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# Investigation of the Interaction Effects of Sitting Comfort and Discomfort Factors

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# **Investigation of the Interaction Effects of Sitting Comfort and Discomfort Factors**

**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.

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## Declaration

I do hereby declare that the work presented in this thesis is the outcome of the research exclusively carried out by me under the supervision of Professor Harsha Munasinghe and Professor John Abeysekara. This 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.

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Professor Harsha Munasinghe

Supervisor 08.02.2010



## 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 lumbar 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	vii	
LIST OF TABLES	x	
ABBREVIATIONS	xiii	
<b>Chapter 1</b>	<b>Introduction</b>	<b>1</b>
1.1	Background	1
1.2	Definitions of Comfort	2
1.3	Scientific Definitions of Comfort	2
1.4	Comfort as a bipolar construct	3
1.5	Comfort and discomfort as two states	4
1.6	Problem statement	6
1.7	Objectives	6
<b>Chapter 2</b>	<b>Review of literature</b>	<b>8</b>
2.1	Measurements of comfort	8
2.1.1	Subjective measures	9
2.1.1.1	Why subjective measures	9
2.1.1.2	Problems in subjective measures	10
2.1.1.3	General comfort rating	13
2.1.1.3.1	Rating on a verbal scale and absolute rating	14
2.1.1.3.2	Direct ranking of chairs	18
2.1.1.3.3	Pair comparisons	20
2.1.1.3.4	The semantic differential technique	21
2.1.1.4	Body part discomfort rating (BPD)	22
2.1.1.5	Chair feature checklist	24
2.1.1.6	Method of adjustment (Fitting trial)	26
2.1.1.7	Personal comments	28
2.1.1.8	Emocards method	28
2.1.2	Objective methods	30



2.1.2.1	Electromyography (EMG)	30
2.1.2.2	Pressure distribution	31
2.1.2.3	Spinal load	33
2.1.2.4	Foot /leg volume change	34
2.1.2.5	Posture measure	35
2.1.2.6	Performance measure	36
2.1.3	Validity of measures	37
	Summary	41
2.2	Comfort related model	43
2.2.1	Motivation Theory – Herzberg	43
2.2.2	Hierarchy of needs - Abraham Maslow	44
2.2.3	Hedonomic hierarchy of needs – Hancock et al., (2005)	46
2.2.4	General comfort model – Vink et al. (2005a)	48
2.2.4.1	Elements of the comfort model	50
2.3	Sitting comfort model	52
2.3.1	Two stage sitting comfort model – Zhang et al. (1996)	52
2.3.1.1	Multidimensional scaling (MDS)	53
2.3.1.2	Factor analysis	54
2.3.1.3	Cluster analysis	56
2.3.1.4	Conceptual model of sitting comfort and discomfort	57
2.3.1.5	Validation of two stage model	58
2.3.2	De Looze et al. (2003) model	62
2.3.3	General ecological framework (Dainoff, 2006; Dainoff et al., 2007)	63
	Summary	65
2.4	Biomechanics of seated postures	66
2.4.1	Anatomy of the spine and sitting	67
2.4.2	Sitting and centre of gravity	68
2.4.3	Flattening of lumber curve	69
2.4.4	Disc pressure	75

2.4.5	Dynamic sitting and biomechanics	77
	Summary	78
2.5	Chair elements and comfort	79
	Summary	84
2.6	Hypothesis	85
2.7	Rating process and comfort perception	86
<b>Chapter 3</b>	<b>Methodology</b>	91
3.1	Methodology of the study under university class room settings	91
3.1.1	Experimental subject	91
3.1.2	Test chairs	92
3.1.3	Questionnaire survey	93
3.1.4	Procedure	95
3.1.5	Data analysis	96
3.2	Methodology of the second experiment under laboratory conditions	96
3.2.1	Subjects	97
3.2.2	Chairs and workstation	97
3.2.3	Task and Time	98
3.2.4	Posture and movement measure (video recording)	99
3.2.5	Questionnaire survey (use of rating scales)	99
3.2.6	Procedure	100
3.2.7	Data Analysis	101
<b>Chapter 4</b>	<b>Results and discussions</b>	103
4.1	Results and discussions of the study under class room settings	103
4.1.1	Factor Separation	103
4.1.2	Comfort factor score vs. comfort ratings	104
4.1.3	Discomfort factor score vs. discomfort ratings	105
4.1.4	Comfort factor score vs. discomfort ratings	107

