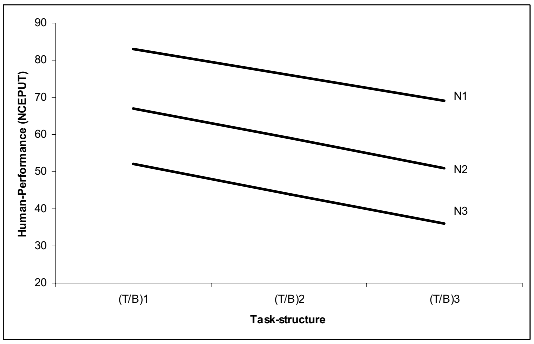


Figure 5: Relationship between data entry task performance and task-structure at different levels of noise (Fairly difficult task).

DISCUSSIONS

From the result it was observed that males and females statistically did not differ significantly in their performance while carrying out simple, moderately and fairly difficult data entry task under the influence of noise and task-structure. The findings get support from many researchers. Fairweather and Hult (1972) had reported that adult males and females performed equally well in choice reaction types of tasks. Loftus, et.al. (1987) and Maccoby & Jacklin (1974) demonstrated gender independent performance while performing laboratory memory tasks. Muzammil (2004) found gender independent performance while investigating cognitive performance under the impact of vibration in a driving environment. Papastergiou and Solomonidou (2005) concluded on the basis of their study that internet activities, such as communication via e-mail, chat or videoconferencing, Web surfing and information search for personal or school purposes, are independent of the gender effect. In the same study Papastergiou and Solomonidou (2005) concluded that boys use the Internet for entertainment and Web pages creation more than girls do. Neely and Burström (2006) found no gender differences in subjective response to hand-arm vibration. Colley (2003) demonstrated gender differences in approaching the technology. Boys approach to computers for play and mastery while girls approach computers as tools for accomplishing tasks. Hermann, et.al. (1992) found that in case of memory task female were found significantly superior than male counter part while learning directions to go to a particular location was marked by better performance by males. As it is evident that the process of data entry task requires memorizing text written on the source document on one hand and reproducing the same on computer screen on the other. As memorizing capability is better in female and locating a particular thing is better in male this might have led to an absence of gender related differences in human performance so far as the data entry task is concerned. While males were faster in movment time (Landauer, et. al., 1980) females were found to be superior to males in their cognitive performance (Carlson, 1990). The difference in decision time and movement time of the choice reaction time can expected to nullify each other in the two cases of males and females.

Noise was found to have a significant effect on human performance in all cases of data entry task (simple, moderately difficult, fairly difficult). Several studies in past has revealed the adverse effect of noise on performance (Johansson, 1983; Belojevic, et.al., 1992;Cohen, 1980;Percival and Loeb, 1980;Warner and Heimstra, 1972). Smith (1983) demonstrated explicit effect of noise on running memory task. Zaheeruddin and Garima (2006) used neuro-fuzzy approach to predict noise effect and found little affect on efficiency at lower level of noise for simple tasks but effects were found detrimental at higher level and specifically for complex task. With higher levels of noise job satisfaction is impaired, resulting in deteriorated productivity has been reported widely in literature (Cox, 1978, 1985; Cooper, 1985; Beehr, 1995). In present work the type of data entry task considered shows the decreasing productivity in presence of environmental stressor “noise”. The finding of the present work is in accordance with the results obtained by previous researchers in terms of decreasing efficiency in noisy environment. Data entry task is one of the very extensively used tasks on desk-top and lap-top computers. Present study suggests that operators doing this type of task should be provided with acoustically conducive environment so as to enhance productivity as well job satisfaction. The Recommended Exposure Limit (REL) for workers engaged in occupations such as engineering controls, administrative controls and work practices is 85 dB(A) for 8 h duration (NIOSH, 1996). NIOSH (1972) also recommended a ceiling limit of 115dB (A). Exposure to noise levels greater than 115 dB (A) would not be permitted regardless of the duration of exposure. Workplace related job stress can also be reduced by way of providing the appropriate environment. Finding of the present study is valid for the kind of data entry task considered in the present study shown in appendix (Task-A, Task-B and Task-C). One can find more expected sevier productivity damage once the nature of data entry task is changed, i.e., data entry using different administrative tool icons given on desk-top/lap-top (e.g., mathematical tool of equation editor).

