Proceedings of the 13th Triennial Congress of the International Ergonomics Association
June 29 - July 4, 1997
Tampere, Finland

"From Experience to Innovation"
IEA’97

Volume 5
Human-computer interaction
Stress and mental load
Aging
Occupational health

Organizers:
IEA International Ergonomics Association
NES Nordic Ergonomics Society
FES Finnish Ergonomics Society
Tampere University of Technology
Tampere University
Finnish Institute of Occupational Health
Finnish Ministry of Labour

Editors:
Pentti Seppälä
Tuulikki Luopajärvi
Clas-Håkan Nygård
Markku Mattila

Technical editors:
Kristiina Kulha
Ella Hänninen

Finnish Institute of Occupational Health
Helsinki 1997
CONTENTS – VOLUME 5

PREFACE

KEYNOTES

Aging and work: problems and solutions for promoting the work ability
Juhanill Ilmarinen

Human factors in multimedia production
Halimahtun Mohd Khalid

Psychosocial aspects of working with video display terminals (VDT's) and employee physical and mental health
Michael J. Smith

1 HUMAN-COMPUTER INTERACTION

1.1 WORK STATION DESIGN

Supporting the forearms on the table top when doing VDU work. A laboratory and field study
Aarás A, Ro O

A questionnaire survey of cathode ray tube versus flat panel display user
Abe S, Sotoyama M, Jonai H, Villanueva MBG, Saito S

A challenge to eye-level, perpendicular-to-gaze, monitor placement
Ankrum DR

The influences of the height of the VDU screen, and the position of the back rest on the neck muscle load and the position of the head
Hautekiet M, Hermans V, Spaepen AJ, Snijders K

Fixation disparity as a function of prism load and viewing distance at visual display units (VDU)
Jaschinski W

Visual comfort at the VDU workplace and oculomotor parameters as a function of vertical inclination of gaze direction
Jaschinski W, Heuer H, Kylian H, Koitcheva V

Developing and evaluating force sensing mice for use in epidemiological studies
Johnson P, Rempel D, Hagberg M

Gaze inclination and health in VDU-operators
Lie I, Fostervold Kl, Aarás A, Larsen S

Reliability and sensitivity of methods to quantify muscle load during keyboard work
Visual ergonomics problems in VDT workplaces and analysis of vertical gaze direction
Salto S, Sotoyama M

Improvement in visual comfort of VDT workers from the aspects of vertical gaze
direction and tear volume
Sotoyama M, Abe S, Jonai H, Villanueva MBG, Salto S

Development of a prevention action plan for workplaces equipped with computer
displays: a global two-way approach
Taverniers W

Six month keyboard intervention study in computer users with hand symptoms: typing
performance and user preference
Tittiranonda P, Burastero S, Rempel D

CRT and LCD TFT screens at computer work stands: visual fatigue and environmental
luminance
Wolska A, Switula M

Device modeling and HCI: modifications for rapid-aimed movement
Zellers SM, Buck JR

1.2 INTERFACE AND SOFTWARE DESIGN

Interruptions in the computer aided office work: implications to user interface design
Burmistrov I, Leonova A

Impact of the user interface on the ergonomic assessment of software
Çakir AE

Software characteristics and stress/strain – correlations between dialogue principles
and self-reported stress/strain
Çakir AE

Describing inertia in interface navigation
Caldwell BS

Affordable virtual reality in ergonomics - some examples
Davies RC

Ergonomic software analysis of a text editor
Dutra ARA, Gonçalves CFF, dos Santos N, Fialho FAP

Instrumental utility and usability of the data processing in work office
Ferreira MC, Weill-Fassina A

Usability study of the PIT (Portable Information Terminal) platform
Hosono N, Suzuki K, Tomita Y

A schema-based software design for interactive computer systems
Kotani K, Tsuchiya K, Horii K, Kitamura Y

Using task analysis to inform requirements analysis of a computer system – a practical
example
Milis S

Toward inspiring creative thinking: Intelligent support for brainstorming
Mori H, Kinoe Y
A neuro-fuzzy approach for adaptable user interface implemented in the information system of Bulgarian parliament
Nikov A,Delichev S,Stoeva S