4.1.5	Discomfort factor score vs. comfort ratings	108
4.1.6	Chair type and time effect	109
4.1.7	Correlation	112
4.1.8	Effect of comfort and discomfort factors	113
4.1.9	Regression analysis	114
4.1.10	Interaction effect of comfort and discomfort factors	117
4.1.11	Interactions of discomfort factors with impression in comfort perception	118
4.1.12	Interactions of discomfort factors with relax in comfort perception	121
4.1.13	Interactions of discomfort factors with relief in comfort perception	123
4.1.14	Interaction of discomfort factors with impression in discomfort perception	126
4.1.15	Interaction of discomfort factors with relax in discomfort perception	128
4.1.16	Interaction of discomfort factors with relief in discomfort perception	130
4.1.17	Proposed comfort/discomfort model	132
4.2	Results and discussions of the second experiment under laboratory settings	134
4.2.1	Factor separation	134
4.2.2	Chair type and time effect	140
4.2.3	Effect of chair, time, comfort and discomfort on body posture movement	142
4.2.4	Effects of comfort and discomfort factors on comfort and discomfort perception	144
4.2.5	Regression analysis	146
4.2.6	Interaction effects of individual comfort and discomfort factors on comfort and discomfort perception	149



4.2.7	Interactions of discomfort factors with impression in comfort perception	150
4.2.8	Interactions of discomfort factors with relax in comfort perception	153
4.2.9	Interactions of discomfort factors with relief in comfort perception	155
4.2.10	Interaction of discomfort factors with impression in discomfort perception	157
4.2.11	Interaction of discomfort factors with relax in discomfort perception	159
4.2.12	Interaction of discomfort factors with relief in discomfort perception	161
4.2.13	Validation of proposed comfort/discomfort model	163
<b>Chapter 5</b>	<b>Conclusions of the study</b>	<b>164</b>
5.1	Conclusions	164
5.2	Practical applications of the study	166
5.3	Future work	168

<b>References</b>	169
<b>Appendix</b>	186
Appendix A: Brief descriptions of student chairs used in the experiment	186
Appendix B: General questionnaire used at the University of Moratuwa and Beijing Jiaotong University	189
Appendix C: Questionnaire A containing rating scales for underlying comfort factors, discomfort factors, overall comfort and General comfort rating for studies under university class room settings with Sinhalese and Tamil translations	190
Appendix D: Questionnaire B containing rating scales for underlying comfort factors, discomfort factors, overall discomfort and General comfort rating for studies under university class room settings with Sinhalese and Tamil translations	197
Appendix E: Questionnaire containing rating scales for underlying comfort factors, discomfort factors, overall comfort, discomfort and general comfort ratings for studies under laboratory conditions with Chinese translation	204
Appendix F: Papers published, accepted for publication and under review	210

## List of figures

Figure 1.1: Certain underlying factors of sitting comfort and discomfort and their use in multi-dimensional scale (Helander and Zhang, 1997)	5
Figure 2.1: General comfort rating scale (Shackel et al., 1969)	14
Figure 2.2: Bipolar adjective scales of the semantic differential technique (Christiansen, 1997)	21
Figure 2.3: Body regions used in BPD ratings (Corlett and Bishop, 1976)	24
Figure 2.4: The Emocards in the circumplex of emotions (Reijneveld et al., 2003)	30
Figure 2.5: Use of Stadiometer (Eklund and Corlett, 1984)	34
Figure 2.6: A hierarchy of ergonomics and hedonomics needs (Hancock et al., 2005)	48
Figure 2.7: Comfort model (Vink et al., 2005a)	50
Figure 2.8: Descriptors of comfort and discomfort, multidimensional scaling approach (Zhang et al., 1996)	54
Figure 2.9: Simplified structure of cluster analysis (Zhang et al., 1996)	56
Figure 2.10: (A) Factor scores of Factor 2 (Discomfort) plotted against ratings of overall comfort. (B) Factor scores of Factor 1 (comfort) plotted against ratings of overall discomfort (Helander and Zhang, 1997)	59
Figure 2.11: Restated two stage model of human comfort perception (Zhang, 1992)	61
Figure 2.12: Theoretical model of comfort and discomfort and its underlying factors at the human, seat and context level (de Looze et al., 2003)	62
Figure 2.13: Segments of the spine (Chaffin et al., 1999)	68
Figure 2.14: The pelvis and lumbar part of the spine when (a) standing; (b) sitting relaxed, with sacrum unsupported in the middle position; (c) sitting erect, with sacrum supported; (d) sitting in the anterior-leaning posture; and (e) sitting relaxed in the posterior-leaning posture (Chaffin et al., 1999)	69



Figure 2.15: A diagrammatic outline of the anterior and posterior thigh muscles is superimposed to show that the limited length of these muscles rotates the pelvis and alters the lumbar curve (Keegan, 1953)	70
Figure 2.16: Angles of pelvic tilt in different body positions (Bridge et al., 1992)	71
Figure 2.17: Definitions of angles: 1, total lumbar angle; 2, sacral-horizontal angle; 3, sacral-pelvic angle; 4, pelvic-horizontal angle; 5, vertebral body angles L1/L2, L2/L3, L3/L4, L4/L5; 6, L5/S1 angle (Anderson et al., 1979)	73
Figure 2.18: The disc consists of a central watery gel – the nucleus pulposus (N) surrounded by layers of hyaline fibers – the annulus fibrous (A) cited by Chaffin et al. (1999)	77
Figure 2.19: Hypothetical model of comfort rating process (Zhang, 1992)	90
Figure 3.1: University student chairs used in the experiment	93
Figure 3.2: Chair types and workstation used in the experiment	98
Figure 3.3: Body part diagram (Vink et al., 1994)	102
Figure 4.1: Comfort factor score against actual comfort ratings	105
Figure 4.2: Discomfort factor score against actual discomfort ratings	106
Figure 4.3: Comfort factor score against actual discomfort ratings	107
Figure 4.4: Discomfort factor score against actual comfort ratings	109
Figure 4.5: Relationship between perception of comfort and discomfort in sitting	133
Figure 4.6: Comfort factor score (comfort) was plotted against actual comfort ratings	136
Figure 4.7: Discomfort factor score (discomfort) was plotted against actual discomfort ratings	137
Figure 4.8: Comfort factor score (comfort) was plotted against actual discomfort ratings	137

