Investigation of the Interaction Effects of Sitting Comfort and Discomfort Factors

Mohamed Gazzaly Mohamed Thariq

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Content of the thesis: testing the validity of the hypothesis 'feelings of comfort and discomfort are affected by the interaction of two sets of variables representing physical needs and emotional needs', this study intends to investigate to what extent each group of variables affect comfort and discomfort, further based on the findings, a predictive model is derived.

M. G. Mohamed Thariq
Department of Architecture
University of Moratuwa
January 2010

Declaration

I do hereby declare that the work presented in thesis is the outcome of the research exclusively carried out by me under the supervision of Professor Harsha Munasinghe and Professor John Abeysekara. Thesis contains the results of my own independent research except where due references have been made. The results presented in this thesis have not been previously or concurrently submitted in whole or part to any university or institution for the same or any other degree.

UOM Verified Signature

Mohamed Gazzaly Mohamed Thariq
Candidate

Date: 21/01/2010

This is to certify that the work reported in this thesis was carried out by the candidate, is of suitable standard for the degree for which it was submitted and worth of consideration.

UOM Verified Signature

Professor Harsha Munasinghe
Supervisor 02.02.2010

Abstract

Comfort and discomfort are two stages in human comfort perception in sitting and the two stages may overlap. Whereas, comfort and discomfort in sitting are affected by different set of underlying factors. The understanding of how various individual underlying factors of comfort and discomfort at their different levels interact to produce perception of comfort and discomfort in sitting is lacking in the existing literature. The knowledge generated in this regard may help in further advancing the seating comfort theories which in turn may help in adding comfort to the seat in its design process. Hence, the objectives of the study were respectively as follows: 1. to investigate the effect of interactions of the sitting comfort (emotional) factors and discomfort (physical) factors at their different levels in producing comfort and discomfort perception respectively while sitting; 2. to quantify and reconfirm the factor structure of sitting comfort and discomfort under the present study context; 3. to propose a model explaining relationship between comfort and discomfort perception in sitting.

Two experiments were conducted to fulfill the objectives. The first experiment was conducted employing subjective method under the university class room settings. In that, 50 university students rated their feelings elicited with five different types of student chairs using questionnaires. The second experiment was conducted to test the fitness of the model under the laboratory conditions employing both objective and subjective methods. Twenty university students evaluated three different types of office chairs. Under the objective method, posture movements were recorded using video camera. For the subjective method, questionnaire was used. SPSS 13.0 version statistical software was used to analyze the data.

The results obtained under the factor analysis in both experiments quantified and confirmed the factor structure of sitting comfort and discomfort. The multivariate analysis indicated that relax and relief feelings in sitting comfort perception are partially emotional unlike impression feeling. Under the laboratory conditions, the study intended to confirm the subjective ratings given for each chair by objective methods i.e. posture movements. The results obtained in the body posture movements confirmed the results obtained in the subjective ratings.

The study could find the interaction effects of physical factors with each emotional factor at each level at 7 point rating scales. The results show that when comfort is perceived, emotional factors are found at higher levels while physical factors are found at moderate or below moderate levels. Higher levels of discomfort (physical) factors are dominant over higher levels of comfort (emotional) factors. Accordingly physical comfort needs are primary which confirms the previous findings that if the physical comfort needs are not satisfied (if higher levels of discomfort factors are present), contribution of higher levels of emotional feelings to comfort perception diminishes. Hence emotional comfort needs become secondary.

The results obtained further indicate that comfort (emotional) and discomfort (physical) factors can co-exist as non-dominant in the non-dominant zone. The non-dominant zone, in general, includes discomfort factors levels between 1 and 4 comfort factors levels between 1 and 5 at the 7 point rating scale. In the non-dominant zone, neither comfort nor discomfort factors dominate the perception, therefore, the report on comfort/discomfort often differ among individuals. From the findings of the study, a graphical model was presented to represent the relationship between comfort and discomfort perception in sitting.

The results show that various individual factors of sitting comfort and discomfort at their different levels have varying degree of relationships with comfort and discomfort perception. The overall results obtained show that the relief feeling is the stronger and the impression is the weaker factors among the emotional factors investigated in affecting comfort perception and evaluation. Upper back pain, mid back pain, low back pain, upper leg pain and fatigue are important physical factors in affecting discomfort perception and evaluation. The level of influence of various individual factors on comfort and discomfort perception needs to be considered in developing multidimensional scale for chair evaluation purpose. The results further show that the chairs need to be designed to give more relief which may produce more comfort. It is assumed that the physical design features such as curved seat front edge, appropriate lumber support, seat that supports backward and forward movement and the seat cushion that is not too soft and too hard may give more relief feelings. However, the effect of these seat features on relief feelings need to be investigated.

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Table of content

List of figures

List of tables

Abbreviations

GCR – General comfort rating

BPD - Body part discomfort

BPDF - Body part discomfort frequency

BPDS - Body part discomfort severity

BPDFS - Body part discomfort frequency severity

CFC - Chair feature checklist

EMG - Electromyography

MDS - Multidimensional scaling

VDU – Visual display unit

SPSS – Statistical Package for Social Science

MANOVA - Multivariate analysis of variance

ANOVA - Analysis of variance