A practical model of user-centred information systems development
Smith A,Dunckley L

Using TQM techniques to improve interface design and usability: the LUCID method
Smith A,Dunckley L

Task appropriateness as a feature of interactive business transactions
Stary C,Totter A

Evaluation of HCI quality based on appropriateness of presented information
Suzuki S,Yazu Y,Ninomiya SP

Study on mental model formation process for problem solving
Yamamoto S,Koyazu T

A motivation oriented human interface
Yokota K,Nagata M

Cognitive ergonomics in human-computer interaction – principles and evaluation
Åborg C,Sandblad B

1.3 MISCELLANEOUS

Perception of virtual conference: the role of ergonomists
Ahasan R,Sen RN,Ukkola K,Kisko K

Effects of icon usage and color on manipulating hypertext documents
Aksehirli Z,Cilingir Ç

A pilot study of a method for determining wrist contact pressure while keying
Albin TJ

Psychological aspects of human computer interaction
Arestova Ö

Disorders of the motor system among persons working at computer VDUs: the results of a poll conducted among representatives of several professions
Blalski J,Romankow J,Zeyland AM

Survey of VDT users from an on-site occupational vision clinic
Burastero S,Wei E,Tillianonda P,Lo C,Bommarito P

Creation of a working group to design an interface: the role of the ergonomist
Castaing M-F

Ergonomic influence on the design of an interface access to coverbal gesture data bases
Castaing M-F,Hurault-Planté M

Visual lobe and lateral masking
Courtney AJ,Lai APY

Study of the relative dexterity of fingers for keying tasks
da Costa LG

The Impact of new technologies and graphic softwares on information design jobs
de Moraes A,Padovani S,Mendes C

iii
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychophysiological approach of stress-strain processes in subjects working with visual screens</td>
<td>167</td>
</tr>
<tr>
<td>Deliu N, Contulescu A, Purice M, Tat M, Licurici M, Litescu E, Herlea E, Setrarescu V</td>
<td></td>
</tr>
<tr>
<td>The influence of the otolithic Input on the quick phase and spontaneous saccade orientation</td>
<td>170</td>
</tr>
<tr>
<td>Draiçchio F, Leonardis C, Pettorossi VE</td>
<td></td>
</tr>
<tr>
<td>How do children watch TV program?</td>
<td>173</td>
</tr>
<tr>
<td>Fukuda R, Hatton K, Fukuda T</td>
<td></td>
</tr>
<tr>
<td>How efficient are VDT combined works to maintain high awaking levels?</td>
<td>176</td>
</tr>
<tr>
<td>Influence on change of task</td>
<td></td>
</tr>
<tr>
<td>Funada MF, Ninomiya SP, Soo CY</td>
<td></td>
</tr>
<tr>
<td>Obtaining and analyzing multi-media data to identify and define requirements in human systems</td>
<td>179</td>
</tr>
<tr>
<td>Gallaway GR</td>
<td></td>
</tr>
<tr>
<td>Ergonomic conditions and subjective complaints in videoterminal users</td>
<td>182</td>
</tr>
<tr>
<td>Gomzi M, Zavalic M, Bogadi-Šare A</td>
<td></td>
</tr>
<tr>
<td>A fundamental study on work feelings of VDT workers during paced and unpaced tasks</td>
<td>185</td>
</tr>
<tr>
<td>Horie Y</td>
<td></td>
</tr>
<tr>
<td>Development of the checklist for a VDT usability testing</td>
<td>188</td>
</tr>
<tr>
<td>Ikeda YT</td>
<td></td>
</tr>
<tr>
<td>Does computer operation cause fatigue?</td>
<td>191</td>
</tr>
<tr>
<td>Kamienska-Zyla M, Prync-Skotniczny K</td>
<td></td>
</tr>
<tr>
<td>Intelligent support for discovering latent relationships among ideas: a methodology based on genetic programming</td>
<td>193</td>
</tr>
<tr>
<td>Kinoe Y, Mori H, Sugita N, Hayashi Y</td>
<td></td>
</tr>
<tr>
<td>Comparison of different viewing angles during vigilance task with large-sized (LS) display</td>
<td>196</td>
</tr>
<tr>
<td>Komine N, Togami H, Akatsu J, Takahashi Y, Hashimoto M, Miyake S, Kumashiro M</td>
<td></td>
</tr>
<tr>
<td>How to create a good VD workplace in compliance with the EU directive</td>
<td>199</td>
</tr>
<tr>
<td>Kukkonen R, Lehtela J</td>
<td></td>
</tr>
<tr>
<td>Eye-controlled pointing device using the line-of-sight and the intentional blink</td>
<td>202</td>
</tr>
<tr>
<td>Lee KT, Park JH, Park KS</td>
<td></td>
</tr>
<tr>
<td>Ergonomics evaluation of a computerized administrative workstation in an attorney's office</td>
<td>205</td>
</tr>
<tr>
<td>Mariño S</td>
<td></td>
</tr>
<tr>
<td>Visual complex organized pattern (the pattern interface) as a means of interaction between person and computer</td>
<td>208</td>
</tr>
<tr>
<td>Molotova A, Ekonomova T</td>
<td></td>
</tr>
<tr>
<td>Website design audit</td>
<td>211</td>
</tr>
<tr>
<td>Murthy MR, Sarac A</td>
<td></td>
</tr>
<tr>
<td>Using ergonomics in creating the human-machine interface</td>
<td>214</td>
</tr>
<tr>
<td>Olszewski J</td>
<td></td>
</tr>
<tr>
<td>Longitudinal evaluation of system acceptance and adoption: voice mail system</td>
<td>217</td>
</tr>
<tr>
<td>Paradkar P</td>
<td></td>
</tr>
</tbody>
</table>
2 STRESS AND MENTAL LOAD