Figure 4.9: Discomfort factor score (comfort) was plotted against actual comfort ratings	135
Figure 4.10: Body posture movement ratio against time for chair type P, Q and S	143
Figure 4.11: Relationship between body posture movement frequency and discomfort	144

## List of tables

Table 2.1:	Chair feature checklist	25
Table 2.2:	Questions and answers for fitting trial	27
Table 2.3:	Factor separation and factor loadings	55
Table 2.4:	Results of factor analysis for 16 descriptors	58
Table 2.5:	Mean angles of pelvic tilt and lumber angles (degrees) in the nine body positions	72
Table 2.6:	Mean angle and standard error of the mean in standing and unsupported sitting	74
Table 3.1:	Height, weight and age of the experimental subjects	92
Table 3.2:	Height, weight, and age of the experimental subjects	97
Table 4.1:	Results of factor analysis	104
Table 4.2:	Chair type and time effect on comfort, discomfort as well as comfort and discomfort factors, p values were given within bracket; values $p < 0.05$ are significant	110
Table 4.3:	Correlation coefficients of feeling factors and scores with comfort and discomfort ( $p < 0.05$ are significant and given within brackets)	112
Table 4.4:	MANOVA for the main effects of feeling factors in perceiving comfort and discomfort, values $p < 0.05$ are significant.	113
Table 4.5:	ANOVA, computation of the regression for comfort perception, p values $< 0.05$ are significant	114
Table 4.6:	Model summary	115
Table 4.7:	ANOVA, computation of the regression for discomfort perception, p values $< 0.05$ are significant	116
Table 4.8:	Model summary	116
Table 4.9:	MANOVA for the interactions between discomfort factors (average ratings of all of the discomfort factors) and comfort feeling factors in perceiving comfort and discomfort, values $p < 0.05$ are significant	117



Table 4.10: Interactions of discomfort factors (average ratings of discomfort factors) with impression in comfort perception	120
Table 4.11: Interactions of discomfort factors (average ratings of discomfort factors) with relax in comfort perception	122
Table 4.12: Interactions of relief with discomfort factors (average ratings of discomfort factors) in comfort perception	125
Table 4.13: Interactions of impression with discomfort factors (average ratings of discomfort factors) in discomfort perception	127
Table 4.14: Interactions of relax with discomfort factors (average ratings of discomfort factors) in discomfort perception	129
Table 4.15: Interactions of relief with discomfort factors (discomfort factor score) in discomfort perception	131
Table 4.16: The results of factor analysis	135
Table 4.17: Correlation coefficient of feeling factors and factor scores with comfort and discomfort, $p < 0.05$ are significant and given within brackets	139
Table 4.18: MANOVA for the chair type, time and chair type*time interactions effects, p values were given in the table; values $p < 0.05$ are significant	140
Table 4.19: ANOVA for the chair, time and chair*time interaction as well as comfort, discomfort effects on posture, p values were given in the table; values $p < 0.05$ are significant	143
Table 4.20: MANOVA for the main effects in perceiving comfort and discomfort, values $p < 0.05$ are significant	146
Table 4.21: ANOVA, computation of the regression for comfort perception, p values $< 0.05$ are significant	147
Table 4.22: Model summery	147
Table 4.23: ANOVA, computation of the regression for discomfort perception, p values $< 0.05$ are significant	148
Table 4.24: Model summery	148

Table 4.25: MANOVA for the interactions between discomfort factors (average ratings of discomfort factors) and comfort feeling factors in perceiving comfort and discomfort, values $p < 0.05$ are significant	150
Table 4.26: Interactions of discomfort factors (average ratings of discomfort factors) with impression in comfort perception	152
Table 4.27: Interactions of discomfort factors (average ratings of discomfort factors) with relax in comfort perception	154
Table 4.28: Interactions of relief with discomfort factors (average ratings of discomfort factors) in comfort perception	156
Table 4.29: Interactions of impression with discomfort factors (average ratings of discomfort factors) in discomfort perception	158
Table 4.30: Interactions of relax with discomfort factors (average ratings of discomfort factors) in discomfort perception	160
Table 4.31: Interactions of relief with discomfort factors (discomfort factor score) in discomfort perception	162

## 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