APPENDIX

Task-A

Universiti sains Malaysia is a one of the good universities in Malaysia. Its main campus is situated in Penang. This campus is very beautiful having lots of good buildings and sports complex. This university is called ‘universiti in a garden’. This campus has two libraries having lots of good books, periodicals, magazines and other resource materials for students and researchers. Class rooms are spacious and equipped with modern facilities of teaching and learning. This campus consists of several boys and girls hostels and also very good mosque. Several kinds of students and other activities keeps this campus alive. Several canteen and food out let are also present to cater the needs of students. Among the annual functions convocation is very attractive. Students get their certificates and degrees in this function which attended by all office bearer of the university as well representative from all schools. Speech of chancellor makes this occasion very memorable. Students wait for this function to get their degrees and certificates. This university has two more campus that is known as Engineering and Medical campus. Medical campus is situated in the state of Kelentan while Engineering campus is in Trans krian. Facilities in Engineering campus is not so good. This campus has one good library and one big mosque. Students hostel are situated in one side of the campus. Recently one new gate has opened. I hope future plan has more facilities in this campus too. I wish all success for students who put hard labor in their studies.

Task-B

Nano-particles are advanced materials with 1-100 nm grain size. They have been widely applied in photo-catalyst, carbon nano-tube, nano-ceramics, fabric fiber, and compound material industries. The techniques for manufacturing the nano-particles can be classified into “top-down” and “bottom-up” methods [1]. The top-down method transforms the material with an initial size of a few micrometers into nano-particles with a size of only 40-200 nm. Mechanical ball milling, sputtering, chemical etching and laser ablation are popular top-down methods. The bottom-up method transforms the material with an initial size of a few micrometers into nano-particles with size of only 40-200 nm. The bottom-up method is to generate the nano-particles by heaping up atoms, or assemble the nano-particles from nano-building blocks. It can produce nano-particles in any desired sizes. Example of bottom-up methods includes aerosol compaction, chemical synthesis, chemical vapor deposition and gas-atomization methods. No matter what kind of methods are used to fabricate the nano-particles, the nano-particles will aggregate again because of the effects of Coulomb electrostatic force and Van der waal force as soon as the grain size of the nano-particles in smaller than 100 nm. In this situation, the nano-particles do not remain at the nanometer size any more.

Task-C
The distribution of anthropometric information is, for practical purpose, well described by mean m (often called the average), standard deviation SD, and sample size n. The range indicates the smallest and largest values.

Check the CV One easy way to check on how diverse the data are is to divide the standard deviation of the data in question by their mean to get the coefficient of variation (CV). For most body dimensions, the CV is in the neighborhood of *3 to 10 percent*; larger values are suspect and should prompt a through examination of the data. However, in most strength data, the CV is between *10 and 85%.*

Use percentiles Anthropometric data often are best presented in percentiles. They provide a convenient means of describing the range of body dimensions to be accommodated, making it easy to locate the percentile equivalent of a measured body dimensions. Also, the use of percentiles avoids the misuse of the average in design (as is discussed later).

To calculate a percentile value p of a normal distribution, simply multiply the standard deviation by a factor k, selected from Table 1-5. Then subtract the product from the mean if p is below the mean:

$$p = m - k\ SD$$

If p is above the average, add the product to the mean:

$$p = m + k\ SD$$

To calculate a new mean from the sum of two distributions, simply add the means of the x and y distributions to obtain the mean of the combined distribution z:

$$m_z = m_x + m_y$$

Equations above contain (Pearson's) correlation coefficient m, which describes the relationship between two sets of data. The value of m ranges from +1 (a "perfect" positive correlation-as x increases, y increases as well) over 0 (no correlation at all between x and y) to-1 (also "perfect", but negatively so-as x increases, y decreases).

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