2.1 MENTAL LOAD

Analysis of cognitive demands of the activities of nurse
Benito GV, Gontijo LA, Jarute MS

Binary choice secondary task as a measure of mental workload
Culic M

Comparison of self-assessment using SWAT and ISA with post-exercise NASA-TLX and objective performance decrement using speech recognition and keyboard control
David H, Pledger S

Assessment of task-specific element-2: the case of computer engineers (The summary on advantage and disadvantage of occupation-general approach and task-specific approach)
Fujigaki Y

Study of the fluctuation in degree of work precision according to time lapse
Hirano S, Fukuda T
2.2 STRESS AND WELL-BEING

Methodology for evaluating the quality of life related to worker's health
Alvarez BR, Duarte MFdS, Lima DGd

The moderating role of social support in work stress
Cieslak R, Widerszal-Bazyl M

Psychosocial factors at work, musculoskeletal complaints, stress symptoms and
muscle activity among office employees
Eklof M, Jorulf L, Kadefors R, Sandsjö L

The regional safety rep as outsider – a healthy anomaly in the Swedish system of
industrial relations
Frick K

Psychological well-being and symptoms among compositors
Jensen LK, Christiansen JM, Eenberg W

Personality, job strain and musculoskeletal symptoms
Johansson Hanse J

Muscular tension, psychosocial factors and shoulder-neck pain. An intervention
project in a group of white collar workers
Jorulf L, Eklof M, Kadefors R, Sandsjö L, Vainikainen A

Musculoskeletal symptoms: relationships to sense of coherence, life style, and
socioeconomic conditions
Larsson G, Kallenberg K

The health and work conditions of bus drivers experienced in Tallinn
Rileaio R, Rjazanov V, Moks M

A study on the relationship among job stress, job cognition and health level
Saito M, Shimizu R, Yamaga Y, Seki H

Sense of competence and sense of coherence as health resources in computer
professionals
Toppinen S, Kalimo R
2.3 PSYCHOPHYSIOLOGICAL MEASUREMENTS

Sustained attention of railway traffic safety personnel in information overload and underload situations
Akila R, Portin R, Revonsuo A, Paakkulainen H, Pällysaho J, Müller K

Individual differences observed among experts engaging in vigilant tasks at a simulated nuclear power plant control room
Akita M, Miyahara S

Neurosensorial changes related to peculiarities of work as basis for ergonomical design
Anghel I, Anghel M, Derevenco P, Tigan S, Tatar I

Temporal structures of man-machine interactions: psychophysiological investigations
Boucsein W

A case study on the biopsychic effect of stress in telephone operators
Bridi VL, Casas LAA, Fialho FAP

Cardiovascular changes during some types of occupational stress
Derevenco P, Anghel I

Psychophysiological correlates of human errors
Göbel M, Suzuki S, Luczak H

The critical flicker fusion test meaningful index for the industrial fatigue research?
Hasegawa T, Kumashiro M

Dual-channel sensory mechanism of stimulus discrimination
Izmailov CA, Shekhter ED

Some empirical findings on heart period variability as measure of mental effort in human computer interaction
Izsó L, Wiethoff M

Stress in the decision making on ship maneuvering
Kobayashi H, Murayama Y, Kato K, Shigeta S, Endo M

Consideration of long-term CFF changes in the result analysis and CFF methodology
Luczak A, Sobolewski A

Operator performance efficiency prognostication
Medenkov AA

Qualitative study of the stress in graduation students
Merino E, Simões M, Veras M, Franco E, Patricio Z

Psychophysiological responses to a coolant level control task
Miyake S, Ōsaki H, Ikeda K, Kubota R, Miyakawa T, Furuta T

Concepts of mental workload in psychophysiological research
Sammer G

Workload and EEG-dynamics
Sammer G

Psychological and medical aspects of human-operator activity reliability prediction
Shlaen P, Lvov V, Gulyanskij G

Electro-physiological signals: indicators of mental fatigue and strain
Shmilovitz O, Glusman JG, Cassuto Y
3 AGING

3.1 AGING AND WORK

Age-oriented personnel policy: the state of the art in the Netherlands
Andries F

Effects of production changes on work strain among young and old workers in a food factory
Arola H, Nygård C-H, Huhtala H, Manka M-L

The Mahis-program: Work ability promotion as a function of a company
Asikainen P, Palolahti T

Work environment, global self-rated health, and early retirement
Borg V, Burr H, Christensen H, the EGA Study Group

Organizational learning – a strategy for development of work?
Bottrup P

Injury risk profile and aging among Québec firefighters
Cloutier E, Champoux D

Training for older workers: government sponsored local training provision in Britain
Collis C, Mallier T, Smith-Canham J

Association between diastolic blood pressure and cumulative work time as a measure of aging related to work
Cordeiro R

The aging of working-age population in Brazil
Ferreira Levy MS, Pagliaro H

Is the combination of organizational and environmental stressors contributing to the aging process?

How can the science of ergonomics better help older workers choose their optimum career?
Getty RL, Getty JM

Changes in blood pressure and perceived work stress: a longitudinal study
Goedhard WJA

Metaknowledge in X-ray operators: an exploratory study
Gonon O, Baracat B, Marquié JC
The ergonomics of clothing for the disabled and elderly
Harwood RJ, Wyatt J

Assessment of performance and psychophysiological reactions in a VDT-based task environment for the aged
Hashimoto M, Takahashi Y, Miyake S, Komine N, Kumashiro M, Ogata H

Development of work methods and tools for ageing professional cleaners
Hopsu L, Louhevaara V

Effects of a work-site physical exercise intervention on the physical fitness and well-being of professional cleaners
Hopsu L, Louhevaara V, Korhonen O

Improving cooperation at work between generations
Huhtanen P, Ahola K, Leino T

Effects on work interest, work ability and health by an ergonomic and health training program for elderly urban transport drivers in Munich
Karazman R, Geissler H, Kloimüller I, Karazman-Moravetz I

Job re-design needs for aged workers
Kawakami M, Ioue F, Ohkubo T, Ueno T

Recent and ongoing activities to promote work and health among the older workforce in Sweden
Kilbom Å, Hultgren D

How do stress impacts change with aging in the profession of bus drivers? Results from a questionnaire survey on 'health and competition' among bus drivers in a public transport system in 1996
Kloimüller I, Karazman R, Geissler H

How can work adaptability be predicted for aged workers?
Kumashiro M

Physical condition, work demand, and implications for aging workers: development of assessment tools
Lai J, Chan J, Tsai M, Lee H

Age and work on assembly lines: studies and actions in an automobile construction plant
Laville A, Sailly M, Volkoff S

Controlling changes in steelworks among elderly steelworkers
Leino T

Work, age and stress in the metal industry
Leppänen A, Elo A-L, Martikainen R

Work ability of middle-aged Finnish construction workers – a follow-up study in 1991-1995

Systems ergonomics for innovation and quality
Lino L

Ergonomic interventions and the Work ability index
Louhevaara V, Hopsu L, Pohjonen T, Punakallio A

FinnAge – Respect for the Ageing Programme 1990-1996: a brief summary
Louhevaara V, Ilmarinen J
Heat tolerance of different age groups of men with and without protective clothing
Marszalek A, Smolander J, Soltynski K, Sobolewski A

Study on cardiorespiratory capacity of aged workers and its relation with work ability

Muscular capacity in older workers
Monod H, Vandewalle H

Ageing: working capacity and job pattern in informal sectors
Nag PK, Nag A

A study of the recreational activity in the aged generation – The influence of the habits and the personality
Nishiguchi H, Saito M

Work ability index related to age, disorders and ergonomics
Noronen R, Soininen H, Louhevaara V

Health and quality of life at work in the perspective of retirement
Paraguay AlBB, Cardoso DM, Zanon MAC

Comfort and discomfort at work: the nurturing and pampering paradigm
Paul RD, Helander M, Morrow J, Zhang L

Ergonomics and out-patient basis to elderly people: balance and gait problems associated with falling
Pinto MR, Caterina G, De Medici S, Napoli C

Exercise and health promotion among home care personnel
Pohjonen T, Punakallio A, Louhevaara V

Work ability and physical fitness of fire fighters in different age groups
Punakallio A, Louhevaara V, Lusa-Moser S, Korhonen O

The effect of age on subjective assessment of work environment
Räsinen T, Laitinen H, Rasa P-L

"Productive Ageing – development of personnel over 40" In the Austrian Bank GiroCredit
Schrierl R, Selbmann H

Aging and productivity: basic concepts
Shephard RJ

Aging and productivity: some physiological issues
Shephard RJ

Worksite health promotion and the older worker
Shephard RJ

Home as a work environment – the quality factors of the physical work environment of home care and home nursing personnel
Sipiläinen P, Kylmäaho E

Effect of a 6-month resistance training program on lumbar extension strength and perceived lifting capacity in fire-fighters
Smolander J, Pollock ML, Proebsting C, Garzarella L, Brechue W, Foley M, Carpenter D

The changes in policemen's physical activity and physical fitness – a 15-year follow-up
Sörensen L, Smolander J, Louhevaara V, Korhonen O, Oja P
A consideration on variations step height of the staircase causing stumbling in skill to ascend and descend
Takeda M, Hayashi Y, Tanii K

The REBUS study: physical work load between 18 and 58 years of age – does it change?
Torgén M, Kilbom Å

Tactile coding designs for the visually disabled persons (case study)
Uchimura Y, Watanabe H

Thermal comfort responses of male and female subjects with and without physical disabilities
Webb L, Parsons K

The work ability of Tallinn policemen
Vilkis A, Kahn H

The sixty-year-old female worker as user of new technology
Virokannas H, Rahkonen M, Luoma I, Sorvari M

Job analysis of common municipal occupations

Personal factors, diseases and work ability of aged workers
Zhiming W, Yajia L, Mianzhen W, Chengjie Z, Ilmarinen J, Klockars M, Tuomi K, Shen N

3.2 AGING AND ERGONOMICS IN THE LIVING ENVIRONMENT

Psychosocial perspective of older people in the developing countries
Ahasan MR, Sen RN, Khaleque A, Sadeque S

A collaboration model in interiors involving the elderly
Demirbilek O, Demirkan H

Project of a survey on different elderly populations to collect data for ergonomic applications
Fubini E, Rabin Massa E, Berra A, Boetsch G

To fall but not to break – safety pants

Difficulties for elderly people caused by age-related yellowing vision
Ishihara K, Ishihara S, Nagamachi M, Osaki H

Ultrasonic urination sensor for home use
Kodama H, Kuchinomachi Y, Yamauchi Y, Hleda I, Sato S, Tekeichi H, Matsumoto H

Anthropometry of the elderly Australian
Kothiyal K, Tettey S

A comparison of visual search characteristics in old people under 75 in early old age and those over 75 in late old age
Kuba Y, Kuchinomachi Y, Kumada T, Kurakata K, Fujimoto H

The relationship between the usability of daily electric appliances and the deterioration in cognitive function of old people
Kuchinomachi Y, Kuba Y, Kumada T, Takeichi K
Biomechanics of slips and falls in the elderly
Lockhart T, Woldstad J, Smith J, Park S, Burchfield D

Adapted technology for senior citizens
Martin H, Raabe S

The everyday activities and mobility of elderly people: needs and hindrances
Mollenkopf H

Supportive living environments for people with dementia: introducing a multimedia-PC application
Pieper R

Automatic NextInfo® phone service for the elderly
Pirinen M, Hautala T, Määttä T, Saajanto E, Väyrynen S, Virokannas H

Different aspects of being elderly in residential wet spaces
Sagdic Y, Demirkan H

Design-relevant functional capacities of the elderly, assessed in the Delft Gerontechnology project
Steenbekkers LPA, Dirken JM, van Beijsterveldt CEM

Color temperature of light source and discomfort glare of elderly people
Takeichi K, Sagawa K, Kuchinomachi Y, Kanaya S, Uematsu M, Koide K

Experiences with elderly panels in the design process
van Berlo A

The Dutch Senior Label: a way to comfortable housing for everyone
van Berlo A

Gerontechnology: mobility and accessibility in later life
Vercruysse M

Welfare cluster on the area of ageing and technology in the Finnish Laboratory of Applied Ergonomics

Multiple criteria evaluation model with weighting factors for chairs
Väyrynen S, Kirvesoja H, Kangas E

A suitable prescriptive exercise program for health maintenance
Yamashita A, Kawakami M, Inagaki Y, Ukai T, Okubo T

Telephone access to the World Wide Web
Zajicek M, Powell C

4 OCCUPATIONAL HEALTH

Investigations regarding the evaluation of the noxious agents and the effects of those against the working personnel health conditions in the glass processing industry
Badescu L, Grigoriu I, Petreanu V, Serac M

Evaluation of a mandated occupational health program: the effects of program process and firm characteristics on hazard abatement
Barthelette D, Lévesque G, Gourde D
Physical job demands in nurses and rehabilitation therapists
Capodaglio EM, Capodaglio P, Bazzini G, Imbriani M

Cooperation between safety representatives and physiotherapists is an important tool for an efficient prevention of musculoskeletal disorders
Crawford-Currie E, Steen L

Ergonomics and back school
Gilbertová S

Physiotherapy and ergonomics: professional limits and mutual respect
Hignett S, Crumpton E, McAtamney L

Physical work load of paper mill workers before and after an intervention
Ketola R, Toivonen R, Rauas S, Viikari-Juntura E

Assessing health status and diagnosing occupational diseases among workers of a paper mill
Misevicius I, Liaukeviciute G

Psychological aspects of back schools
Moffett JAK

Safety climate and injuries: the case of occupational exposure to HIV
Murphy L, Grosch J, Gershon R, DeJoy D

The worker’s health in the context of modernization
Oliveira S

Conceptual design and implementation of the health at work services in the metropolitan company of São Paulo, Brazil
Paraguay AIBB

An exercise training program for improving work- and functional capacity
Rautalin O, Kauppila P, Heinonen OJ

Back school experience from the car Industry
Sahtulková A, Ptácková A

Activity which maintains the company's operating and work ability - systematic implementation model - KYKY - WAP-(Work Ability Process) model
Sillanpää P

Evaluation of occupational health services for farmers in Finland
Taattola K, Husman K, Peurala M, Susitalval P

Promotion of functional capacity – a challenge for the occupational physiotherapist. A survey of the physiotherapist's goals and tasks in occupational health care in the province of Turku and Pori
Tamminen-Peter L

Occupational overuse spinal syndrome
Wilson A

AUTHOR INDEX